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Water Environment Research Foundation

Public Perception of Biosolids Recycling: Developing Public Participation And Earning Trust

Co-published by

Water Environment Federation®
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IWA Publishing

00-PUM-5

PUBLIC PERCEPTION OF BIOSOLIDS RECYCLING: DEVELOPING PUBLIC PARTICIPATION AND EARNING TRUST

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2004

WERF

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This report was co-published by the following organizations. For non-subscriber sales information, contact:

Water Environment Federation	IWA Publishing
601 Wythe Street	Alliance House, 12 Caxton Street
Alexandria, VA 22314-1994	London SW1H 0QS, United Kingdom
Tel: (800) 666-0206	Tel: +44 (0) 20 7654 5500
Tel: (703) 684-2452	Fax: +44 (0) 20 7654 5555
Fax: (703) 684-2492	www.iwapublishing.com
www.wef.org	publications@iwap.co.uk
pubs@wef.org	

Library of Congress Catalog Card Number: 2004115485
Printed in the United States of America
WEF ISBN:1-57278-228-5   IWAP ISBN: 1-84339-710-2

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Ned Beecher holds a B.A. in Geology from Amherst College and an M.S. in Resource Management from Antioch University. After working in environmental education and residuals management, he became the first director of the New England Biosolids and Residuals Association (NEBRA) in 1998, where he administers membership services, provides an information network hub, and assists with public outreach and participation efforts regarding the recycling of biosolids and other organic residuals. He is the lead author of the 2001 NEBRA report *Saving Soil: Biosolids Recycling in New England*. His work on public perceptions and participation has led to continued consulting with WERF in developing WERF's "Public Partnering" initiative. Through NEBRA, and in conjunction with project associates, he offers workshops and consulting on public participation in biosolids management programs. He lives in rural New Hampshire with wife, Christine Clyne, and two children.

Barry Connell is Executive Director of the non-profit Center for Environmental Communications. The Center conducts research and educational projects in waste management; it works to limit exposure to products or wastes that may degrade human health or environmental quality; and promotes public policies and private investment in services or technologies that maximize resource conservation and pollution prevention. Mr. Connell is also currently a middle school teacher near his home in Newburyport, MA.

Eliot Epstein, Ph.D., was a principal in the Massachusetts firm E & A Environmental Consultants . He is currently with Tetratech, an adjunct professor at the Boston University School of Public Health, and co-editor of a new journal of biosolids management science. He resides southeast of Boston.

Jennifer Filtz, B.S., was with E & A Environmental Consultants during her work on this project.

Nora Goldstein is Executive Editor of *BioCycle, Journal of Composting and Organics Recycling*, published by The JG Press, Inc. in Emmaus, Pennsylvania. In addition to having written over a 100 articles related to biosolids recycling, she has conducted a number of surveys on biosolids management practices nationwide. Goldstein has participated on several advisory committees related to development of the Environmental Management System program administered by the National Biosolids Partnership, and was a co-author/co-editor of the *National Manual of Good Practice for Biosolids*, prepared under contract with the Water Environment Research Foundation. In 2003-2004, she is on the project team assisting WERF in its new "Public Partnering" initiative.

Maile Lono holds a B.A. in Community & Environmental Planning from the University of Washington and is pursuing a Masters in Not-for-Profit Leadership at Seattle University. Maile has been the Manager at Northwest Biosolids Management Association (NBMA) since 1999. The NBMA began activities in 1988 and was incorporated as a non-profit association in 1994 with the mission to advance environmentally sound biosolids management. The NBMA focuses it's goals and activities around providing a regional voice in the Northwest for biosolids management by offering networking and educational opportunities for members, regulators, private companies and the public; participating in the development of local, state, and federal biosolids regulations; and dedicating funding towards ongoing biosolids research. The NBMA has won awards from the U.S. EPA and Washington Department of Ecology for their leadership in biosolids management.

ABSTRACT AND BENEFITS

Abstract:

This report provides an overview of the current public perception and public acceptance of biosolids recycling in North America. It provides conceptual models for understanding the development of current public perceptions, including the influence of many factors--technical issues, typical human responses, communications, information, politics, and social context.

The report includes an annotated bibliography and narrative review of recent literature regarding public perceptions and public acceptance of biosolids recycling. Fourteen succinct case studies provide more detailed information on representative biosolids recycling program experiences. There are examples of biosolids management programs that have failed because of public controversy, as well as programs that have worked well, with community support. The latter programs have several things in common: they are well-run operations following best management practices; their benefits to communities and the environment are obvious; they communicate well with—and involve—stakeholders; most were introduced to communities through a respectful, mutually-beneficial communication process; and they had strong organizational commitment behind these public outreach efforts.

In order to assess current public knowledge and perception regarding biosolids recycling, a survey was conducted for this project by the University of New Hampshire Survey Center. The survey results include:

- Knowledge of "biosolids" is limited, but growing (14% can define it fairly accurately)
- Support for wastewater treatment is very high (93%).
- People are initially uneasy about biosolids recycling and cannot accurately assess its risks.
- The choice of words makes a difference—using "sewage sludge" instead of "biosolids" creates more negative response.
- Most people think that biosolids recycling is a relatively small risk to them.
- Although they clearly expressed support of the concept of recycling biosolids, respondents indicated that the strongest argument against biosolids recycling is "not enough is known," indicating that they are uncomfortable with their own personal lack of information and/or what they perceive to be an overall lack of information on this topic.

Because there is growing entrenched conflict regarding the benefits and risks of biosolids recycling, one part of this project has been to promote greater public participation, including alternative dispute resolution and consensus building, within the field of biosolids recycling. On April 11, 2002, the project held a day-long workshop on consensus building, led by Dr. Lawrence Susskind of the Harvard/MIT dispute resolution program. Biosolids management leaders from across the continent attended. A summary of the workshop is included in the report.

Through increased public participation, biosolids managers will increase the likelihood of reducing the risk of sudden costly setbacks. The report provides some strategies for evaluating public perception of a biosolids program and for selecting appropriate tools for public outreach and participation.

Benefits:

- ♦ Informs biosolids managers and other stakeholders about the current range and tenor of public perceptions of biosolids recycling in North America—including information from the largest nationwide survey on biosolids public perception.
- ♦ Provides understanding regarding how the public's perceptions of biosolids recycling are formed and what influences those perceptions.
- ♦ Provides biosolids managers and other stakeholders with information about the impacts on public perception and participation of various biosolids management program communications, actions, and other factors.
- ♦ Provides biosolids managers with background information and understanding about social science research regarding similar environmental and public policy issues, so that biosolids managers may benefit from the findings and recommendations of that body of research.
- ♦ Provides recommendations as to how biosolids management programs can more effectively communicate with and involve the public and key stakeholders such as site and facility neighbors, local communities, public interest groups, environmental groups, etc.
- ♦ Provides biosolids management programs with recommended resources, strategies, and tools for developing enhanced two-way communications, greater public participation, and the trust of communities in which they operate.

Keywords: biosolids management, sewage sludge, sludge, public acceptance, public education, public opinion survey, consensus building, environmental education, stakeholder

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EXECUTIVE SUMMARY

The ultimate goal of a biosolids recycling program's outreach, education, public relations, and public participation efforts should be to develop "public relationships" with the variety of stakeholders who may be involved with and/or potentially impacted by a biosolids recycling program. Developing relationships through listening to, and having dialogue with, all stakeholders leads to increased trust and respect, as well as increased public understanding of biosolids recycling. In most instances, this relationship-building approach also will build better biosolids management programs that are supported widely by a diverse public. This report provides recommendations for how biosolids managers can increase constructive relationships with communities, neighbors, and other public stakeholders.

To develop their recommendations, investigators collected about 1,000 references from peer-reviewed, published and gray literature regarding public perceptions and interactions with biosolids recycling programs and social science literature on communications and public perceptions and participation. A searchable electronic, annotated bibliography is **included on the enclosed CD-ROM.**

The team also developed 14 case studies that document and analyze a variety of experiences with public perceptions and public involvement in biosolids recycling programs. The details of the case studies are **included on the enclosed CD-ROM.**

Based on the literature review and case studies, the investigators developed the first-ever, large-scale national survey regarding public perceptions of biosolids recycling. The University of New Hampshire Survey Center conducted the survey by telephone in early 2002, collecting opinions from more than a thousand U.S. residents. The details of this survey are **included on the enclosed CD-ROM.**

Finally, investigators held a one-day workshop in the Boston area in April 2002 in order to bring additional expertise from the social sciences to the project. At this workshop, the project team and advisors from around the continent learned more about how public perception develops, what affects the public's understanding of and response to a proposed project, and how biosolids managers might better interact with the public to gain greater trust and improve their programs. Details from this workshop are **included on the enclosed CD-ROM.**

The results of these four steps were brought together into this document, Developing Public Participation and Earning Trust.

Literature Review

The literature review was conducted to learn what has been written about biosolids recycling by those in the biosolids management field as well as interested persons outside the field. The included literature pertained to 1) public knowledge, perceptions, opinions, and behavior about biosolids recycling, and 2) the most significant and summary literature regarding public knowledge, perceptions, opinions, and behavior around related environmental issues (e.g., siting of facilities, solid waste management, energy, and new technologies). A wide variety of perspectives on environmental issues and biosolids recycling were included.

Case Studies

In consultation with a group of biosolids recycling stakeholders convened for this project, the investigating team chose to develop case studies about public acceptance issues and efforts at fourteen different biosolids recycling programs around North America. The experiences described in these case studies range from programs that have developed considerable public support by developing effective communications, trust, and long-term relationships with key “gatekeepers” (e.g., King County, WA) to programs that were stopped by public outrage (e.g., Kern County, CA). The case studies provided additional insights into how public acceptance issues noted in the literature review play out as biosolids recycling programs interact with the public.

The 2002 Biosolids Knowledge and Perception Survey

Based on the understanding developed from studying the literature and case studies, the investigating team developed a nationwide survey questionnaire, with assistance from the University of New Hampshire Survey Center. The Survey Center conducted the formal survey by telephone utilizing a nationwide sample that, in the end, totaled 1,069 individuals. Those surveyed were selected at random from the nationwide pool of home owners and house renters—people thought more likely to know something about sewage treatment and agriculture/gardening. Significant findings include:

- Knowledge of the term “biosolids” is limited (only 3% can accurately define "biosolids" and another 11% had a fairly good idea of what “biosolids” are).
- Support for wastewater treatment is very high (93%).
- Regional differences are minimal regarding the level of public knowledge and perceptions of biosolids recycling.
- People are uneasy and have questions about biosolids recycling.
- The choice of words makes a significant difference: using "sewage sludge" instead of "biosolids" creates a marked drop in positive response to a neighbor's hypothetical use of the material.
- If they need to learn more about biosolids, people want more information about many different aspects of biosolids recycling.
- Faced with a hypothetical situation in which biosolids are used by a neighbor, people say they would turn to and trust friends and neighbors, government agencies, and academic researchers for initial information.
- Faced with a hypothetical situation in which biosolids are used by a neighbor, people say they would trust government and others who appear knowledgeable and objective; they strongly distrust those with a profit motive.
- People favor constructive uses of biosolids (creating energy, recycling nutrients).
- Some factors increase people’s concern about biosolids (if it includes an industrial waste source or is from a large city), others decrease their concern (if it is certified annually, if they are contacted prior to its use, if it is supervised locally).
- Strong arguments in favor of biosolids recycling are: Biosolids recycling returns nutrients to the soil, and recycling biosolids disposes of a necessary waste.

- Most people think that biosolids recycling is a relatively small risk to them.
- Although they clearly expressed support for the concept of recycling biosolids, respondents indicated that the strongest argument against biosolids recycling is “not enough is known,” indicating that they are uncomfortable with their own lack of information and/or what they perceive to be an overall lack of information on this topic.

The 2002 Biosolids Public Knowledge and Perception Survey provides biosolids managers and other stakeholders with information about many factors and actions that will impact their chances of building trust, improving communications, and building public support for biosolids recycling programs.

Workshops on Public Participation

One important aspect of developing stronger public input and participation in biosolids management is training. How to interact with the public is not a common training topic in the wastewater management and engineering fields. Therefore, the project sponsored a one-day workshop to provide initial training on conflict resolution and the “mutual gains approach.” In attendance were project advisors, biosolids managers, and other stakeholders from around North America. The summary from that workshop appears in Appendix D. Lessons learned from this and other workshops conducted subsequently at Water Environment Federation conferences have been incorporated into the concepts and recommendations included in this report.

Recommendations for Working with the Public

Managing sewage sludge is an important public function in modern society. Sewage sludge and biosolids managers should recognize that:

- They do not have to decide all by themselves how to manage sewage sludge and/or biosolids;
- If they want to ensure that the decisions being made are the best possible—and the most publicly supportable—they should get input from a variety of stakeholders (i.e., they should strive for and insist on public participation);
- If they are going to involve the public in meaningful, constructive ways, they must build “public relationships” with individual stakeholders; and
- Building public relationships requires attention to the relationship-building factors of trust, fairness, honest and useful information, two-way communications, and organizational commitment and motivation to do things right for most stakeholders.

In short, all public outreach, communications, and participation efforts and actions, as well as many technical decisions regarding biosolids management, should be developed and implemented with this question in mind:

“What will be the impact of my next action on our program’s relationship(s) with key stakeholders?”

The report discusses twelve steps for developing and implementing a public outreach and participation program (see Table I-1). Many of the recommendations are not new, but their consistent implementation by biosolids managers has not yet been realized.

Biosolids managers are encouraged to pay attention to social aspects of their programs. An overarching guiding principle is to say things and take actions that build constructive long-term public relationships. Building positive public relationships hinges on the following principles, which have become central WERF themes identified from social science literature and experience through this project and a related one. Think of public relationships as an umbrella held up by:

- trust;
- fairness;
- quality of information;
- excellent communications; and
- your organizational commitment to public outreach, dialogue, and participation.

In addition, the following factors are important for biosolids managers to keep in mind:

- Listen to stakeholders; encourage their input; never discount or scoff at questions or concerns—most questions are reasonable to those raising them.
- Demonstrate that you care about protecting the environment. Ensure continual improvement in practices, and consider how you can remove factors that contribute to nuisances or public outrage (e.g., size and site projects appropriately). An Environmental Management System can help institutionalize continual improvement.
- Ensure independent oversight, either by a state or county agency or by creating independent oversight at the local level: it builds public trust, credibility, and confidence in your program.
- Give the public time to learn; big trouble comes when people feel pressured by looming deadlines. This may mean communicating extensively and getting public input long before any required public hearing or application deadlines, so that people are already well-informed when the deadlines arrive.
- Engage stakeholders as early in the process as possible: since biosolids recycling is a public function, interested citizens have a right and a responsibility to constructively assist the biosolids manager. Engaging constructive stakeholders may be one of your biggest challenges—so start working on it as soon as possible.
- Focus on building long-term relationships: Remember to ask yourself “What will be the impact of my next action on our program’s relationship(s) with key stakeholders?”

Remember, you are not giving up responsibility or control by reaching out and involving stakeholders. You are still ultimately responsible, but you will have greater confidence (and your program will be less vulnerable) knowing that different stakeholders know about, have been involved in, and accept what you are doing. The information contained in this report will help you develop constructive relationships with communities, neighbors, and other public stakeholders.

INTRODUCTION

Project Overview

The nation's dependence on effective wastewater treatment requires an increasing capacity for the management of sewage sludge and biosolids. The amount of municipal sewage sludge generated annually continues to rise. The U.S. Environmental Protection Agency (U.S. EPA) estimates that more than seven (7) million dry tons of sewage sludge are generated each year, compared with four and one half (4.5) million dry tons in 1972, and that U.S. municipalities will produce more than eight (8) million dry tons annually by the year 2010. Approximately 60% of the sewage sludge produced today is applied to land as biosolids fertilizers or soil amendments, an increase from 33% in 1988. This trend, in conjunction with the increasing amount of biosolids produced, means that more land application sites are being proposed to meet a growing demand.

From September of 2000 through 2003, investigators under contract with the Water Environment Research Foundation (WERF) explored and analyzed public acceptance and public involvement in the field of biosolids recycling in North America. For this report, the term "biosolids" is used to mean municipal sewage sludge solids (sludge) that have been treated and tested and are being used as fertilizers and/or soil amendments. Four tasks were completed before the writing of a final analysis and recommendations.

1) Investigators collected about 1,000 references from peer-reviewed, published and gray literature regarding public perceptions and interactions with biosolids recycling programs and social science literature on communications and public perceptions and participation. A searchable electronic, annotated bibliography is **included on the enclosed CD-ROM.**

2) Investigators developed 14 case studies that document and analyze a variety of experiences with public perceptions and public involvement in biosolids recycling programs. The details of the case studies are **included on the enclosed CD-ROM.**

3) Based on the literature review and case studies, the investigators developed the first-ever, large-scale national survey regarding public perceptions of biosolids recycling. The University of New Hampshire Survey Center conducted the survey by telephone in early 2002, collecting opinions from more than a thousand U.S. residents. The details of this survey are **included on the enclosed CD-ROM.**

4) Investigators held a one-day workshop the Boston area in April 2002 in order to bring additional expertise from the social sciences to the project. At this workshop, the project team and advisors from around the continent learned more about how public perception develops, what affects the public's understanding of and response to a proposed project, and how biosolids managers might better interact with the public to gain greater trust and improve their programs. Details from this workshop are **included on the enclosed CD-ROM.**

The results of these four steps were brought together into this document, Developing Public Participation and Earning Trust.

What follows are summaries of the findings from each part of the project, which are detailed further in the subsequent chapters of this report and can be found on the enclosed CD-ROM.

Literature Review

The literature review was conducted to learn what has been written about biosolids recycling by those in the biosolids management field as well as interested persons outside the field. The scope of the literature search was narrowed to documents published or presented mostly after 1990 and mostly in the United States and Canada. The included literature pertained to 1) public knowledge, perceptions, opinions, and behavior about biosolids recycling, and 2) the most significant and summary literature regarding public knowledge, perceptions, opinions, and behavior around related environmental issues (e.g., siting of facilities, solid waste management, energy, and new technologies). A wide variety of perspectives on environmental issues and biosolids recycling were included.

History of Public Acceptance

Beginning in the 1970s, the U.S. EPA, state agencies, and managers of municipal sewage sludge began to recognize the importance of public perception and public acceptance. Technical manuals and guidance documents began to include short sections on working with the public regarding the use or disposal of sewage sludge.

By the early 1990s, “public acceptance” had become a regular topic of interest in the trade press and at conferences. As public interest in civic and environmental affairs was generally increasing around North America, a growing number of conflicts between biosolids recycling programs and local communities were underscoring the importance of public acceptance. “A technically well designed and executed program can still fail because of community opposition," noted one author.

The Water Environment Federation (WEF) tackled the public acceptance challenge through its publications, including a biosolids communication plan developed by a Washington public relations firm (Powell-Tate, 1993). The “Powell-Tate” communications plan encouraged biosolids managers to identify and communicate proactively with “gatekeepers,” individuals who are leaders of public thinking in their communities (political leaders, agricultural advisors, conservationists, civic club leaders, etc). Efforts to gain public acceptance stressed the importance of conveying the abundant scientific information on which biosolids recycling practices were based, especially with the help of allied gatekeepers. The assumption was that if people learn more about biosolids recycling, they will come to accept it.

Pushed in part by public concerns, U.S. EPA engaged the National Academy of Sciences (NAS) to conduct a review of the science behind the federal 40 CFR Part 503 regulations—the 1993 regulations that govern sewage sludge management in the U.S. That 1996 report confirmed what proponents had been saying, that, according to the best available science of the time, biosolids recycling involved only “minimal” risk. But that scientific information did not quell the conflicts, and the NAS panel knew it would not. They recommended that biosolids recycling program managers pay attention to "early public involvement in the design of land application programs"; support of strict enforcement, oversight, and best management practices*;

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* The term “best management practices,” as used in this report, refers to a variety of actions that those managing and using biosolids take to help ensure that any potential risks or negative impacts from their biosolids recycling program(s) are reduced as much as possible. Best management practices (“BMPs”) develop over time, through general agreement within the field, and are usually based on research findings. Occasionally, researchers, regulators, or agricultural advisors (e.g. cooperative extension) compile into a guidance document current best management practices for a particular aspect of biosolids recycling (e.g. U.S. EPA’s *Guide to Field Storage of Biosolids*). BMPs

demonstration programs; indemnity of farmers; and empowerment of local and state officials to address and enforce nuisance and other complaints.

Soon after the publication of the NAS report, the Cornell Waste Management Institute circulated a paper called "The Case for Caution," a critique of biosolids recycling that raised many questions about its safety and long-term impacts. Local newspapers, which had covered biosolids recycling controversies in scattered locations, began to be joined by occasional regional and national press coverage. By the turn of the millennium, failure to gain public acceptance was becoming a relatively common reason for the failure of biosolids recycling programs. Local and county restrictions or bans were being enacted from New Hampshire to southern California. In response to the growing public concern, regulations were strengthened in many states.

In response, the biosolids "industry" formed a few regional biosolids management associations and implemented training programs and developed a progressive Environmental Management System for biosolids program to help reduce nuisance problems. Communications to the public were stepped up—more videos, fact sheets, and brochures appeared. U.S. EPA requested another NAS review; it was completed in July, 2002.

As opponents to biosolids recycling became more organized and effective through publications of their own, including use of Internet websites and email, more biosolids managers and regulators began to recognize that biosolids recycling nationwide was strongly threatened by the "public veto"—the ability of small groups of committed citizens to put social and political pressure on local and regional citizens, regulators, and legislators to stop particular projects. Discussion in trade journals and conferences turned to the need for increased public participation in developing and implementing biosolids recycling programs.

Topics in the Biosolids Recycling Public Acceptance Literature

Much of the literature on public acceptance of biosolids recycling fell into the following general categories:

- *Scientific and public health issues.* These include the potential impacts (and how to discuss them) of trace elements ("heavy metals"), chemicals, and pathogens in biosolids; odors and air quality; oversight and enforcement; surface water and groundwater quality; soil and food quality; transportation and trucking; economic viability; changes in demographics and changing expectations; and emerging issues and uncertainty.
- *Examples of biosolids recycling programs that gained public acceptance.* Biosolids management professionals have written many "success stories" about biosolids recycling programs. These are widely used to promote the benefits of the practice.
- *Biosolids recycling program communications and outreach. How much and what type of biosolids information does the public need? Who should speak for biosolids recycling?* Building on the Powell-Tate communications plan and other guidance documents, an increasing number of conference and trade press papers urge biosolids managers to communicate better and provide better information. Some discuss *how* biosolids managers may best communicate the biosolids recycling "story."
- *Political and legal efforts.* A few papers in the literature describe political and legal efforts against or in defense of biosolids recycling.

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develop and improve over time. High quality biosolids management is knowledgeable about—and utilizes—the most current BMPs available.

- *Public opinion surveys and biosolids marketing analyses.* Several biosolids recycling programs in North America have conducted surveys or marketing analyses to better understand public perceptions and concerns around biosolids products. However, only two small *nationwide* surveys were found in the literature–one conducted as part of the development of the WEF communications plan by Powell-Tate and the other as a later check on progress from that plan.
- *Addressing issues through Environmental Management Systems (EMS).* As the National Biosolids Partnership began to develop its EMS program in the late 1990s, with the goal of encouraging "practices that build public confidence within local communities," papers began to discuss the potential benefits of an EMS in terms of public acceptance.
- *The roles of third parties and the media.* As the media took more notice of biosolids recycling—especially conflicts around it—biosolids managers wrote more about "how to deal with the media."
- *Literature expressing concerns about biosolids recycling.* Any review of the literature on public acceptance of biosolids recycling must include the extensive and growing number of articles, papers, fact sheets, and Internet sites that express concerns about the practice. Besides "The Case for Caution," a book on public relations called *Toxic Sludge is Good For You* became popular amongst critics. Many small civic and environmental groups have printed reports critical of specific projects or biosolids recycling in general. An Internet search using the keyword "sludge" will access a wide variety of information, much of which pertains to biosolids recycling, but some of which is about other kinds of sludge (dredged sludge, oil sludge, hazardous waste sludge, etc.). This literature expressing concern has grown in volume and impact over the years. How to counter it has become an on-going public acceptance topic in the biosolids management field and literature.

Social Science Literature

The project team found only a handful of social science studies that had been conducted to look specifically at the social factors involved in public perception and acceptance of biosolids recycling. However, the literature review includes social science research topics that are relevant to biosolids recycling, including:

- how people perceive potential risks ("risk perception"),
- risk communications,
- trust,
- equity and fairness,
- public participation,
- conflict and conflict resolution, and
- general public attitudes regarding the environment and technology.

The modern literature on these and related topics dates back only as far as the late 1970s. Since then, social scientists have increasingly sought to understand behavior change and the relationships between the public's knowledge of a subject and their attitudes, perceptions, and behavior—especially in the environmental fields of energy, nuclear power, and hazardous waste management. What they found was that public perceptions about energy and the environment were not shaped exclusively by technical or scientific information. They also noted that, over time, the public was becoming more skeptical of new technologies and their perceptions were not the same as those of the "experts" (i.e., scientists, engineers, and government officials).

Social scientists Peter Sandman, Paul Slovic, and others researched risk perception and developed the concept of “outrage” factors that influence how an individual perceives a particular risk (risk = hazard + outrage). How best to communicate risks was an area of study that developed from this understanding of risk perception. Others, such as Lawrence Susskind, looked at conflicts around environmental issues and examine individual behaviors in terms of trust, credibility, equity, fairness, and respect. These were identified as key factors in developing productive interactions that led to resolution of conflict or avoidance of conflict. Susskind and his associates developed and have written extensively about the “mutual gains approach” to resolving conflict, which emphasized trustworthy actions and a focus on building long-term relationships.

Through the 1990s, such concepts were developed further and reached into specific fields—for example, the health field and journalism has utilized risk communications extensively.

At the same time, the public has come to expect, more than ever, to be able to be involved in public sector decisions, if they choose to be. Thus, “public participation” has become a major topic in diverse environmental and public policy fields. There have been many different attempts and models for how to involve the public most effectively. The International Association for Public Participation (IAP2) has attempted to standardize strategies and tools for use in fostering public participation in any field. Most recently, social scientists have been evaluating the effectiveness of different public participation models. One researcher (Rowe and Frewer, 2000) recommends the application in the public participation process of certain criteria that he believes make a model more acceptable to the wider public:

- ♦ representativeness (how well does the participation effort manage to involve all representative stakeholders?),
- ♦ independence (is the public participation group able to act and make decisions independently of any one stakeholder group?),
- ♦ early involvement (people tend not to want to be involved if they cannot participate early in the process, when key decisions often are being made),
- ♦ influence (is the public able to have real influence on the outcome?), and
- ♦ transparency (is the process by which decisions are made and actions taken transparent to all involved?),

He also recommends process criteria that he believes make a model more likely to be effective:

- ♦ resource accessibility (do all participants have fair and equal access as needed to information and other resources?),
- ♦ task definition (is the task of the public participation group or effort well defined and well understood?),
- ♦ structured decision making (is their a clear, defined, agreed-upon process by which decisions are made?), and
- ♦ cost-effectiveness (will the public participation process avoid breaking the bank?).

The complete literature review appears on the enclosed CD-ROM, in addition to the annotated bibiliography.

Case Studies

In consultation with a group of biosolids recycling stakeholders convened for this project, the investigating team chose to develop case studies about public acceptance issues and efforts at fourteen different biosolids recycling programs around North America. The experiences described in these case studies range from programs that have developed considerable public support by developing effective communications, trust, and long-term relationships with key "gatekeepers" (e.g., King County, WA) to programs that were stopped by public outrage (e.g., Kern County, CA). The case studies provided additional insights into how public acceptance issues noted in the literature review play out as biosolids recycling programs interact with the public (Table I-1).

Table I-1. Public Acceptance Issues Identified in the Biosolids Case Studies.

Public Acceptance Issues	1. King Co., WA	2. Milwaukee, WI	3. Jefferson Co., AL	4. Princeton, BC	5. Fulton Co., IL	6. Boulder, CO	7. New York City CAC	8. NYC and Rural Communities	9. Denver,CO	10. Philadelphia, PA	11. Montgomery Co., MD	12. Everett, WA	13. Kern Co., CA	14. New Hampshire
Social/Political														
Trust	•		•	•		•	•	•	•			•		•
Equity and Fairness	•		•	•	•	•		•	•	•	•	•	•	
Communications	•	•	•	•				•	•	•		•		•
Information (Sources and Timing)	•			•			•		•			•	•	•
Public Participation	•			•	•	•	•	•	•		•	•	•	•
Changing Demographics	•		•			•			•	•	•			•
Politics									•		•		•	•
Oversight and Enforcement	•							•	•				•	•
Scientific/Public Health														
Trace Metals and Chemicals	•	•						•	•	•		•	•	•
Pathogens								•		•	•	•	•	•
Odors and Other Air Quality				•	•		•			•				•
Water Quality			•	•					•	•		•		•
Soil and Food Quality										•			•	
Transportation/Trucking			•	•				•	•				•	•
Economic Viability			•		•		•	•	•		•	•	•	•
Emerging Issues and Uncertainty													•	•

The highlights of each case study are as follows:

1. *King County, WA*—The Seattle area's long-standing biosolids recycling program has relied on strong partnerships with allies: university researchers, cooperative extension staff, local community leaders, farmers and farming groups, and a conservation consortium—the Mountains-to-Sound Greenway Trust. The biosolids program has high standards for the management of its biosolids, applying best management practices and conservation measures to minimize any potential negative impacts, including nuisances. Applications of biosolids on forestry and agricultural sites are developed and researched to show clear benefits. King County has invested millions of dollar in research and public outreach. Staff have spent much time and effort introducing biosolids projects to local communities. Regular, multi-pronged communications keep stakeholders informed. Questions and concerns are addressed promptly, through the Northwest Biosolids Management Association, university research and demonstration, and/or by knowledgeable County staff. The program's allies are willing to speak in support of the program. King County's biosolids program consciously implemented the Powell-Tate (1993) communications plan and staff believe that has led to the stable long-term biosolids recycling projects the County has today.

2. *Milwaukee, WI*—Milorganite®, a bagged, pelletized, heat-dried biosolids fertilizer product, has been marketed since 1926. Its success has come from its performance as a pleasing, easily-managed, effective commercial product—it stimulates plant growth and customers are happy with it. This level of customer satisfaction has come about because of Milwaukee's recognition, decades ago, that they create a *product* that must meet the demands of the consumer. Thus, Milwaukee's biosolids program has a consumer-oriented organizational ethos that understands and responds to its customers, requiring proactive communication, listening, and constant attention to quality and improvement.

3. *Biosolids Mine Reclamation in Jefferson County, AL*—This county biosolids recycling program, serving Birmingham and neighboring communities, established a land reclamation project in Beltona that provided clear benefits to the land and neighbors. However, when the County proposed the same kind of project at another site in the town of Adger, neighbors objected to the city "dumping on them" and worried that their wells or children might be harmed. "It was a natural reaction to something they didn't know about," said biosolids program staff. This case study indicates that, with concerns about biosolids being openly and frequently expressed on the Internet and in other media sources, past successes are no longer predictors of future public acceptance. On-going outreach and public involvement is required to ensure the long-term viability of any biosolids recycling program.

4. *Princeton, BC*—Clear benefits to the local community was the hallmark of the Greater Vancouver Regional District's reclamation with biosolids of the Granby mine tailings at Princeton, BC. The project managers emphasized this perspective as they communicated extensively with the local media and residents, addressing questions and concerns openly and honestly. The project started with a small demonstration, to show the potential benefits of the project, and then grew to become a project noted by the British Columbia Lung Association. In an article in that association's publication, *Your Health*, they stated that the biosolids application had significantly reduced airborne dust and some people have now moved into the area for the air quality.

5. *Chicago Biosolids at Fulton County, IL* —In the early 1970s, the Metropolitan Water Reclamation District of Chicago purchased more than 15,000 acres of mine-spoiled land in Fulton County, south of the city. A local steering committee was formed to assist the District in developing the project to reclaim and restore the mine-lands with biosolids. District staff who managed the operation lived near the site. Early operations created odors and public concerns, which took many improvements to practices and years of operations to overcome. Today, even though the Prairie Plan biosolids recycling program is one of the longest continual land application programs, and has yielded clear benefits to the land, local public acceptance is limited. "Local people are still not thrilled about it coming from Chicago," says an Illinois regulator.

6. *The Study Review Group, Boulder, CO*—When Boulder's biosolids land application program met strong local resistance in 1994, the staff convened a "Study Review Group" of diverse stakeholders that was given the task of finding an acceptable method of biosolids management. The group was provided independent technical consultation and a neutral facilitator. They met regularly for months, learning about various options, and eventually agreed on an interim plan that was presented to the City council for approval. The interim plan included a combination of Class A and Class B biosolids recycling, with the proportion of Class A composting to be increased once a pilot compost operation was completed. The outcome and the process were considered fair and productive by all involved, and controversy around the topic subsided after the interim plan was approved and began to be implemented. In the end, the City was able to adhere to its policy goal of recycling 100% of the sewage sludge it produced.

7. *New York's Citizen Advisory Committee*—In 1989, New York City established a diverse Citizen's Advisory Committee (CAC) for sewage sludge management that included representatives of environmental groups, community and borough board members, business representatives, city staff, and more. Committee members brought different interests and agendas to the process, but all recognized their responsibility for developing an agreed-upon Biosolids Management Plan. The City provided the CAC independence and technical support. The CAC commented on, and revised, the Plan, which eventually was approved and implemented. Thereafter, when issues arose, the CAC responded, defending the biosolids management program. A revised CAC still meets six times a year to review new information and make additional recommendations. Researchers have noted that the effectiveness of CACs is improved by agreed-upon ground rules, wide and equitable representation, transparency of the process, early involvement in the decision-making process, opportunities for full learning of technical details by all CAC participants, and full sharing of information.

8. *New York City and the Rural Communities of Sierra Blanca, TX, and Prowers County, CO*—Part of New York City's biosolids management plan has been to transport biosolids long distances for agricultural use in rural areas in western states. Biosolids managers recognized that overcoming concerns about contaminants in the City's biosolids would be a significant obstacle. They took actions to overcome this: stepped-up pretreatment, reducing the corrosiveness of the City's drinking water, strict monitoring of the biosolids, and garnering support from their Citizens Advisory Committee. In addition, City staff insisted that they be visible and involved in all communications and interactions with the communities where the biosolids were going to be recycled. For their part, the biosolids management companies that conducted the land application

programs worked with local community members to develop practices that would help allay local concerns, including a container inspection and handling plan to ensure that nothing but actual biosolids could be slipped into shipments. Extensive communications were conducted. Local farmers, ranchers, and officials were well-informed, so that some became proponents of the biosolids recycling programs. Another critical component of the success of the Prowers County program was that the host community experienced direct financial benefits through decreased fertilizer costs and improved soils and crop yields. These two New York City biosolids projects highlight critical factors that lead to gaining public support:

- ♦ New York City worked with contractors who had the resources to do the job;
- ♦ City staff have been partners in the program, assisting the contractors in maintaining credibility;
- ♦ The contractors identified and understood the relevant local issues and socio-political situations and addressed them appropriately; and
- ♦ Both contractors utilized local resources to address local issues.

9. *Denver, CO's Metrogro Farm Biosolids Land Application Program*—Understanding and addressing the needs of the local community was a central element in making Denver's Metrogro Farm in Deer Trail, CO, a viable site for on-going land application of Class B Denver biosolids. When Metro bought their own huge tract of land for their biosolids recycling program, they expected to have little local public resistance. But neighbors and civic leaders became concerned about their farming methods. When an order to stop land application of biosolids came from the County Supervisors, Metro decided not to bring legal action, but, rather, to try to better understand and address the concerns. Over several years of dialogue, many tours of the site, and the development of an extensive independent monitoring program by the U. S. Geological Survey, relations between Metro and the local community of Deer Trail have improved. Lessons learned include:

- ♦ Actions speak louder than words—the most important thing a biosolids program can do is to constantly strive to do the right thing, to pay attention to every detail ("doing what we say we will do—not just lip service!");
- ♦ Listening is more important than talking--it is critical to understand that critics are often right and can provide valuable feedback;
- ♦ There is no easy, canned solution to gaining public support.

10. *The Philadelphia Biosolids Mine Reclamation Program*—Philadelphia biosolids have been used for more than 30 years to restore barren lands scarred by past mining. This use has included extensive study by university researchers. Yet considerable public concern has developed throughout the state, and opponents have become sophisticated and effective:

- ♦ Concerned citizens have organized around the issue;
- ♦ They point to the origins of biosolids and the uncertainties involved in recycling them;
- ♦ They encourage distrust of those producing and managing biosolids;
- ♦ They have convinced some larger regional organizations and state legislators to oppose biosolids recycling;
- ♦ The Internet has made communication amongst those concerned much easier;
- ♦ Opponents point to two deaths they believe were caused by land application of biosolids; and
- ♦ They draw support from some experts in the field, notably EPA "whistleblowers."

As a result, maintenance of the Philadelphia mine reclamation program has become far more complex than it once was. Contractors must now pay constant close attention to local and regional social and political factors, more open and regular communications with more different stakeholders, addressing questions and concerns, and understanding the interests of concerned citizens.

11. *The Washington Suburban Sanitary Commission Site 2 Montgomery County Regional Composting Facility*—Siting of this composting facility in the small bedroom community of Calverton, MD (outside of Washington, D.C.) was fraught from the start with controversy and legal battles. In 1982, the site finally began receiving and composting sewage sludge; odors were an immediate problem. Over the next 10 years, a variety of expensive odor control measures were added, amidst mounting local public anger and pressure. In 1999, local opposition had created enough political power to force closure of the facility. Several lessons can be learned from this case:

- ♦ Proper siting of any facility is extremely important.
- ♦ Communities change, and a site that was once good may no longer be.
- ♦ A new technology and/or facility should be scaled up in phases in order to evaluate and deal with potential problems.
- ♦ Citizens should be engaged in the development process as early as possible.
- ♦ Involving the public in planning and decision-making can often result in better, more efficient, and cost-effective decisions.

The experiences gained at Site 2, the nation's first large-scale municipal sewage sludge composting facility, have assisted in establishing better management practices elsewhere.

12. *Everett, WA*—Biosolids managers from the City of Everett have reflected on their failure to successfully develop a forestry biosolids land application program on the Tulalip Indian Reservation. Although the City staff notified and involved local community members early in the development process, they failed to involve some key community leaders. More importantly, they were not well trained and were unable to answer questions and concerns in a timely manner. In addition, some social and political factors were overlooked; for example, the agreement worked out between the City and the tribe turned out to be politically and socially unacceptable to many people in the area. Finally, City staff did a poor job of gauging the mayor's and city council's commitment to the project; when the public outcry grew, their support waned. Key lessons from this case study include:

- ♦ Being open and honest was not good enough; there needed to be greater organizational commitment of resources (e.g., staff time and training);
- ♦ A successful project requires staff to cultivate strong support from elected officials;
- ♦ Local sponsors for the project must be treated as partners;
- ♦ Community leaders must be contacted early;
- ♦ These and other opinion leaders must be kept informed and their support nurtured;
- ♦ City staff must be very knowledgeable before the project is announced;
- ♦ The public must trust that the City knows what it is doing;
- ♦ Information must be timely, and questions about the project must be answered promptly.

13. *Kern County, CA*—In late 1999, Kern County, an agricultural county in south-central California, adopted an ordinance banning land application of Class B biosolids. The ban

threatened major biosolids recycling programs of Los Angeles and Orange County. Issues that led to the ban included:

- The lack of any education and outreach campaign, which resulted in entrenched, unchangeable opposition exemplified by the comments of a Kern County farmer who stated, “We don’t want to be L.A.’s toilet;”
- The impossibility of proving zero risk;
- Apparent scientific uncertainty regarding the safety of biosolids recycling;
- The opposition of local carrot growers because of their fear of public perception associating biosolids with their produce;
- Use of low-bid contractors who took shortcuts to reduce costs, which led to local environmental concerns; and
- Lack of monitoring of contractors and practices.
- The biosolids program contractors failed to recognize significant political and social motivations in Kern County and how to deal with them. Since the conflicts of 1998 and 1999, it has taken several years to begin to reestablish some trust amongst stakeholders.

14. *How Biosolids Recycling Failed and Rebounded in New Hampshire*—When the federal Part 503 regulations were adopted in 1993, New Hampshire chose not to regulate biosolids beyond the federal rules. Because Part 503 has few requirements for managing biosolids in ways that do not cause public nuisance, New Hampshire quickly experienced conflict between some biosolids managers who failed to avoid the generation of malodors and other nuisances and communities in which land application programs were occurring. In addition, the following factors were in place and helped create public concern:

- Lack of oversight and enforcement at the national level due to the low priority placed by EPA on oversight of sewage sludge use or disposal.
- A relatively young biosolids management market and infrastructure, involving many competitive private firms and numerous wastewater treatment facilities trying to find the most cost-efficient ways to manage sewage sludge, creating incentives for cutting corners and trying untested management processes.
- A prevailing concept within the wastewater management field that sewage sludge was something to be disposed of in the most cost-efficient manner possible.
- A public mostly unaware of wastewater treatment and sewage sludge management.
- A rural state feeling the social effects of growth, with development impinging on agricultural lands, generating local conflicts.
- A strong tradition of local control and skepticism (even distrust) regarding outsiders and government.

By 1995, conflicts were occurring around the state. Biosolids recycling became a political issue, even in the 1996 and 2000 gubernatorial campaigns. Opponents convinced more than 30 towns to impose significant restrictions or outright bans on biosolids recycling. This spurred biosolids managers, wastewater operators, and state regulatory officials to work harder at addressing the conflict through meetings and advisory groups. Although it was a difficult and frustrating public debate for all involved, increased mutual understanding occurred. Once new rules were adopted in 1999, fewer complaints ensued and conflicts diminished.

Today, New Hampshire biosolids managers better understand the perspective of concerned environmentalists–concerns about the long-term impacts of trace metals and chemicals applied to the land in biosolids products, the potential impacts on public health of trace pathogens (especially in Class B biosolids), and concerns about the amount of testing, oversight, and enforcement being done to ensure that existing regulations are being followed. For their part, many critics of New Hampshire's biosolids recycling programs have come to a better understanding of the limited options for cost-effective sewage sludge management and the challenges faced by water quality professionals working with wastewater and biosolids on a day-to-day basis. The mutual respect that has developed amongst some people on various sides of the issue is a sign of the development of important relationships that could lead to more productive and mutually satisfying progress on sewage sludge management issues in the future.

Details on these case studies can be found on the enclosed CD-ROM.

The 2002 Biosolids Knowledge and Perception Survey

Based on the understanding developed from studying the literature and case studies, the investigating team developed a nationwide survey questionnaire, with assistance from the University of New Hampshire Survey Center. The Survey Center conducted the formal survey by telephone utilizing a nationwide sample that, in the end, totaled 1069 individuals. Those surveyed were selected at random from the nationwide pool of home owners and house renters—people thought more likely to know something about sewage treatment and agriculture/gardening. The phone interviews were conducted in February, 2002. The results of the survey were developed by the Survey Center using standard statistical methods. Significant findings include:

- Knowledge of the term “biosolids” is limited (only 3% can accurately define "biosolids" and another 11% had a fairly good idea of what “biosolids” are).
- Support for wastewater treatment is very high (93%).
- Regional differences are minimal regarding the level of public knowledge and perceptions of biosolids recycling.
- People are uneasy and have questions about biosolids recycling.
- The choice of words makes a significant difference: using "sewage sludge" instead of "biosolids" creates a marked drop in positive response to a neighbor's hypothetical use of the material.
- If they need to learn more about biosolids, people want more information about many different aspects of biosolids recycling.
- Faced with a hypothetical situation in which biosolids are used by a neighbor, people say they would turn to and trust friends and neighbors, government agencies, and academic researchers for initial information.
- Faced with a hypothetical situation in which biosolids are used by a neighbor, people say they would trust government and others who appear knowledgeable and objective; they strongly distrust those with a profit motive.
- People favor constructive uses of biosolids (creating energy, recycling nutrients).
- Some factors increase people’s concern about biosolids (if it includes an industrial waste source or is from a large city), others decrease their concern (if it is certified annually, if they are contacted prior to its use, if it is supervised locally).
- Strong arguments in favor of biosolids recycling are: Biosolids recycling returns nutrients to the soil, and Recycling biosolids disposes of a necessary waste.

- ♦ Most people think that biosolids recycling is a relatively small risk to them.
- ♦ Although they clearly expressed support for the concept of recycling biosolids, respondents indicated that the strongest argument against biosolids recycling is “not enough is known,” indicating that they are uncomfortable with their own lack of information and/or what they perceive to be an overall lack of information on this topic.

The 2002 Biosolids Public Knowledge and Perception Survey provides biosolids managers and other stakeholders with information about many factors and actions that will impact their chances of building trust, improving communications, and building public support for biosolids recycling programs. There is no silver bullet—no one thing that will make the difference in terms of improving public perceptions, participation, and support for a particular biosolids management program. Rather, there are many small actions and factors that a biosolids manager can pay attention to—and the total sum of those actions will increase the likelihood of gaining greater public participation, greater public trust, and improved public perceptions of any particular biosolids management program.

The CD-ROM contains the summary and interpretation of the data from the survey. The survey questionnaire and the compiled raw survey data are included in Appendices B and C, respectively.

Workshops on Public Participation

The reviews of literature and case studies and the results of the survey pointed the investigators to the need for greater interaction with the public on the part of biosolids management programs. How to accomplish that became the final important research goal of this project.

One important aspect of developing stronger public input and participation in biosolids management is training. How to interact with the public is not a common training topic in the wastewater management and engineering fields. Therefore, the project sponsored a one-day workshop to provide initial training on conflict resolution and the “mutual gains approach.” In attendance were project advisors, biosolids managers, and other stakeholders from around North America. The summary from that workshop appears in Appendix D. Lessons learned from this and other workshops conducted subsequently at Water Environment Association conferences have been incorporated into the concepts and recommendations included in this report.

Conclusion: Developing Public Participation and Earning Trust

This report provides recommendations for how biosolids managers can increase constructive relationships with communities, neighbors, and other public stakeholders. Over the course of this project, the investigators changed their perspective from a focus on finding ways for biosolids managers to gain "public acceptance" of their biosolids recycling programs to a focus on "developing public participation and earning trust"; the recommendations reflect this change in perspective. The two approaches involve significantly different assumptions, speech, and actions.

> **The "public *acceptance*" approach—**One-way communication:
> "I am the expert. I know about biosolids. I will give you more information and educate you and then you will agree with me."
>
> **The "public *relationships*" approach—**Two-way communication: "Let me hear your concerns…. O.K., I think I understand. Can we discuss this more? I want to help address your concerns. May I share with you what I know and suggest who else you might talk with? How can we start?"

The ultimate goal of a biosolids recycling program's outreach, education, public relations, and public participation efforts should be to develop "public relationships" with the variety of stakeholders who may be involved with and/or potentially impacted by a biosolids recycling program. Developing relationships through listening to, and having dialogue with, all stakeholders leads to increased trust and respect, as well as increased public understanding of biosolids recycling. In most instances, this relationship-building approach also will build better biosolids management programs that are supported widely by a diverse public.

What is the Problem?

The conflicts that develop around biosolids recycling are uncomfortable for everyone. People become emotional. People get angry. Biosolids managers feel defensive, hurt, indignant, right, wrong, uncertain. For many, this is their first experience with public conflict, and it doesn't feel good.

From the public's point of view, the recycling of biosolids is a complex concept that many people find difficult to understand and accept. It is rife with factors that create uncertainty—what exactly is in any one truckload of biosolids? Because no one knows all of what gets put down drains into sewers, could there be harmful quantities of organic chemicals or "heavy metals" in some biosolids? What will be the lasting effects of adding cumulative amounts of "heavy metals" to soils over many years? What about the pathogens in biosolids?… And uncertainty is just one of many things about biosolids that can raise the level of some people's concern.

Further, while much of the wastewater treatment process requires little interaction with the general public, biosolids recycling is different—it extends wastewater operators' and engineers' work right into communities and the consumer marketplace. If biosolids managers are not aware of the affects of real and perceived uncertainty, they have trouble responding constructively to natural human concerns when they are forced into interactions with concerned citizens.

Too often, biosolids managers feel that the public's questions and concerns are threats to their biosolids recycling program and their efforts to protect water quality. They react defensively.

Instead, biosolids recycling program managers need to look at these and other "social" factors that affect a biosolids recycling program. If they don't, they will likely end up, sooner or later, getting some surprising and unpleasant feedback from the public. Sometimes, as seen in some of the case studies, that feedback is so strong that biosolids programs—even ones that have strong technical merit—are stopped. This "public veto" of biosolids recycling programs has happened all too often—and mostly because of the failure of biosolids managers to recognize the importance of public interests and concerns.

What's a Biosolids Manager to Do? Overarching Recommendations:

Managing sewage sludge is an important public function in modern society. Sewage sludge and biosolids managers should recognize that:

- they do not have to decide all by themselves how to manage sewage sludge and/or biosolids;
- if they want to ensure that the decisions being made are the best possible—and the most publicly supportable—they should get input from a variety of stakeholders (i.e., they should strive for and insist on public participation);
- if they are going to involve the public in meaningful, constructive ways, they must build "public relationships" with individual stakeholders; and
- building public relationships requires attention to the relationship-building factors of trust, fairness, honest and useful information, two-way communications, and organizational commitment and motivation to do things right for most stakeholders.

In short, all public outreach, communications, and participation efforts and actions, as well as many technical decisions regarding biosolids management, should be developed and implemented with this question in mind:

"What will be the impact of my next action on our program's relationship(s) with key stakeholders?"

If the impact(s) will be negative, consider whether you should continue with that action. How critical are the relationships that will be negatively impacted? Remember that, if trust is broken, it can take years to regain. Are there other actions you can take—e.g., talking to the impacted stakeholders in advance—that will help lessen the negative impact on the relationships? Sometimes you have to take actions that will be unpopular with some people—but it is best to do so knowing what the reaction will likely be. And, if possible, it is always best to let people know in advance.

Today, for many biosolids programs, the first decision has to be to come out from under the radar. Biosolids recycling programs are too often hidden. Biosolids managers often feel that "as long as no one is noticing and no one is complaining, all is well." Such programs are vulnerable, at any moment, to discovery and sudden public outcry.

It is hard to do, but in the long run, making your program more visible, speaking openly of its benefits and risks, and sharing information widely with diverse stakeholders will help to ensure its long-term stability. The benefits to biosolids management programs of improving public relationships are:

- you will have others willing to stand up and support your decisions because they were involved in those decisions;
- you will increase the likelihood of avoiding mistakes;
- you will reduce the vulnerability of your program to criticism;
- you will find more efficient and environmentally beneficial solutions through the diverse input you receive.

The report discusses 12 steps for developing and implementing a public outreach and participation program (Table I-2). Many of the recommendations are not new, but their consistent implementation by biosolids managers has not yet been realized.

Table I-2. Twelve Steps for Developing Public Participation and Earning Trust.

Step 1.	Build commitment within your organization.
Step 2.	Understand the national and local context.
Step 3.	Learn more about conflict.
Step 4.	Determine what is beyond your control; work on what you can control.
Step 5.	Determine who your stakeholders are.
Step 6.	Get input from key stakeholders as soon as possible, early in the process.
Step 7.	Redefine success.
Step 8.	Build public relationships.
Step 9.	Improve communications, especially listening and dialogue.
Step 10.	Provide information useful to *recipients*.
Step 11.	Don't be afraid of conflict—work patiently through it.
Step 12.	Continue to monitor public perceptions and public relationships.

Key Principles to Guide Public Participation

Biosolids managers are encouraged to pay attention to social aspects of their programs. An overarching guiding principle is to say things and take actions that build constructive long-term public relationships. Building positive public relationships hinges on the following principles, which have become central WERF themes identified from social science literature and experience through this project and a related one. Think of public relationships as an umbrella held up by:

- trust;
- fairness;
- quality of information;
- excellent communications; and

- your organizational commitment to public outreach, dialogue, and participation.

- In addition, the following factors are important for biosolids managers to keep in mind.:

- ***Listen*** to stakeholders; encourage their input; never discount or scoff at questions or concerns—most questions are reasonable to those raising them.
- ***Demonstrate that you care*** about protecting the environment. Ensure continual improvement in practices, and consider how you can remove factors that contribute to nuisances or public outrage (e.g., size and site projects appropriately). An Environmental Management System can help institutionalize continual improvement.
- ***Ensure independent oversight***, either by a state or county agency or by creating independent oversight at the local level: it builds public trust, credibility, and confidence in your program.
- ***Give the public time to learn***; big trouble comes when people feel pressured by looming deadlines. This may mean communicating extensively and getting public input long before any required public hearing or application deadlines, so that people are already well-informed when the deadlines arrive.
- ***Engage stakeholders as early in the process as possible***: since biosolids recycling is a public function, interested citizens have a right and a responsibility to constructively assist the biosolids manager. Engaging constructive stakeholders may be one of your biggest challenges—so start working on it as soon as possible.
- ***Focus on building long-term relationships***: Remember to ask yourself "What will be the impact of my next action on our program's relationship(s) with key stakeholders?"
- ***Remember, you are not giving up responsibility or control*** by reaching out and involving stakeholders. You are still ultimately responsible, but you will have greater confidence (and your program will be less vulnerable) knowing that different stakeholders know about, have been involved in, and accept what you are doing.

CHAPTER 1.0

DEVELOPING PUBLIC PARTICIPATION AND EARNING TRUST

Ned Beecher
Nora Goldstein

"People wake up to this going on in their neighborhood,
and no one from your industry has gone to them to explain what it is.
And they become afraid. People are going to be concerned….
People have a right to be concerned. And, what I get when I ask questions
is a barrage of research papers and lots of facts, but what's left is still
that people are concerned, and nobody is talking to them."
--Sally Garner, Producer, CBS Evening News

1.1 Introduction

It has been more than 30 years since the passage of the Clean Water Act and more than 10 years since the promulgation of 40 CFR Part 503, the federal Environmental Protection Agency (U.S. EPA) regulations for the management of municipal sewage sludges. The use of biosolids—treated sewage sludge—in applications to soils as fertilizer and soil amendments has become common across the U.S. and Canada. Today, nearly 60% of U.S. sewage sludges are applied to soils in biosolids recycling programs (National Research Council, 2002). Yet relatively few people are aware of biosolids recycling programs. And those who are aware have varied perceptions of biosolids recycling. Some have expressed considerable concerns, and organized opposition is challenging the viability of a number of biosolids recycling programs.

The research leading to this report has provided an overview of the current state of public perceptions and public acceptance of biosolids recycling in North America.See the accompanying CD-ROM for the detailed literature review (Chapter 2.0), case studies (Chapter 3.0), comprehensive national telephone survey (Chapter 4.0), and associated appendices The results of that research confirm that biosolids recycling programs that find strong support from a variety of stakeholders[1] tend to have the following characteristics:

[1] The term "stakeholder" is used in this chapter to refer to those most directly involved or potentially impacted by a biosolids management program, including farmers using biosolids, agricultural advisors, immediate neighbors, etc.

- they are compliant, well-run operations following best management practices[2];
- their benefits to communities and the environment are obvious;
- they introduce themselves to stakeholders early in the siting process and employ a respectful, joint-learning process, often led, in part by local farmers or other citizens;
- they communicate well through a variety of methods with the variety of stakeholders;
- they provide consistent, high-quality, receiver-appropriate, timely technical information to anyone interested;
- some incorporate significant public participation (or customer feedback) in program planning; and
- they have strong organizational commitment (staff time and funding) behind their public outreach efforts (including from the public agency producing the biosolids).

Other programs, however, have failed to work well with and for the public, and conflict has sometimes become intense and debilitating.

One important aspect of developing stronger public input and participation in biosolids management is training. For technical jobs such as wastewater treatment and biosolids management, the focus of training is on critical operations and maintenance of infrastructure, proper operating practices, and worker safety. Even larger biosolids management programs that have the benefit of a public affairs and/or public relations person may not have staff trained in the concepts and strategies recommended for effective, constructive public input and participation. Recognizing this, a workshop was held April 11, 2002, as part of this research project, to provide training to project advisors, including biosolids managers and other stakeholders from around North America. Dr. Lawrence Susskind, Professor at the Massachusetts Institute of Technology and lead author and editor of *The Consensus Building Handbook,* provided basic training on the “mutual gains approach” to addressing public conflicts and “How to Work with Your Critics.” The mutually agreed to summary of this workshop is included as Appendix D on the accompanying CD-ROM.

The following is a compilation of recommendations developed from the annotated bibliography, literature review, case studies, survey, and workshop. It provides conceptual models for understanding the development of current public perceptions, including the influence of many factors—technical issues, typical human responses, communications, information, politics, and social context.

The information presented is intended to help biosolids managers better understand the social aspects of biosolids management. It provides insight into how and to what the public reacts and why, how conflicts evolve, how to manage conflicts if and when they occur, and how to minimize (and ultimately avoid) program-disrupting conflict in the future. In general, conflicts appear to develop because of differences in people’s perceptions, goals, and values. People have

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The term “public” applies to all citizens—a broader group of people who may or may not be directly involved or impacted.

[2] The term “best management practices,” as used in this report, refers to a variety of actions that those managing and using biosolids take to help ensure that any potential risks or negative impacts from their biosolids recycling program are reduced as much as possible. Best management practices (“BMPs”) develop over time, through general agreement within the field, and are usually based on research findings. Occasionally, researchers, regulators, or agricultural advisors (e.g. cooperative extension) compile into a guidance document current best management practices for a particular aspect of biosolids recycling (e.g. EPA’s *Guide to Field Storage of Biosolids*). BMPs develop and improve over time. High-quality biosolids management is knowledgeable about—and utilizes—the most current BMPs available.

differing needs and wants that inevitably create conflict—and in a democratic society, people expect to speak up and defend their interests. Biosolids managers must be willing to join the fray, respectfully championing the interests of their customers, their utilities, their biosolids management programs.

1.1.1 Cautionary Notes

The conceptual models and recommendations presented in this chapter are based on analysis of past biosolids management experiences and social science research regarding similar environmental public policy issues. These models and recommendations have been informally tested by the authors. Similar recommendations have been put to use in other environmental fields, with considerable documented success. Nonetheless, the recommendations below may benefit from additional formal field testing and evaluation for effectiveness within the biosolids management field.

The models and recommendations below are not guaranteed to lead to any particular outcome(s). However, the authors believe—and experience indicates—that utilizing these concepts and recommendations will increase the likelihood of attaining more stable, sustainable, cost-efficient, and environmentally beneficial biosolids management programs that enjoy public support.

At the same time, biosolids managers should recognize that “the public” in their area may include a few dedicated critics of biosolids recycling who will take advantage of any opportunity to further their particular goals. It is important to involve these outspoken critics, listen carefully to their concerns, and take actions to address those that make sense. At the same time, however, it is essential to work with a diversity of other public representatives in order to obtain a broader view of public perspectives and craft a biosolids management program that a large proportion of the community can support or accept.

1.1.2 A Focus on Land Application

The following discussions often refer to “biosolids land application.” This term is commonly used to identify biosolids recycling programs that involve application of bulk, Class B biosolids (or bulk Class A products) to farm soils or lands being revegetated after disturbance. Other forms of biosolids recycling involve more highly processed and stable Class A general-use products, such as composts and pellet fertilizers. Land application of Class B biosolids has been, by far, the greatest focus of public criticism. One reason is that, historically and presently, the majority of recycled biosolids in the U.S. and Canada are Class B (or equivalent). The other reasons are that Class B biosolids are usually less stable, can be more odorous, and contain viable pathogens.

The focus of this chapter, therefore, is on land application issues that develop around farms and reclamation sites where bulk Class B (or some bulk Class A) biosolids are used. Nonetheless, many of the recommendations apply as well to Class A biosolids recycling, and the overall approach recommended should prove useful in all biosolids recycling efforts.

What may be required, however, of the biosolids manager or public agency, is an evaluation of the costs of implementing robust public outreach and participation in a particular program. Many Class A compost or pellet fertilizer programs will have different public outreach and participation needs than a Class B land application program, and the costs will be different. The project team estimates that most programs that currently recycle Class B biosolids can benefit greatly from strengthening public outreach and participation, and that such programs will find the costs, while sometimes considerable, to be worth it.

1.2 What is the Problem?

Many managers and staff of biosolids recycling programs can relate to "A Bad Day in Biosolidsland."

1.2.1 A Bad Day in Biosolidsland

It has been almost a year since you started the paperwork, mapping, testing, site evaluation, a public hearing, and obtaining the permit. Finally, the trucks are actually rolling, carrying biosolids to the field! The tractors are spreading it. Hurrah! You're happy, and the farmer is happy. Now the biosolids are finally being applied so the corn can be planted. Your hard work has paid off.

But then, late in the day, you get a call from a local politician asking questions about the biosolids. They've been getting calls from worried neighbors complaining about unusual odors. You remind the politician that you had met with them about this some months ago. Yes, he says, but we didn't know it was going to upset people. Within a few days, many neighbors are angry at you and angry at the farmer. A local opposition group is formed. Your biosolids program is suddenly front page news in the local paper—and not good news. Within weeks, a public hearing is being held on adopting a local ordinance to ban the local use of biosolids. Even the politicians are voicing opposition. It's happened so fast, you don't even have time to defend your good work. What happened?

The conflicts that develop around biosolids recycling are uncomfortable for everyone. People become emotional. People get angry. Biosolids managers feel defensive, hurt, indignant, right, wrong, uncertain. For many people, this is their first experience with public conflict, and it doesn't feel good.

The difficulty for the biosolids manager is that there are many conflicting perspectives about biosolids recycling. And there are many stakeholders—the farmers using the biosolids, their neighbors, researchers and agricultural advisors, local politicians, local and regional environmental groups, state regulators, federal regulators, and more. All have their own understanding, perceptions, and interests in biosolids recycling:

- the agricultural advisor is concerned about farm economics, crop health, and overall regional soil and water quality;
- regulators feel pressure from all sides (and some say they have done a good job if everyone is equally mad at them);
- the farmers are concerned about biosolids quality and need the biosolids at specific times;
- the environmental groups are concerned about long-term impacts of trace biosolids contaminants on soils and ecosystems.

While much of the wastewater treatment process requires little interaction with the general public, biosolids recycling is different—it extends wastewater operators' work into communities and the consumer marketplace. Biosolids recycling program managers need to look at the “social” factors that affect a biosolids recycling program. If they don’t, they will likely end up, sooner or later, getting some surprising and unpleasant feedback from the public.

1.2.2 Why Bother?

As biosolids managers face their first round of public opposition, they almost always ask themselves, at some point, “Why bother? Is it worth this hassle?” The stakeholders in a biosolids recycling program are on a continuum with regard to their level of commitment to the program. So when the question “Why bother?” comes up, some will throw in the towel more quickly than others.

Private contractors or consultants, whose business is developed around the concept of biosolids recycling, know that they must continue to work through any issues in order to stay in business. They will often work the hardest to protect the biosolids recycling program.

Public utility staff and management are often less motivated because their livelihood does not depend on recycling biosolids. They can work within their agency to develop other options for their biosolids, such as landfilling or incineration, and they get paid just the same. (Generally, those other options meet little public resistance, because they keep biosolids out of sight and out of mind in controlled disposal systems.) However, wastewater utilities may have a conviction that biosolids recycling is the most environmentally sound form of sewage sludge management, and that conviction can motivate commitment to the program. In some areas, utility managers know that biosolids recycling is a lower cost option, which benefits their ratepayers.

Farmers or other users of biosolids also vary in their commitment to the biosolids program. There are those for whom the cost and time savings are considerable and they are motivated and willing to defend the program vigorously. But, other farmers and users of biosolids do not realize—or may not recognize—such significant benefits. They are less willing to extend their already long work hours, less willing to attend emotional meetings where they stand accused, and less willing to stake their reputations in their local community.

In many cases, the result is that a biosolids recycling program gives up and goes away before the public conflict reaches any resolution. The decision to give up is often arbitrary, based on the level of discomfort felt by the particular biosolids program manager, staff, or farmer.

In the end, the defense of biosolids recycling often falls disproportionately on the private contractor or consultant. Because of this, a public perception is generated: the private contractor (“who is interested only in profits,” cynics will say) and the public utility biosolids manager (“interested in curbing costs”) are the ones who stand before the public and most vigorously defend biosolids recycling. State regulators, who are subject to public pressure, don’t want to appear to promote a practice that they also must regulate (Beecher, 1999b). And because they are often not involved in discussions (because of the long hours they work), farmers or other users of biosolids products are presumed, by cynics, to be “duped” by the private interests. So a strong public perception has developed that biosolids recycling is mainly the interest of the private companies who make a profit by it. The 2002 survey for this research, discussed in Chapter 4.0 (see accompanying CD-ROM), and experiences around the country, have shown that if the skeptical public perceives a profit motive at work, their level of skepticism and concern increases.

Ideally, the question “Why bother to recycle biosolids?” should be a larger policy question that is addressed by a community or region or society as a whole, including the wide variety of stakeholders (including concerned citizens and environmental advocacy groups).

Absent such a process, and if public concerns continue (which seems likely into the foreseeable future), more biosolids managers will ask “Why bother?” and give up on biosolids recycling.

1.3 What’s a Biosolids Manager to Do?

1.3.1 Building Public Participation Will Help

The answer to the sometimes negative public perception (and sometimes public anger) facing biosolids management programs today is to build public participation and earn public trust.

1.3.1.1 Don’t Make Decisions in a Vacuum

Fortunately, biosolids management is not something that anyone is required to do on his or her own. Biosolids managers do not have to make decisions in a vacuum. In fact, if they want to ensure that the decisions being made are the best possible—and the most supportable—they should ensure that they have input from a variety of stakeholders.

Ideally, such input would start at the beginning of the process, when a utility and municipality are deciding what to do with the sewage sludge generated locally. There would be a multi-stakeholder group, including representatives from local and regional environmental groups, community leaders, and people from neighborhoods that are near a possible land application site or facility. Such a group would have the best chance of devising a workable plan that would be defended by a wide variety of stakeholders.

Of course, it is rare that a biosolids program is at that point—many are operating already. A biosolids program that is operating can, however, start involving the public more at any time. Convene a group of diverse stakeholders. Have them address the questions: “How is our program doing? How might we make it better? How do you envision our local biosolids being managed in five to 10 years? What might we be working towards?”

By involving a variety of stakeholders, the biosolids manager and the wastewater treatment utility as a whole share the burden of responsibility with the community.

1.3.1.2 Come Out From Under the Radar

Biosolids management is a public service, provided—directly or indirectly—by public agencies. Today there is a society-wide expectation that public programs should have significant public input and participation (Renn et al., 1995). Even if citizens do not express any interest in participating or providing input—as is often the case with wastewater and biosolids management—they still expect and feel it is their right to give input and participate whenever they choose.

In stark contrast to this societal expectation is the common practice amongst wastewater and biosolids management and staff to operate “below the radar.” “Keep the biosolids program hidden,” they say. “If no one is noticing and all is quiet, that’s a good thing.” This attitude is driven by:

- fear of public anger if the program is noticed;
- fear of media attention that often stresses the negatives; and
- farmers' parallel desire for staying "under the radar," because of concern that their crop values may be reduced by negative public perceptions of biosolids.

These are all legitimate fears. But hiding and hoping to avoid being noticed is not the answer. Yes, that approach has worked for some biosolids recycling programs for some time. But it is risky: once "discovered," such programs can face debilitating public outrage—like the "bad day in Biosolidsland" scenario above.

Today, a small but growing percentage of the public is learning about and becoming interested in biosolids recycling, most often because of complaints about odors and the growing perception of potential health effects. When public interest is initiated by complaints, there is a negative start to the public interest and involvement.

It is wiser for the biosolids manager to show off the program, to proactively seek public interest and involvement. Get people to notice the program when it is going well, so that there are some positive public perceptions of it to counteract the negative impressions that might be generated by the inevitable occasional problem. This chapter discusses how to do this.

1.3.1.3 "But There are Critics Just Waiting to Attack!"

Today, any public discussion of biosolids recycling at the local, regional, or national level may draw the attention and involvement of vocal critics. The biosolids manager's best efforts at "telling the biosolids story" may be threatened by public concerns fueled by:

- communications that are faster than ever (e.g., via the Internet);
- organized national opposition;
- occasional media stories reporting on conflicts over biosolids (when people read reports that include conflict about something, their concern about that thing increases—Covello and Sandman, 2001);
- heightened public sensitivity to environmental issues;
- the public's tendency to oppose anyone *perceived* as threatening the environment or public health ("the polluters"), especially "industry," "corporations," and "bureaucratic government;"
- increased public fears and anxiety about all kinds of perceived threats (Freudenberg, 1996).

On top of all these, there are more biosolids to manage and fewer remote areas in which to manage them—so biosolids programs are increasingly close to the public.

Biosolids managers have to accept these circumstances. This is the playing field on which their biosolids programs must play, and broad societal expectations are generally out of their control. What biosolids managers can control is how their biosolids management program acts and reacts within this social context.

1.3.1.4 There is Hope …

Despite the apparently momentous hurdles facing biosolids managers, there is much that is reassuring. For example, social science researchers have noted that in many public debates, there typically is a small percentage of the public (maybe 10%) that will vocally oppose a proposed project and another small percentage that will vocally support it (again, maybe 10%).

The remaining majority of the public (maybe 80%) does not participate much but, if the debate becomes highly visible, will listen to both sides of the discussion. These quiet, undecided people have been called "guardians" by some (Ozawa and Susskind, 1984).

"Guardians" will tend to believe and side with the opposition if they perceive the proponents of the proposed project as being arrogant, condescending, close-minded, unsympathetic, dishonest, distrustful, and/or unfair. Other research has shown that many people make decisions about whether something is good and safe based not on technical information as much as on the perceived trustworthiness of those providing information about it.

So biosolids managers have an opportunity to avoid turning the guardians—that critically important majority—against them. To take advantage of this opportunity, biosolids managers must consider carefully how their words and actions are perceived. Does it help to operate "under the radar" or is that perceived as having something to hide? Does it help to tell someone you are the expert and they shouldn't worry—or is that perceived as condescending?

Wouldn't you like it better if someone explained to you in advance that some unfamiliar trucks will be dumping material on the neighboring farm field and that if you have any questions he or she is available to talk with you? Wouldn't you like it better if someone listened carefully to your concerns and expressed interest in working to address them? If biosolids managers listen, develop dialogue, and work with neighbors and other stakeholders, they will earn the trust and support of many of those stakeholders—as well as the "guardians."

As described in the case studies in Chapter 3.0 (see accompanying CD-ROM), there are reassuring examples of biosolids recycling programs that have benefited greatly from public input and participation—gaining increased public trust and support, reducing risk and vulnerability, and improving the long-term sustainability of the program.

1.3.1.5 Taking the First Steps…

As a biosolids manager takes the scary first step of bringing their biosolids program "out from under the radar," they initially find that no one seems interested. They announce tours, they hold meetings—and no one shows up. Why? Everyone is busy, and biosolids are not that interesting to most people. Then the vocal critics appear—and suddenly public interest begins to grow, because there is controversy.

Early in this process, hopefully before any controversy starts, is the time to demand help. Biosolids managers carry out a significant responsibility for the public and they should be able to expect the public—at least representatives of public interests (e.g., politicians, community groups, universities, cooperative extension, and non-profit environmental advocacy groups)—to help them with their public responsibility for biosolids management. While ultimately it is the biosolids managers' responsibility to manage biosolids using their best professional judgment, the public and political and environmental leaders are expected to be responsible and not just criticize. The public should help guide biosolids management decisions through constructive, collaborative problem solving. Of course, the biosolids manager also has to provide opportunities for public involvement that work for the public, such as holding evening meetings in neighborhoods rather than daytime meetings at the plant.

The ideal goal of public participation is to get to the point where the biosolids management program, no matter what type of use or disposal it involves, has the support of informed and involved individuals in the communities in which it operates. Ideally, these people have easy access to information about the program and are willing and able to pick up the phone and ask questions or make observations. If they note something that could be improved, they are comfortable making suggestions and the biosolids manager welcomes their input. The biosolids manager and staff check in with these people now and again to be sure the relationships are healthy and communications are good. They are all part of a team, working together to make the biosolids management program as beneficial as it can be.

In summary, public scrutiny is a part of our open society, and there is always a risk of "the public veto." Why ignore that risk? It can be argued that it is irresponsible for an agency manager to put millions of public dollars into any engineered solution without a process of public participation in the development of the project. There is just too great a risk of wasting money should the project fail from lack of public support.

1.3.2 "Public Acceptance" Versus "Public Relationships"

The literature on the interactions between biosolids recycling programs and the public has long been focused on the concept of "public acceptance." As the team working on this project began collecting information in 2000, this was also the focus of this project. For example, the first draft of the literature review (Chapter 2.0—see accompanying CD-ROM) was imbued with the viewpoint, held by many biosolids managers, that interactions with the public are aimed at gaining acceptance of existing biosolids management practices. The biosolids manager, in consultation with the biosolids user, regulatory staff, and agricultural advisors, makes the decisions. These are the technical experts who know the science. Once the decisions are made, the public just needs to be educated, so they will accept the decisions. This "decide—announce—defend" ("DAD") approach historically has been the most widely used approach in biosolids management. Not surprisingly, the management of wastewater treatment byproducts is not high on the list of things that most members of the public think or care about. So it has been easy for biosolids managers to operate without much public interest or participation.

During the course of this project, however, the project team underwent a change in perspective. By looking at the bigger picture—observing the trends in biosolids recycling public acceptance and recognizing that biosolids recycling conflicts are similar to other environmental conflicts—the shortcomings of the "let's gain public acceptance" approach became apparent.

1.3.2.1 Characteristics and Outcomes of the "Public Acceptance" Approach

Efforts to gain public acceptance have been discussed in numerous biosolids management industry conference papers on "educating the public." The focus has been on conveying the information the experts have, in order to convince the public. As has long been hypothesized (Logan, 1995; see also the survey results in Chapter 4.0), when citizens have only a little information about biosolids recycling and its potential and perceived risks, they may experience a large level of concern, even fear. Efforts to develop public acceptance through conveying information often go only as far as getting into the average citizen's mind this minimal level of information. Then the public reacts from their concern and fear. As noted below, information and communications are critical components, but not if they are only aimed at convincing the public you are right.

The "let's gain public acceptance" approach encourages setting goals and expectations that may be dangerously out of sync with known public perceptions of biosolids recycling. The survey conducted for this project (see Chapter 4.0) detected a significant, apparently inherent uneasiness with the concept of biosolids recycling. Given this fact, providing only minimal information and outreach to the public about biosolids may backfire.

Think of the typical opportunities that many biosolids managers use to provide information to the public:

- a single public meeting or hearing,
- a brochure and a fact sheet,
- a letter to abutting landowners,
- a notice in a local newspaper,
- an information-packed website.

All but the first of these are one-way communication tools. Even a public hearing too often becomes a lecture by the experts with just a few questions from the audience. The biosolids manager has no opportunity to hear the diversity of thoughts and perspectives in the community. He or she only hears a few vocal opponents, and they do not seem credible at all. So the biosolids manager can write off public concern, because the concerns heard are ridiculous. But the public is diverse! A few vocal critics do not speak for the numerous other perspectives at a hearing.

If biosolids proponents use only the traditional tools listed above, then, when questions start coming at a public hearing, there are no arrangements for further dialogue, for understanding the people's perceptions and concerns. Instead, the biosolids manager feels cornered and defensive. He or she tries to give more information to alleviate the concerns. But, at times like this, people do not like to be talked at, talked down to, and/or pressured to be convinced of something. Piling on more technical information at such times is a mistake. People don't like to have their opinions, concerns, and questions rebuffed, put down, or ignored. They like to take in the variety of perspectives and information and mull it over before they make any decision. But often the biosolids manager's goal is to get through the public hearing as soon as possible so that the needed permit is granted ASAP. Pushing forward with an agenda at a time like this can incite public anger. As they try to push their way through the hearing, proponents of the biosolids program lose credibility, trust, and respect. It's at this point that you begin to hear angry personal attacks, like "You're not from here. You don't care about this community. You're just out to save a quick buck by dumping your filth on some poor rural town!"

Even worse, the depth of this anger occasionally motivates some individuals to devote days and days of their lives to unpaid work opposing biosolids recycling. The devotion to that work, in some cases, may be driven, as much as anything, by a motivation to inflict retribution on particular individuals or on the "biosolids industry" as a whole, which they view as arrogant, condescending, uncaring, and money-grubbing.

In the "typical bad day in biosolidsland" scenario outlined above, think through what the neighbor's reaction might be to the "public acceptance" approach and what that could lead to (we'll call the neighbor Sue and the biosolids manager Jack):

> *After a weekend of putting up with some periods of bad odors, Sue finally reaches the biosolids manager, Jack, on Monday morning. They talk.*
>
> *The biosolids manager speaks and acts on the assumption that Sue just needs to learn more about biosolids and then she will understand the minimal risk and calm down and accept the situation (the information-sharing, "public acceptance" approach). So Jack starts explaining the science behind the practice. He is surprised when Sue interrupts him with*

some anger in her voice: "What's in that stuff? Is it harmful?" His efforts to provide factual technical information and calm clear answers do not have the intended effect. But he does not recognize this. Instead, he continues with more information. At the same time, he begins to feel tense and defensive."Why is she attacking me? I do excellent work and this is good for the environment."

Jack has not recognized that, in many cases, if someone takes the time and effort to pick up the phone and call, there is a fairly strong motivation for doing so. People don't bother to call their wastewater treatment facility for the fun of it. There is likely to be emotion behind such a call. Jack failed to find out what Sue is thinking and feeling and address that.

Sue's frustration comes from her natural uneasiness with something different nearby that doesn't smell good. She feels a loss of control—something is happening to her and she can't do anything about it. Add to that the fact that she hasn't been able to find out any specific information for more than two days. And now this biosolids manager is talking to her in technical jargon that does not seem to address her experience and concerns. People want their concerns heard and validated. Jack's well-intentioned effort—"you just don't understand the science; let me explain"—is off target. Sue sees his effort as unsympathetic and patronizing. Her frustration builds. Her fears increase. Jack is losing credibility. She begins not to trust him.

Further, if Sue happened to have gotten information from the Internet, or from established opponents to biosolids recycling (and Jack can't know whether this has happened or not—unless he asks Sue questions and listens carefully), Sue's distrust grows: Jack is clearly not telling the whole story.

Remember that typically the neighbor knows almost nothing about biosolids, and does not have the same context the biosolids manager has: soil science, agriculture, wastewater treatment, etc. So the information Jack provides is meaningless: at this stage, the neighbor can't judge whether something makes sense and whether it is "true" or not.

Further, if Sue has heard back from a dedicated opponent who expressed sympathy, the unsympathetic Jack has no chance. As Peter Sandman (2000) points out, active opponents—e.g., the dedicated opponent who returned Sue's call—do not create public outrage, they merely "harvest" it. The concerned neighbor wants to believe someone, to be reassured that her experience was real.

So Sue makes a judgment based on her perceptions of the circumstances and the people she has communicated with:

> *"This stranger, Jack, who has a profit motive, is telling me this stuff that disturbed my weekend is okay. But my experience is that it stinks. And I have read on the Internet that it is not okay. I talked to another stranger who was empathetic to my concerns and validated my experience. I don't really know enough about this biosolids stuff*

to know whom to believe. Meanwhile, this biosolids person goes on talking to me in techno-babble."

Who would you be more inclined to trust, if you were in Sue's shoes? Someone who you perceive as responsible for creating the uncomfortable experience and who is unresponsive to you? Or someone who empathized with you and validated what you experienced?

When a problem arises—an odor issue, a neighbor's concern (and it is almost inevitable that problems happen now and again)—public ignorance or grudging public acceptance of your biosolids program will not help you. What is needed at such times is a high enough level of local public trust and established public relationships so that communications and exchange of information remain possible, even when emotions run high. Wouldn't it be helpful if the biosolids manager, Jack, could say to the concerned neighbor, Sue:

"I understand that you are feeling concerned about the biosolids on the neighboring farm. You might want to talk with others. For instance, your neighbor, Joe, was involved in reviewing our biosolids program. He had some of the same concerns. And we have a meeting scheduled at your neighborhood meeting place on Tuesday evening, because we expected there might be some questions, once the biosolids were applied."

Building public relationships can provide many rewards over the long term.

1.3.2.1 Characteristics of the "Public <u>Relationships</u>" Approach

The new perspective gained through this project attempts to find ways to avoid the pitfalls of the historical "public acceptance" focus. This new perspective, developed from understanding public perceptions, conflict, and conflict resolution as experienced in numerous other fields, aims to enhance the integrity and credibility of biosolids managers and their public relationships with diverse stakeholders.

As discussed extensively below, biosolids managers are encouraged to cultivate constructive relationships through enhancing two-way communications skills. Listening, being open to others' ideas and perspectives, and learning from constructive criticism can enhance the biosolids manager's public relationships. This process also provides important understanding of the public perceptions and social context within which a biosolids recycling program operates. Gaining public input and participation also provides critical information to decisions, so those decisions will end up being better and the program more sustainable.

The practices that people learn to reduce tensions, heal conflicts, and build long-term relationships in their private lives also can be applied to public relationships. Think of how you feel when you are in a situation like the neighbor described above. Think of what you would want the other person to say and do:

"I hear your concern. I apologize that we caused you some discomfort. We are addressing the problem in this way. We appreciate your patience and want to avoid you having the same discomfort again. We'd like to talk more with you—get your input. May I call you tomorrow to update you on our progress? Here is my phone number, in case you have any questions. Call anytime."

The authors hypothesize that excellent, long-term biosolids programs have been successful because of the public relationships around them (such success has often come to these programs without people realizing that the building of public relationships was what made the difference). The public relationships have been more valuable than the fact sheet, m the technical report, or the letter to the editor. Hosting a tour is the best example of a simple relationship-building tool; it makes a difference because the public becomes aware that the utility has nothing to hide and that the people who work there are fine people. Open information on a website makes a difference because it shows the utility is transparent and open. The odor complaint hotline makes a difference because it shows that the utility is sensitive to an issue that affects the neighbors and welcomes anyone's input. The common denominator in the success of these efforts is that they build better relationships with a variety of people.

Based on the results of the literature survey, case studies, and public survey, the authors recommend a "public relationship" approach to biosolids recycling in place of the "public acceptance" approach. This approach agrees with what social scientists, who study conflict around environmental issues, recommend. It's not "public relations;" it's "public relationships." Critical components of this approach are briefly outlined here. Many of the same concepts are discussed in more detail later in this chapter:[3]

- TRUST AND FAIRNESS: Constructive public relationships are built on trust and fairness. Biosolids managers build trust by repeatedly doing what they say they are going to do and communicating a lot with people who may be affected. Fairness is worked out through direct and honest negotiations with stakeholders. Neither requires that people be best friends, or even like each other. Public relationships are not necessarily about friendship and enjoying each other's company. They are about getting along decently, respectfully, and equitably in the particular situation—even when there is strong disagreement.

- INFORMATION AND COMMUNICATIONS: Public relationships are facilitated by good information and communications. Biosolids managers can ensure that the information they provide is clear, direct, complete, and useful to the recipient and that the biosolids program and staff provide clear verbal and written communications at all times. Remember, it's important to be communicating during non-conflict times, as well as during times when there is tension. Good information and communications do not necessarily take lots of time and energy; just remembering to make a call or send a note before the trucks roll down the street can help. It's a matter of courtesy, showing that you understand and respect others' needs and concerns.

- ORGANIZATIONAL COMMITMENT AND MOTIVATION: Public relationships, like good biosolids management programs, are built over time and require strong organizational commitment and motivation. Throughout the literature on biosolids public

[3] The components presented here are consistent with the developing Water Environment Research Foundation (WERF) conceptual framework of "Public Partnering." These concepts—trust, fairness, information, communications, etc.—were identified from the literature during the first year of this project. They were also identified independently by a parallel WERF project regarding public perception and participation in water reuse (Hartley, 2003). They were further refined through discussions with that project team, including especially Troy Hartley, Ph.D., Principal Investigator, Juliana Birkhoff, Ph.D., and Mary McDaniel, M.D., J.D., MPH. The authors extend our appreciation to each of them.

perception and acceptance, there is constant encouragement for agencies and companies to commit adequate resources to working with the public (CH2M Hill, 1982; Hartley, 2003). Unfortunately, all too often, the public participation or public education or communications line item is the first to go when budgets are trimmed. The authors believe that biosolids recycling may not remain a long-term viable option for organizations that fail to provide significant, on-going commitments of finances and personnel to developing public outreach, information, communications, and public participation. If such a commitment is not made, it may be best to manage biosolids in some way other than land application, so as to minimize interaction with the public.

♦ OVERSIGHT AND ENFORCEMENT: Today, across North America, one of the largest issues around biosolids recycling programs is the adequacy of oversight and enforcement (U.S. EPA Office of Inspector General, 2000; National Research Council, 2002). Public knowledge, understanding, and trust of biosolids management programs are enhanced by direct public observation and monitoring. Biosolids managers can provide opportunities for stakeholders to see how biosolids are produced, treated, managed, and utilized in compliance with local (if applicable), state, and federal regulations. Because biosolids recycling is highly regulated and *its safety depends on strict management and compliance*, the public's confidence will be increased if they know that biosolids are being recycled properly. Thus, biosolids programs will benefit by ensuring independent monitoring and by openly and proactively providing detailed records of biosolids recycling activities. Biosolids managers are encouraged to involve stakeholders in designing and implementing local oversight and monitoring systems or witnessing existing oversight and enforcement conducted by state or local authorities[4].

While the authors recommend that biosolids managers develop strong public outreach and communications programs, they see such programs as only a part of a larger public participation effort. Public outreach, or public relations, without public participation (e.g., two-way communications and public input in decision making) is not enough and may result in public outrage.

Ask yourself these questions as you decide what to do or say in any given situation:

♦ Have I listened enough and am I sure that I have all critical information?
♦ Do I understand the situation from a variety of perspectives, including community and public stakeholder perspectives?
♦ Have I covered all the angles and am I sure that I have incorporated diverse perspectives and interests in this decision, this action, or what I am going to say?

Be humble—you don't have all the answers. Then, ask one last question before you take any action or make any statement:

"What will be the impact of my next action on our program's relationship(s) with key stakeholders?"

If the impact(s) will be negative, consider whether or not to continue with that action.

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[4] These concepts fit well with the National Biosolids Partnership's Environmental Management System for Biosolids program (National Biosolids Partnership, 2000b)).

How critical are the relationships that will be negatively impacted? Remember that if trust is broken, it can take years to regain. Are there other actions you can take, such as talking to the impacted stakeholders in advance, that will help lessen the negative impact on the relationships? You will, at times, have to take actions that will be unpopular with some people—but it is best to do so knowing what the reaction will likely be. And, if possible, it is always best to let people know in advance what you are doing and why.

1.3.3 Benefits of Public Participation Done Right

As noted above, biosolids managers benefit from public participation by knowing that someone else supports their decisions and actions; managers don't have to make decisions alone, in a vacuum. The most significant benefit of public participation in biosolids management decision-making and implementation can be that it leads to better decisions and improved environmental performance and efficiencies. By working with a variety of public stakeholders through a robust public participation process, biosolids managers may ensure that decisions are made with as much information, and with as many different and specialized perspectives, as possible. With an able group of well-informed stakeholders—including agricultural advisors, communications specialists, local environmental group representatives, farmers, local politicians, neighbors, engineers, and wastewater operators—the biosolids manager will:

- decrease the likelihood of making mistakes,
- reduce the vulnerability of the program to criticism, and
- find a more efficient and environmentally beneficial solution.

However, it must be noted that there is no guarantee that public involvement will result in the choice of the best possible solution—that depends on how careful, fair, and equitable the public input process is. (There are many examples in the literature regarding public participation in environmental decision-making that resulted in poor and wasteful choices.) And it is certainly possible that a robust public participation process may result in a decision that is not the initial first choice of the biosolids manager. If it's a good choice, that's okay. Ideally, the final decision can be one that everyone is able to accept, even if it may be no one's first choice (this is what is often achieved by consensus). To avoid bad choices, however, the biosolids manager—and all other participants in the decision-making process—must be willing and able to strongly state his or her interests. Experts need to state clearly their best professional judgment and to deny any decision that they know is not technically viable, environmentally sound, or economically possible. If needed for critical and potentially costly decisions, biosolids managers can learn about and/or seek assistance to create a robust public participation process that will avoid potential pitfalls.

1.4 Stumbling Blocks

Biosolids managers want to know "What works?" That is what the authors attempt to answer in the rest of this chapter. But before turning to that, it's good to review a few things that *don't* work.

Some actions and attitudes of biosolids managers will increase the likelihood that a biosolids recycling program will not be sustainable for the long-term. Over the course of this project, the following "stumbling blocks," or factors, were found to impede public participation and the development of public trust. Although some of these factors cannot be controlled by the biosolids manager, the way in which the program addresses these issues is something the biosolids manager or public agency can control.

Stumbling blocks that are largely out of a biosolids manager's control include, but are not limited to:

- public uncertainty about the concept of recycling materials that are derived from sewage or human waste;
- widespread public environmental worry about possible hazards of wastes, especially those that include industrial sources;
- public uneasiness about anything "new" (even though formal biosolids recycling programs have been going on for decades, they are "new" to each individual as they first encounter the concept);
- rural citizen distrust of urban products, especially urban "wastes";
- a low level of general public knowledge and understanding of wastewater and biosolids management;
- the public perception (and, in some cases, actual reality) of little or no enforcement or oversight on the part of local, state, or federal government officials (or other form of independent monitoring and oversight).

Stumbling blocks that are in biosolids manager's control include, but are not limited to:

- a poorly designed and operated biosolids management program (proper siting is critical!);
- use of biosolids that create highly negative personal experiences for neighbors or other members of the public (e.g., poorly controlled odors);
- biosolids managers, staff, and biosolids end-users who are *not* knowledgeable, respected, open, and honest;
- poor communication (especially lack of listening);
- ineffective communicator(s);
- lack of credible information, or conflicting information;
- pre-existing conflicts between biosolids end users / program participants and neighbors / communities; and
- attempts to cut corners to save money (a situation that may be encouraged by the competitive marketplace for sewage sludge management services both private and public).

The following sections provide further discussion of what works and what does not work in addressing the social aspects of biosolids recycling. Many of these recommendations are not new (see, for example, CH2M Hill, 1982), but their consistent implementation by biosolids managers has not yet been realized.

1.5 Twelve Steps for Developing Public Participation and Earning Trust

Based on an evaluation of how a biosolids recycling program is currently perceived by a variety of stakeholders, managers can develop goals and strategies to improve long-term relationships with various stakeholders. Recommended actions for developing public participation and earning public trust are distilled into twelve critical steps (Table 1-1). Each of the steps is discussed in more detail in the following sections.

Small biosolids management programs may find a less detailed approach more suitable, but the overall concepts will apply. For example, even small programs will benefit from building organizational commitment to public participation (Step 1), identifying and getting input from stakeholders (Steps 5 and 6), providing a range of public participation opportunities with a focus on opinion leaders (Steps 8 and 9), and making public participation an ongoing effort (Step 12). These most critical action steps appear in bold in Table 1-1.

Table 1-1. Twelve Steps for Developing Public Participation and Earning Trust.

Step 1.	**Build commitment within your organization.**
Step 2.	Understand the national and local context.
Step 3.	Learn more about conflict.
Step 4.	Determine what is beyond your control; work on what you can control.
Step 5.	**Determine who your stakeholders are.**
Step 6.	**Get input from key stakeholders as soon as possible, early in the process.**
Step 7.	Redefine success.
Step 8.	**Build public relationships.**
Step 9.	**Improve communications, especially listening and dialogue.**
Step 10.	Provide information useful to *recipients*.
Step 11.	Don't be afraid of conflict—work patiently through it.
Step 12.	**Continue to monitor public perceptions and public relationships.**

1.5.1 Build Commitment Within Your Organization

* **a *most critical* action step**

How committed is your organization to public outreach and participation? Successful public outreach and participation requires funding and attention. This means that biosolids management budgets and contracts need to explicitly include staff time and other costs associated with public outreach and participation. Absent this dedicated funding and staff time, biosolids programs may be wise to select management options that impose as little as possible on the public. For example, consider only very isolated sites for Class B land application, invest in producing a fine quality Class A biosolids product that will win consumer confidence in the marketplace, or choose landfilling or incineration. Any biosolids recycling program that fails to commit adequate resources toward public outreach and participation is doing the entire biosolids management industry a disservice and may bring public outrage upon itself.

The viability of most biosolids recycling programs hinges on the ultimate cost, often measured as the cost for use or disposal of each wet ton or gallon of biosolids. Public outreach and participation costs are not generally included in budgets as part of the basic cost of biosolids management—they are seen as added costs. In many communities, public wastewater utilities are required to follow public bid processes that require acceptance of lowest cost bids. In other locations, biosolids management is done by agency staff and wastewater budgets are scrutinized by boards and politicians. Some public contracts for management or disposal of biosolids include requirements for public outreach and participation and best management practices, but many Requests for Proposals and contracts do not include such terms, or if they do, oversight does not happen to ensure they are done. Cost too often remains the sole critical factor, and when public outreach and participation requirements are not spelled out in the budget or contract and enforced, they don't happen.

The true cost of a biosolids recycling program with robust public outreach and participation can be considerable. The highly-acclaimed King County, WA biosolids recycling program has cost the County millions of dollars over the past decade, including membership support of the NBMA, university applied research, land acquisitions, demonstration sites, and staff that independently audit each land application program (see Chapter 3.2.1). Likewise, Denver's Metrogro Farm (Chapter 3.2.9) has remained in operation to a large extent because of the City's $1.6 million funding of an independent monitoring program by the U.S. Geological Survey. And Merco, the New York City biosolids land applier at Sierra Blanca, Texas, spent $3 million on research and monitoring. The cases of Boulder, Colorado (Chapter 3.2.6) and New York City's Citizen Advisory Committee (Chapter 3.2.7) are additional examples of public participation efforts that cost considerable effort and money. Even less-formal public outreach and participation efforts—including communications, information-sharing, and media relations—require a considerable commitment of time and resources on the part of the public utility and/or biosolids manager.

Is it worth it? In recent years, it appears that many biosolids managers and agencies have chosen recycling programs based on factors other than short-term costs. Considerations have included:

- biosolids recycling may prove to be more cost-effective in the long-term as landfill costs increase and biosolids products become more valuable and return income;
- recycling biosolids is "the right thing to do"—more environmentally correct than disposal;
- the natural resources value of biosolids (e.g., for soil remediation, building soil organic matter to improve moisture retention); and
- recycling biosolids is a more sustainable, long-term option for society.

Still, issues of cost often make or break a biosolids recycling program, as seen in the Sierra Blanca land application program (Chapter 3.2.8) and the closure of the Site 2 composting facility in Montgomery County, MD (Chapter 3.2.11). In some parts of the country, low landfill tipping fees make recycling of biosolids more expensive than landfill disposal, even without considering public outreach and participation costs. Even in parts of the country where landfill costs are high, such as the Northeast, the total costs of successful biosolids recycling programs, including public outreach and participation, approach the cost of landfilling.

An additional cost issue, now routinely weighed by many communities, is the indirect costs associated with policy decisions, including exposure to risk and liability. Biosolids recycling, depending on how it is done, may or may not create less exposure to liability and legal action—and this needs to be included in cost analyses. No matter what final end use or disposal is chosen for sewage sludge, a community establishes a certain amount of risk and liability, and it is hard to be certain of how risky any particular option may be perceived to be in the future. Social scientists who promote the use of mutual gains negotiation and consensus building (Susskind et al., 1999b), suggest that there are two significant cost-related benefits of involving the public in policy decisions: 1) reduction in potential risk and liability due to improved informed analysis and decision-making, and 2) avoidance of costs associated with defending unilateral policy choices, including legal and “damage control” costs.

The biosolids management case studies (Chapter 3.0) illustrate that successful biosolids recycling programs require far more skill, patience, dedication, and commitment of resources than any other form of sewage sludge management. Programs that have met with the greatest difficulties in terms of public outrage have often been those that have not ensured adequate resources for public outreach and participation and/or have cut corners (see Chapters 3.2.13 and 3.2.14). Indeed, some biosolids recycling projects that fail to gain public acceptance do so through a downward spiral driven by cost-cutting measures:

- ♦ The lowest-bid contractor is awarded the contract to manage the biosolids recycling program;
- ♦ Stiff competition creates a low bid that does not include any resources allocated to public outreach and participation initiatives;
- ♦ The low bidder cuts corners, providing little or no training to staff;
- ♦ Best management practices are curtailed;
- ♦ The need for efficiency and speediness leads to careless mistakes such as land applying odorous biosolids during a neighbor's Memorial Day picnic without having notified anyone;
- ♦ When angry neighbors begin asking questions, the staff's lack of training and knowledge regarding the scientific basis for biosolids recycling leads to charges of incompetence;
- ♦ Staff feels threatened and defensive and either reacts defensively or shuts down the program and runs away;
- ♦ In either case, constructive, informative discussion and other productive public education, participation, and relationship-building processes don’t happen.

This repeated biosolids recycling scenario results in an increase in the number of citizens with a negative impression of biosolids recycling.

Most of the 16,000+ wastewater treatment facilities in the U.S. are small, with limited budgets, and the experiences of King County or Denver may not be applicable (Ross & Associates Environmental Consulting, 2000). However, there are ways to improve the efficiency of public participation programs, while providing assistance to smaller facilities. One approach is the formation of cooperatively funded outreach programs for all biosolids programs within a region. For example, the Northwest Biosolids Management Association—which involves agricultural, farmer, and academic communities, as well as wastewater and biosolids management organizations—conducts cooperative public outreach, funded disproportionately by larger agencies who understand that a problem with any biosolids recycling program, large or small, affects public perceptions of biosolids in general.

In summary, to build organizational commitment, biosolids managers have to estimate the costs and do their best to “sell” to their management and political boards the importance of public outreach and participation. It is a significant challenge. Write these costs into the routine operating budget. Write public outreach and public participation responsibilities into someone’s job description and give them the time and funding to do it. Write into biosolids recycling management contracts strict requirements for implementation, reporting, and evaluation of public outreach and participation efforts. And make sure there is a robust system in place for checking that these requirements are followed.

1.5.2 Understand the National and Local Context

A review of the literature (Chapter 2.0—see accompanying CD-ROM) reveals the evolution of biosolids recycling and public acceptance in the U.S. over the past decades. Over this period, recycling rates have risen, as have efforts to research and regulate the process. Public outreach efforts and public acceptance of biosolids recycling have had ups and downs. Key developments include U.S. EPA's application of the risk assessment approach to sewage sludge, promulgation of 40 CFR Part 503 regulations, reviews by the National Research Council (in 1996 and 2002), and the October 2003 petition to U.S. EPA regarding stopping land application (see diagrams of key developments in Appendix E on accompanying CD-ROM). Because all biosolids management programs operate within the context of these national trends, it is helpful for biosolids managers to understand the historical trends and key events as they plan for the future of their programs.

One national trend has been that technical development and extensive research of biosolids recycling over the past several decades have been conducted, shared, and debated almost entirely within the biosolids field. The survey conducted for this project (see Chapter 4.0) confirmed a low level of knowledge about biosolids amongst the public. This gap in knowledge between "experts" and the lay public is common in many fields, and it has been the subject of social science research. One approach for closing this gap includes "joint fact-finding" or "collaborative research" and on-going public participation in development of understanding and policy (Susskind and Field, 1996). The Boulder Case Study (Chapter 3.2.6) successfully included this kind of joint learning process. The NBMA and King County took steps in this direction with the development of their partnership with the Mountains-to-Sound Greenway Trust (see Chapter 3.2.1). The National Biosolids Partnership has also taken steps in this direction with involvement of public environmental group representatives in the development of the Environmental Management System program.

An important result of "bringing the public along" is that, by so doing, biosolids managers will quickly come to understand when "the public" does not want to be "brought along." Thus, the biosolids manager will avoid being surprised by a public unwilling to agree to what the biosolids manager proposes.

Knowing the context is helpful in other ways in reducing the vulnerability of your biosolids program to public concerns. For example, in 2003 and 2004, there has been growing citizen concern over possible health risks from Class B land application sites. Even if conflict has not been a problem for your program, it may be worth evaluating the potential risks to neighbors of such sites and proactively managing that potential risk before concerns are raised.

However, before taking any action, biosolids managers can determine the importance of any particular issue by getting public input. Currently, many programs are adopting Class A technologies in order to reduce vulnerability from pathogen issues. At least some of these decisions have not had the benefit of stakeholder input and some programs may be surprised down the road to find that even some Class A biosolids are not accepted. With the current state of public concerns about biosolids management, any significant decision regarding a biosolids management program might do well to include public input and advice from biosolids stakeholders who are knowledgeable about current issues and trends.

A wealth of information is available to help biosolids managers understand the national and regional context in which their biosolids program operates, much of it on the Internet (Table 1-2). The National Biosolids Partnership, the Water Environment Federation, and regional associations all provide information at Internet websites and through electronic and paper newsletters. The Cornell Waste Management Institute website is an excellent source of information about current public concerns. Searching the Internet using the keyword “sludge” will identify many more sites expressing concerns about biosolids recycling. As with any information, the reader should be aware of the source of the information and its credibility.

Table 1-2. Websites with General Information and Recent Developments on Biosolids.

National Biosolids Partnership (Water Environment Federation, Association of Metropolitan Sewerage Agencies, & U.S. EPA) : http://www.biosolids.org

U.S. EPA (national biosolids program): http://www.epa.gov/owm/mtb/biosolids/index.htm

U.S. EPA (Rocky Mountain states) biosolids program:
http://www.epa.gov/region08/water/wastewater/biohome/biohome.html

Cornell Waste Management Institute: http://www.cfe.cornell.edu/wmi/

California Association of Sanitation Agencies: http://www.casaweb.org

Great Lakes By-products Management Association: http://www.glbma.org/

Mid-Atlantic Biosolids Association: http://www.mabiosolids.org

New England Biosolids and Residuals Association: http://www.nebiosolids.org

Northwest Biosolids Management Association: http://www.nwbiosolids.org

State of Virginia Biosolids Program: http://www.biosolids.state.va.us/

State of Pennsylvania Biosolids Program:
http://www.dep.state.pa.us/dep/biosolids/biosolids.htm

State of Washington Biosolids Program: http://www.ecy.wa.gov/programs/swfa/biosolids/

Publications that cover biosolids management news and developments; all require paid subscriptions:

BioCycle, Journal of Composting & Organics Recycling (JG Press): http://www.biocycle.net

Clean Water Report (Business Publishers, Inc.): http://www.bpinews.com

Knowing the national and regional context, it is then possible to evaluate your local program’s relationships with stakeholders and the public. The first question is who knows about your program? If the answer is you, your staff, the farmer, and your family, there’s work to be done. Other questions are:

- Does your program get input from stakeholders? Is that input formal—i.e., through a "complaint" hotline or an advisory group? Or is it more informal—i.e., staff talking to neighbors and the farmer every now and then?
- How much do stakeholders know about the biosolids recycling program? For example, is the farmer or end user well-informed? Could he or she answer questions of neighbors or town officials? Do program staff check in with the farmer on a regular basis? Does the farmer receive user-friendly reports on biosolids quality on a regular basis?
- How much does the general public know about it? What opportunities exist for them to learn about it?
- Has there been any conflict around the biosolids program? Has this created strong opposition that you have to contend with? Has any conflict been resolved or are there still questions or issues left hanging?
- Has the community experienced conflict over other environmental issues or siting of facilities? What was the role of the farmer/end user in that conflict, if any? What was the role of site neighbors? Often new potentially controversial proposals will re-open old wounds and divisions in communities—it's possible your biosolids program proposal could do this.
- How is the farmer's/end user's relationships with his or her neighbors? With community leaders?
- Has there been any media attention to the biosolids program? Has it been accurate, fair, and balanced coverage, or not? Have you ever spoken with local or regional media?
- What would a graph of public knowledge and support for your program look like? Is it up and down? Or steady?

These same questions can be reworded to apply to any form of biosolids recycling program or any facility site (e.g., a biosolids composting facility or pelletizing plant) or with regard to whatever communities or groups of stakeholders a biosolids recycling program operates around. Understanding your local history and context will help identify priority public outreach and participation needs.

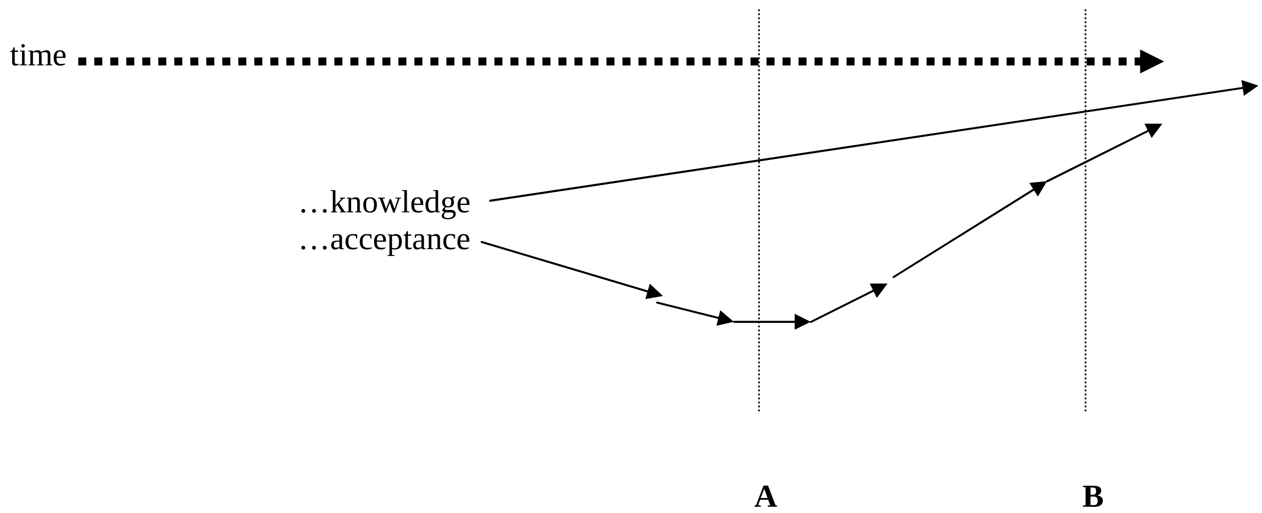
1.5.3 Learn More About Conflict

Many of the case studies (Chapter 3.0) discuss the development of public knowledge and perception of biosolids in a particular location (e.g., see Boulder, CO and New Hampshire case studies). To develop insight into how conflicts about biosolids/sewage sludge management develop in communities, three possible models are proposed that consider the role of shared knowledge and/or shared values in the community over time.

Model 1. Conflict is triggered by a lack of shared knowledge about biosolids. When the public learns more about biosolids, their acceptance will increase.

Logan (1997) suggested that as people learn about biosolids recycling, too little knowledge can result in uncertainty and fear. If that is as far as people go in their knowledge and thinking about biosolids, then they may end up with a high level of concern and a negative impression. Logan suggests that, with more information and time to absorb it, people will come to understand biosolids recycling and accept it. Clearly, the development of strong knowledge and understanding of the technical aspects, including risk management, involved in biosolids recycling often results in an improved perception and acceptance of the practice.

Figure 1-1. One Possibility: Progression Toward Acceptance.



According to this model, acceptance may decline initially but will rise as the level of knowledge continues to rise (Figure 1-1). This reaction to a little knowledge about biosolids was confirmed by the survey conducted for this project, which found that people have some initial uncertainty and quickly come up with relevant concerns and questions.

This model has important implications for biosolids managers. If people learning about biosolids recycling only have time and energy to get as far as time "A" in Figure 1-1, they will know something about biosolids recycling, but will likely remain uneasy about it—especially if the initial information they have received raises questions. If the biosolids manager is put off by the lack of acceptance and abandons the project, unwilling to work through the conflict, he or she leaves the situation at time A—at the lowest point of acceptance, when the public's knowledge is still minimal. The result is a lasting negative impression and unresolved questions.

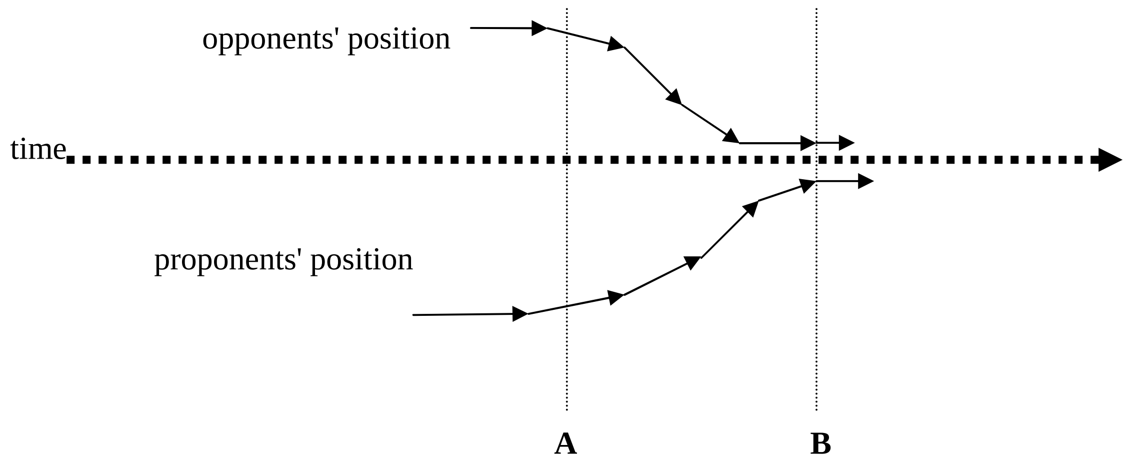
On the other hand, if the biosolids manager encourages people to take the time and continue the process of learning about biosolids management—thus acquiring more knowledge and getting to time B or beyond—questions may be answered and the uncertainty may be reduced, resulting in increased acceptance. This is the experience in some situations, as reported by Logan and others.

Some social scientists might argue, however, that public acceptance is created not by increased knowledge as much as by the act of listening and caring enough to respond respectfully. That is, the process of communication and developing the public relationship is more important than the actual knowledge. This perspective is reflected in the following:

Model 2. Conflict is triggered by a lack of shared knowledge about biosolids–as well as by emotional, social, cultural, and value differences. When there is interaction and a sharing of information, mutual understanding improves, agreement is reached, and the conflict is reduced.

With emphasis on *dialogue*—the mutual sharing of information and understanding—a biosolids/sewage sludge conflict may mature over time from widely divergent views and positions toward greater mutual understanding and a smaller gap between positions (Figure 1-2).

Figure 1-2. Another Possibility: Divergent Views Move Over Time Toward Mutual Understanding.



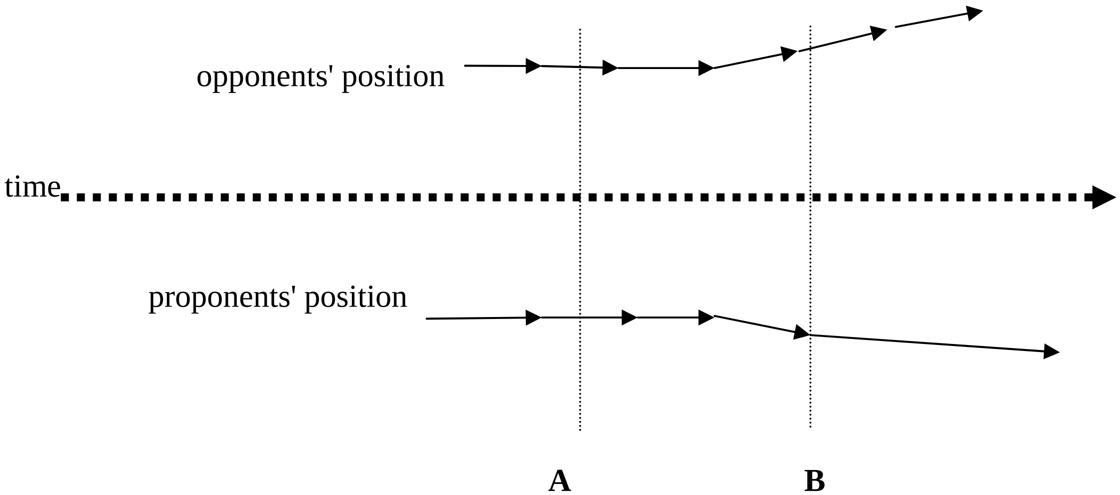
Once again, if the development of the debate is arrested too early (i.e., near time A in Figure 1-2), the widely diverging perspectives and positions in the debate will be locked in place. This scenario may result, for instance, when a biosolids manager decides to avoid conflict and abandon a project at the first hint of public concern. In contrast, if the local policy debate is allowed to mature over time, it is possible (though not guaranteed) that time B can be reached and the gap can be closed—at least to a large extent.

In both of the above models of conflict, it benefits the biosolids manager to work through the process and try to get at least as far as time B. The result will likely be a more mature discussion focused on more substantive issues and the "grays" in the middle of the debate. This can be a productive dialogue in which each side is learning from the other and might lead to a better outcome, including a more environmentally beneficial biosolids management program. Such dialogue may also improve long-term relationships.

Model 3. Conflict is triggered more by emotional, social, cultural, and value differences–and lack of shared information exists, but is less important. When there is interaction and a sharing of information, the value differences only become clearer and the conflict becomes entrenched and may increase.

If the individuals involved in the initial interaction are incompatible—e.g., have differing values or communication styles—then it is possible that no rapport develops and, on the contrary, there is wariness and/or growing distrust. Thus, as time B is reached, an entrenched conflict is developing and the positions held by the two opposing sides may actually move farther apart (Figure 1-3).

Figure 1-3. A Third Possibility: Entrenched Conflict Develops Over Time.



This scenario has developed in many biosolids recycling situations (e.g., Chapter 2.2.13). Conflict of this sort is described by Birkhoff (Water Environment Research Foundation, 2001), who summarized some of the social science literature:

> [W]ithout productive engagement, disagreements over policy choices may escalate to antagonism between parties. These hostile interpersonal dynamics develop through psychological and social psychological processes. They may begin instrumentally, as one party seeks to differentiate itself and its view on the issues from the other parties…. The community also goes through a predictable cycle as the conflict escalates. Opposing side[s] may become increasingly polarized. New organizations and leaders may spring up to further different interests. Existing community organizations are drawn into the conflict and may increase polarized relationships. Finally, word of mouth communication increases as people begin to mistrust traditional sources of information and news.

It is important to recognize entrenched conflict as soon as possible, in order to discontinue the forms of communications and actions that tend to further increase the conflict. Once conflict is entrenched, it is usually necessary to apply conflict management and conflict resolution strategies (for more information, see Sandman, 2000; Susskind and Field, 1996).

As you develop a public participation process for your biosolids recycling program, think about any conflict you are in and what you can do to help reduce it—but don't be afraid of conflict or run away from it. Be willing to work through it in a respectful, open, honest, and caring manner. Conflict, as Birkhoff and others point out, is an integral part of social interactions in a democratic society. There are many examples of sound decisions coming from public processes that involved considerable conflict. For example, a Vermont town on the shore of Lake Champlain recently spent several years struggling with developing a plan that was acceptable to all parties for protecting the local lake water quality. An initial public citizens advisory group failed to produce an acceptable plan. However, because of the learning and public involvement that occurred during that process, a second advisory group was able to efficiently develop a plan that was accepted by all.

1.5.4 Determine What is Beyond Your Control; Work On What You Can Control

There are many factors that affect the public perceptions and acceptance of a biosolids program. Many of these factors directly affect the development of public relationships. For example, if a neighbor to a proposed land application site has had a negative experience with the farmer proposing to use biosolids, that former experience will have a significant impact on the relationship between the biosolids manager and the neighbor and, thus, on the proposed program.

Biosolids managers often note (and complain about) such factors, and some are discussed in the case studies (see Chapter 3.0). However, the biosolids manager needs to recognize which factors are generally beyond his or her control (Table 1-3). Pre-existing experiences, predilections, and prejudices cannot always be predicted. And they can only be avoided if the choice is made to refrain from pursuing any communication or relationship whatsoever—which means abandoning the project. While it is distracting and unproductive to focus much attention on uncontrollable factors, the biosolids program manager still needs to know about them and understand their potential influence on the biosolids program. The best way to learn about and understand these factors is to develop relationships with stakeholders and keep the lines of communication open.

If you find yourself complaining about something, stop and think about whether it is something you can control or not, or if you can avoid it, and determine its possible impacts. Then move on.

It is also possible to use this kind of analysis of factors to aid in choosing between alternative biosolids management options. For example, if a pre-existing negative relationship between a neighbor and a farmer is likely to translate into opposition for biosolids use, the biosolids manager may decide to choose a different location, make additional concessions, or select another biosolids management technology.

Table 1-3. Some Factors Out of Biosolids Managers' Control.

FACTOR	POTENTIAL IMPACTS	CASE STUDY EXAMPLES
Pre-existing relationships between local landowner (farmer or facility site) and neighbors	Communities often split into opposing groups along existing “fault” lines; a biosolids program could cause a wound to re-open.	New Hampshire (Chapter 2.2.14) Denver's Metrogro Farm (Chapter 2.2.9)
Urban/rural conflict; perceived or true imbalance of power between urban and rural communities	The biosolids manager may be starting with a strike against her or him. It will be an added hurdle to establishing trust and a sense of fairness.	New York City and Rural Communities (Chapter 2.2.8) Philadelphia Biosolids Mine Reclamation Program (Chapter 2.2.10) Chicago, IL (Chapter 2.2.5)
Changes in land use near application sites	Varied expectations re quality of life, community	Boulder, CO (Chapter 2.2.6) Montgomery County (Chapter 2.2.11)
Exaggerations and misinformation, people become concerned because of what’s on the Internet	Means more work to present useful, accurate information and to have dialogue with stakeholders.	New Hampshire (Chapter 2.2.14) Philadelphia Biosolids Mine Reclamation Program (Chapter 2.2.10)
Scientific dispute; uncertainty	People are often concerned when they become aware of uncertainty in the scientific basis of what to them is a “new” technology. Risk communications may be useful.	New Hampshire (Chapter 2.2.14)
Past issues sensitize the community.	What’s happened before cannot be changed, but will influence how people react to new conflicts.	New York City and Rural Communities (Sierra Blanca, Chapter 2.2.8) Denver’s Metrogro Farm (Chapter 2.2.9)
Regional social differences (e.g. public familiarity with farming, denser or less dense populations, history of public acceptance or not, level of environmental interest and concern, etc.)	Some existing factors aid a biosolids manager, such as familiarity with organic waste management. Information provided should be appropriate for the audience.	New York City and Rural Communities (Prowers County, Chapter 2.2.8) New Hampshire (Chapter 2.2.14)
A new thing - introducing new technology	People are leery of what they perceive as “new” technology.	King County, WA (Chapter 2.2.1) Everett, WA (Chapter 2.2.12)
Distrust of the biosolids manager who has a stake or a financial interest.	Will require more effort to overcome distrust.	Kern County, CA (Chapter 2.2.13)

1.5.5 Determine Who Your Stakeholders Are

* **a *most critical* action step**

Who may potentially be impacted by your program? Imagine how people will learn about your program. Will their experience of learning about it likely be a positive or a negative experience? Table 1-4 is a list of possible stakeholders and some of the potential impacts and concerns that may affect them. Not all of the impacts listed will be significant in every project; it may be useful to further develop this table for your particular program.

Table 1-4. Identifying Biosolids Management Program Stakeholders.

Stakeholder	Impact: Perceived Benefit	Impact: Perceived Risk	Degree of Impact (as perceived by that stakeholder)	Other information about stakeholder
Farmer/biosolids user	Fertilizer, cost savings	Liability, trace contaminants, nutrient control, pathogens	Benefit: great Risk: some to minimal	May have had plenty of time to study biosolids.
Biosolids land application workers	Employment	Trace contaminants, pathogens, heavy machinery	Benefit: great Risk: minimal to moderate	Familiar with biosolids—experienced.
Neighbors to utilization site or facility	Possible appreciation that farm/open space remain viable	Odors, air emissions, pathogens, lower property values	Benefit: minimal to none Risk: minimal to considerable	Unfamiliar with biosolids, concerned about something new.
Local officials in the area of the biosolids land application use	Commercial activity, economic benefit to farms, landowners	Liability, safety, citizen concerns	Benefit: minimal to considerable Risk: minimal to considerable	May not be knowledgeable about biosolids; motivated by what concerns citizens.
Local citizen or environmental group	Open space or the benefits of cleaning water that leads to sewage sludge production	Citizen concerns, potential for pollution, mismanagement, public health, long-term impacts	Benefit: minimal to none Risk: potentially considerable	Watch dogs and instigators of change, sometimes an important societal function.
News media	Possibly interesting story; may be required coverage since it deals with public works	Difficult story to write in a balanced way, with technical accuracy. Complex. People are upset.	Benefit: minimal Risk: minimum to considerable (discomfort due to conflict, complexity)	May or may not pay much attention or spend time learning; local press can have considerable influence.
Wastewater facility/generator (and the local officials who oversee the utility)	Biosolids use, cost efficiency (political standing)	Liability, proper management, public image (political standing)	Benefit: considerable to huge Risk: minimal to considerable	This stakeholder's interests are the major driver in most biosolids programs.
Sewer users, septage haulers	Efficient sewer rates	None, unless due to illegal discharge	Benefit: minimal to considerable Risk: none	Both groups often know little about biosolids recycling and the benefits they get from it.
Neighbors to truck route/drivers/road	None	Highway safety, damage to roads,	Benefit: none Risks: minimal to	Can be a big concern if there

crews		noise, odors, dust	considerable	are lots of trucks.
Area farmers/agricultural interests	Cost efficiency for farm, soil improvement	Potential impacts, nutrient management, public perception of regional crop quality	Benefit: minimal Risk: minimal to considerable	Farmers and other providers of food and other consumer products are concerned about perceptions of their products and may choose to avoid being associated with biosolids use if they see the public is concerned.
(who else?)				

1.5.6 Get Input from Key Stakeholders as Soon as Possible, Early in the Process

*** a *most critical* action step**

Your biosolids management program needs to assess the importance of developing relationships with each of the identified stakeholders. You can prioritize who should get more attention, but don't leave out any of the obvious stakeholders as you develop a two-way communications plan. You should keep track of what stakeholders are thinking and how they perceive your program. Develop a system for tracking interactions. Make a special effort to talk to and listen to neighbors, communities where biosolids are managed, and local political leaders. Ask them for assistance in making your program more compatible with its surroundings. Provide stakeholders with opportunities to help plan, implement, and monitor the program. Research clearly shows that involving stakeholders as early as possible in the process engenders greater trust and better long-term relationships. And stakeholders are more be willing to be involved if they know they can make a difference—something that is more likely to happen if they are involved early in the process.

To what extent should you involve stakeholders? You need to involve them enough so you can have confidence that you know what they are thinking and feeling about your program. Some stakeholders and situations will require more extensive public involvement. For example, there may be neighbors who are especially concerned and should be engaged in helping make the program work better in their community. For them, you might establish a Citizens Advisory Committee and a complaint hotline. In some situations, state and federal oversight is perceived as minimal, so the biosolids manager may want to encourage and support community efforts to provide local independent monitoring that will help build trust and confidence.

Throughout the process of developing public outreach and participation, the biosolids manager will need to assess how extensive the public participation process should be. Susskind (personal communication) delineates four levels of public involvement, from some to a great deal:

- write a fact sheet, have a tour;
- develop multi-stakeholder dialogue, build relationships;
- develop joint fact-finding and collaborative activity; and
- commit to implementing programs together.

How far you want to go with stakeholder/public participation is up to you and your stakeholders. In general, it is better to offer the public *more* responsibility and *more* opportunities for input rather than too little. (Even if they don’t take you up on the offer, they appreciate it and will trust you more.) If they get involved, you have to make it worthwhile for them. Avoid token gestures toward public participation—they can be worse for your program’s image than not involving the public at all. In this report, the authors focus on the second and third items in the above list: dialogue, building relationships, and developing joint fact-finding and other collaborative efforts around issues of concern.

While pursuing stakeholder involvement, the biosolids manager should not lose sight of his or her ultimate job responsibility for managing the biosolids in accordance with legal and agency requirements. The biosolids manager still will be held accountable and his or her expertise must be utilized throughout the process. Involving stakeholders does not mean giving up expertise, responsibility, or all control. Nor does it mean giving up robust science and engineering in your biosolids management program. And it does not mean that there will be agreement about all issues, or that everyone will become friends.

Finally, what about those “stakeholders” who inevitably show up to disrupt the process, determined to stop your biosolids management process? Expect them and plan how to deal with them. It is good to involve these people, to some extent, and listen carefully to their concerns and take actions to address those that make sense. At the same time, it becomes even more critical to work with a diversity of other stakeholders in order to obtain a broader view of public perspectives and craft a biosolids management program that works for the largest possible percentage of the community. That is the biosolids manager’s responsibility.

Ideally, extreme points of view will marginalize themselves—and the biosolids manager can just graciously stand back and let them do so. However, sometimes it will be necessary to efficiently, but respectfully, marginalize extreme points of view and move on with constructive dialogue amongst the other stakeholders (who will, ideally, include someone who can constructively represent some of the perspectives of the marginalized person(s)). This is hard to do unless you have developed relationships from working with the broad diversity of stakeholders who will support you through this process. It should be done only with care and the input of some of those other stakeholders. This is one reason why you do not want to put your efforts into working only with dedicated opponents—you will need others to work with you if difficulties arise.

1.5.7 Redefine Success

It is important to understand what constitutes "success" and what constitutes "failure" of a biosolids recycling program. Some in the business of recycling biosolids might suggest that a program has achieved success if it results in biosolids hitting the ground. Some opponents to biosolids recycling would consider it a success to stop any biosolids from hitting the ground.

This report's authors recommend a more exacting definition of success that includes four elements, where each is a building block that further strengthens a program's potential for long-term success:

- Biosolids are managed in a technically sound program in accordance with applicable laws and best management practices…
- With the awareness, understanding, and a reasonable level of input on the part of informed neighbors, local communities, and other interested stakeholders…
- With the acceptance, or support, of many stakeholders (they are satisfied, have trust, and feel they are treated fairly and with respect)….
- Consistently, over time, without dramatic fluctuations in levels of conflict or public trust and support.

Each of these components of success is discussed below.

1.5.7.1 Biosolids are Managed in a Technically Sound Program in Accordance with Applicable Laws and Best Management Practices…

A "successful" biosolids management program should not only comply with applicable laws, but also should adhere to best management practices. By going beyond compliance, this definition "sets the bar higher" than is currently the case in some biosolids management programs. The federal Part 503 rule focused on issues related to biosolids quality, application rates, and significant potential impacts; with a few exceptions (e.g., setback distance from surface waters), Part 503 does not stipulate management practices. A growing number of states, however, now include best management practices in their biosolids management regulations. Overtly and formally including current best management practices in a biosolids recycling program can help move the program toward the new definition of success.

In the experiences noted in this report, if a program is not in compliance with legal requirements and best management practices, it will eventually run into public opposition/perception issues. An illegal program may be shut down by regulators. But beyond issues of legality, if people who are initially uneasy about biosolids recycling discover that the program near them is not being run in accordance with best current practices, they will (often successfully) use that fact as a rationale for stopping or changing the program.

Programs that are perceived as poorly run create public distrust and even outrage, and their managers will lack credibility. The fact is that all stable, successful biosolids recycling programs today go above and beyond regulatory requirements. Many have negotiated with stakeholders to establish special practices that meet the needs of the local situation.

1.5.7.2 …With the Awareness, Understanding, and a Reasonable Level of Input on the Part of Informed Neighbors, Local Communities, and Other Interested Stakeholders…

There are many currently operating biosolids recycling programs that appear to be operating smoothly in the absence of informed neighbors. No one is complaining, and the biosolids are going on the ground.

However, as the experiences in the literature review and case studies show (see Chapters 2.0 and 3.0 on the accompanying CD-ROM, biosolids managers in such situations can be surprised by sudden public opposition. Such programs are vulnerable because the biosolids managers have no information on what stakeholders are thinking or how stakeholders may react.

Meeting this second requirement for success is probably the most difficult hurdle for the biosolids manager. The recommendation is that existing biosolids programs stand up and say “we’re here, and this is what we’re doing.” This first proactive step toward fully informing neighbors and other stakeholders about a biosolids recycling program can be a frightening experience.

In some instances, this step creates an explosion of concern, anger, and turmoil. This is often referred to as “outrage,” which Peter Sandman (2000) defines as “everything else that the public considers part of risk” besides the actual calculated death rate hazard (e.g., one death in a million). His theory is that the public perceives risk as a sum of hazard and outrage. Thus, the minimal risk that some scientists have calculated (and that biosolids managers actually experience as they work) will be increased, in the minds of the public, by the addition of outrage factors (Table 1-5). The more of these factors operating in a particular biosolids recycling program, the greater the perceived risk of the program.

Table 1-5. Outrage Factors that May Increase Public Perception of Risk (after Sandman, 2000).

OUTRAGE FACTOR	EXPLANATION
Involuntary	Imposed on the public stakeholder, not something he or she chose to have happen
Industrial	Not natural.
Uncontrollable	Out of personal control. For example, we accept the high risk of driving because we feel we have a lot of control in the situation.
Exotic	Not familiar, strange. For example, we accept the high risk of driving in part because it is familiar.
Unknowable	Some uncertainty exists; this is common in science-intensive topics, where scientists cannot and will not say that something (like biosolids) is 100% safe. Similarly, the exact content of any particular bag or load of biosolids is somewhat unknowable.
Unfair	For example, a neighbor may feel it is unfair to have to put up with odors when he or she receives no apparent benefit from a biosolids program.
Memorable	Odors make strong, memorable impressions on the brain, and this can be significant for biosolids programs. In addition, other “yuck” factors can make biosolids recycling negatively memorable.
Concentrated in time and space	For example, a Class B biosolids land application event, with associated odors, tends to be concentrated in time and space.
Dreaded	Feared. For example, with a biosolids program, a neighbor might be scared thinking about what could happen to his or her well water or health.
Morally relevant	Moral arguments can be made about it. For example: Is it moral and fair for urban wastes to be recycled on rural land?
Created by a process that is seen as closed	For example, a local community can experience the permitting process as closed if they are not invited to be involved much.
Untrustworthy	Outrage is increased if those proposing the program are seen as untrustworthy or if the system cannot be trusted.
No perceived benefits	For example, many biosolids programs provide no obvious benefits to the neighbor or other local stakeholder.

The survey conducted for this project (see Chapter 4.0) corroborated the significance of several of these factors. For example, the survey respondents' concern was increased when industrial sources were mentioned.

Therefore, the process of standing up and saying "we're here" needs to be done with care—and with the help of risk communications (see below). By reducing the number of outrage factors—for example, by inviting stakeholders to provide input—you can reduce perceived risk. For example, many Class A biosolids recycling programs (e.g., Tagro in Tacoma, WA and biosolids composts in San Antonio, TX and Merrimack, NH) have developed public support by working with communities and customers so that the direct benefits are clear to homeowners and other citizens through demonstrations and word-of-mouth recommendations from satisfied customers.

When you stand up and say "here we are," you are not actually creating negative public reactions; you are discovering public concerns that were unknown to you. By instigating the process, the biosolids manager can be prepared for the ensuing public discussions and education process and will likely be credited for his or her outreach effort and openness. It is far better to be at least partially in control of this public dialogue process rather than be caught by surprise when your program is suddenly "discovered" by a negative media storm Also, remember that working through discussions and conflict can help build long-term public relationships—which should remain the focus of any biosolids public outreach effort.

Finally, biosolids program managers are not the only ones who must be involved and prepared for this critical second step toward a higher standard of success. Those with whom the biosolids program partners—farmers and customers—need to be informed and involved in the risk communications process, especially if they are going to be caught up in the discussion or conflict. For some biosolids managers, a significant hurdle may be convincing a farmer to work together on being more open and communicative with neighbors and the surrounding community.

1.5.7.3 …With the Acceptance, or Support, of Many Stakeholders (They are Satisfied, Have Trust, and Feel They are Treated Fairly and with Respect)…

If a biosolids management program is going to avoid costly conflict, it will need to have some community *support*. Once dialogue with key stakeholders, including neighbors, has been established (see more on developing public relationships, below), it is likely that many will accept or openly support the program. This has been the experience of many programs.

The biosolids survey (Chapter 4.0) confirms that most people don't know about biosolids and that when they first learn about them, many have questions and concerns. However, such people find arguments that biosolids recycling "disposes of a waste product" and "returns nutrients and organic matter back into the soil" to be effective and reassuring. Other survey results indicated what the public tends to be concerned about and what can reduce their concerns. These results point to actions that biosolids managers can take to reduce public worry about biosolids:

- ♦ When people have questions, most ask their neighbors and then turn to state, federal, and academic experts for answers. If these experts are informed about your program, they will be able to answer questions with confidence and objectivity, which reduces public concern.

- People favor constructive uses of biosolids (e.g., extracting energy from biosolids or recycling nutrients), so biosolids recycling programs should be able to clearly demonstrate such uses.
- People are concerned about contaminants and pathogens in biosolids, and these issues, as well as source reduction and pollution prevention, should be addressed and discussed forthrightly.
- People are concerned about industrial waste in biosolids. Pretreatment programs should be robust and the public can be invited to learn more and help with this crucial aspect of creating high quality biosolids.
- People are very supportive of wastewater treatment and, therefore, should understand the necessity of managing biosolids.

This third step in the definition of success does not suggest that *every* stakeholder has to support the biosolids management program for it to be a success. There will always be people who disagree with the concept and/or the way it is being implemented. The goal of this element of success is to ensure, through an educational process and dialogue with the public, that there are at least a good number of stakeholders, representing differing perspectives, who accept your biosolids management program. Over time, the number of supporters may well increase if the program is well run and people witness its benefits and minimal risks.

1.5.7.4 …Consistently, Over Time, Without Dramatic Fluctuations in Levels of Conflict or Public Trust and Support.

Many biosolids recycling programs are able to manage several years of relatively good "public acceptance." However, true success comes when the first three steps above are in place, *and* the level of public support does not suffer dramatic swings over time. In other words, even if biosolids are accidentally spilled on a highway or there is a national news story about problems at some other biosolids recycling program, there are enough informed local stakeholders and citizens to work together to address the concern in a cooperative, positive, problem-solving way, rather then reacting with outrage.

As Figure 1-4 illustrates, building a biosolids management program that is truly "successful" over the long term is a step-by-step process involving the public. The steps outlined above serve to build trust and relationships. Even when challenges arise, a biosolids recycling program built openly around relationships—with neighbors, elected officials, regulators, contractors, treatment plant personnel, environmental and public health groups and other stakeholders—is equipped to handle a situation, calmly solve a problem, and move on.

Figure 1-4. Steps Toward a New Definition of "Success" for Biosolids Recycling Programs.

1.5.8 Build Public Relationships

*** a *most critical* action step**

1.5.8.1 The Common Denominator of Success: Building Relationships

One goal of this WERF research project has been to identify what actions are consistently effective in developing positive public perceptions and public support for biosolids management. A theme that runs through many programs that have gained public support is *building public relationships*.

Relationships are what many of the managers of successful long-term biosolids programs talk about. Almost all of the case studies (see Chapter 3.0 on accompanying CD-ROM) include some discussion of how relationships had—or would have had—a significant impact on public perceptions of biosolids management. Biosolids programs that have gained public acceptance have developed relationships with critical stakeholders—neighbors, agricultural advisors, researchers, government officials, the media, concerned citizens.

Lawrence Susskind and Patrick Field (1996) begin their book, *Dealing with an Angry Public*, with this: "There are many reasons for the public to be angry. Business and government leaders have covered up mistakes, concealed evidence of potential risks, made misleading statements, and often lied….Wouldn't you be angry if you had been hurt, misled, or threatened?" Biosolids managers should recognize that the public's reaction to them will be colored by past experiences with other public officials, scientists, or engineers who may have misled or lied to them. The way to overcome this possibility is to develop a relationship with that citizen. Only through beginning of dialogue, through building a relationship, can a biosolids manager begin to gain the confidence of citizens in a community.

Many successful biosolids managers over the years have noted the importance of building relationships with "the public," with "stakeholders," with "gatekeepers":

- ♦ In Charlotte, NC, biosolids manager Trille Mendenhall, an active Sierra Club member, developed relationships with other environmentalists who learned about biosolids recycling from her.
- ♦ In King County, WA, former biosolids manager Peter Machno developed relationships with local farmers and, in the Mountains-to-Sound Greenway project, with a variety of environmental leaders (see Chapter 3.2.1).
- ♦ In the City of Wichita, KS, the Biosolids Management Plan for land application "outlined and pursued a public education and acceptance program for the affected agricultural community" by establishing "credibility and an understanding working relationship" (Vaughan et al., 1994).
- ♦ In Austin, TX, relationships developed between the wastewater treatment facility and the local Audubon society and its birdwatching members because storage ponds provide precious habitat for birds.

1.5.8.2 Attributes That Earn Trust and Build Relationships

There are specific personal and organizational attributes—ways of acting and communicating—that help earn trust and build public relationships. Many of these attributes (such as honesty, fairness, and following through on commitments) are the same kinds of attributes that build personal relationships. Table 1-6 lists some key attributes, along with references to case studies in Chapter 3.0 (on the accompanying CD-ROM). Consultants and academic specialists in the fields of public participation and communication can assist biosolids managers to incorporate these attributes into their programs and their personal interactions with the public.

Table 1-6. Some Key Attributes for Building Relationships.

ATTRIBUTE	CASE STUDY REFERENCE	MORE INFORMATION
Personal and Organizational Attributes		
Working to improve, with public input, environmental goals and outcomes; Environmental Management System (EMS)	3.2.9 Denver's Metrogro Farm	National Biosolids Partnership, www.biosolids.org
Openness, transparency, sharing information	3.2.1 King County, WA 3.2.6 Boulder, CO; 3.2.8 New York City and Rural Communities (Prowers County)	Sandman, 2000 Susskind and Field, 1996
Honesty–admitting mistakes, humility, not overstating accomplishments	3.2.6 Boulder, CO, 3.2.8 New York City and Rural Communities (Prowers County)	Susskind and Field, 1996
Fairness, respect, equity, sharing power	3.2.6 Boulder, CO 3.2.7 New York's CAC	Hartley, 2003 Renn et al., 1995
Excitement and belief in what you're doing, being personable	3.2.1 King County, WA 3.2.2 Milwaukee, WI 3.2.5 Chicago, IL 3.2.8 New York City and Rural Communities (Prowers County)	Toffey, 2000(d)
Compassion		Sandman, 2000
Being predictable, meeting expectations, doing what you said you would do, integrity, trust	3.2.12 Everett, WA	Susskind and Field, 1996
Ensuring adequate resources to do the job right (reducing costs, meeting budget, and profit are not the only things that count).	3.2.1 King County, WA	
Supporting consistent staff and procedures to help support long-term relationships	3.2.1 King County, WA 3.2.9 Denver's Metrogro Farm	
Communications & Information		
Ability to listen and hear, allowing others to	3.2.1 King County, WA	

talk, empowering others.	3.2.2 Milwaukee, WI 3.2.12 Everett, WA	
Acknowledgement of others' concerns, being responsive.	3.2.6 Boulder, CO	
Clarity, using appropriate modes of communication (e.g. avoiding technical jargon), communicating technical information in ways the audience can understand but is not patronizing or overly simplistic.	3.2.1 King County 3.2.6 Boulder, CO 3.2.8 New York City and Rural Communities 3.2.12 Everett, WA	Sandman, 2000 Wantland, 2002
Knowing risk communication concepts.		Sandman 1987(a & b)
Follow-through; providing answers.	3.2.12 Everett, WA	
Having support and communication via a variety of people; third-party support and spokespeople.	3.2.1 King County 3.2.8 New York City and Rural Communities (Prowers County)	
Communication by the ultimate responsible party (e.g. the public utility biosolids manager rather than just the contractor), even in distant biosolids use localities.	3.2.1 King County, WA 3.2.10 Philadelphia Mine Reclamation Program	Susskind & Field, 1996
Reducing surprise (telling people in advance). Providing information to media and public proactively, communicating benefits and risks forthrightly and honestly.	3.2.1 King County	Wantland, 2002; Rocky Mountain WEA
Having the right person communicate; training for biosolids program communicators.		Wantland, 2002; Rocky Mountain WEA
Knowing needs of the other (e.g. knowing media deadlines)	3.2.14 New Hampshire	Rocky Mountain WEA; Wantland, 2002

1.5.8.3 Choosing the Right Tools

"Tools developed jointly are relationship-building." --Lawrence Susskind

After reviewing many different experiences, the authors conclude that the most useful, efficient tools for developing public outreach and participation are those that further develop relationships with stakeholders. Such tools also are most likely to improve perceptions and support for the biosolids management program. (This assumes, of course, that the program is in compliance and follows best management practices, so that the public outreach program is built on integrity and excellence.)

Here is an example. If a biosolids manager has determined that the neighbors to a land application site don't know much about the program, she has many choices of how to inform them. She could send out a fact sheet, write a letter to the editor, or get the paper to write a news story. All of these actions would provide some one-way communication of information, but would not be likely to further build relationships. Holding an informational meeting (hearing) at which technical experts provide detailed technical information about the benefits and risks may involve some dialogue that develops relationships with the public a bit more—but the technical presentations are mostly one-way communications and can result in distrust and resentment.

Better choices for the biosolids manager would be attending neighborhood meetings to informally discuss what is going on and ask if people have any questions or concerns. Or the biosolids manager can invite the neighborhood to a tour of the wastewater treatment facility and farm so they can see first hand how the program operates and what steps are taken to address concerns. Or the biosolids manager could invite community members to participate in a multi-stakeholder committee assisting the agency in developing new odor control measures. These options are recommended because they involve opportunities for building relationships.

Table 1-7 includes a list of common tools for developing public outreach and communication programs. You may think of additional tools that you can add to this list. For tools that you are considering using, answer each of the questions in the matrix. Sometimes, the same tool used in different situations will result in different answers to the questions. For example, while a letter to the editor is often a simple one-way communication that does not build dialogue, in some instances—such as when it is in response to a request for specific information and its appearance will show responsiveness and enhance trust—it is an appropriate part of dialogue and advances relationship building.

Table 1-7. Evaluating Public Outreach and Participation Tools.

TOOL	WHO?	COMMUNICATION & INFORMATION					RELATIONSHIP BUILDING				COST
	Which stake-holder(s) does it reach?	Does it educate stakeholders?	Does it improve understand-ing among stakeholders?	Does it improve understanding among biosolids staff/mgmt?	Does it increase credibility of information?	Does it provide an on-going means of communication?	Does it provide an on-going means of problem solving?	Does it help resolve conflict?	Does it share decision-making?	Does it improve relation-ships?	Cost?
PRINT/PHONE/MEDIA											
Phone/ email complaint hotline											
Consumer surveys											
Fact sheets & brochures											
Advertising, product promotions											
Website, email											
White paper											
Newsletters, annual report, updates (contacting before spreading)											
Letters to editors											
News coverage											
Provide B-roll video to TV stations											
Talk radio or television											
(other?)											

PUBLIC MEETINGS/GROUPS											
Facility or site tours, picnics											
Hosting public meetings											
Speaking at community /neighborhood meetings											
Citizen Advisory Committee											
Joint fact finding, co-learning											
Having a local excited and expressive “champion”											
Developing mutually-beneficial projects in cooperation with garden clubs, citizen groups, watershed groups, etc.											
Stakeholder involvement in developing group meetings and process											
Formal conflict resolution process, consensus building											
(other?)											

ASSURANCE MECHANISMS											
Research demonstration sites											
Complaint response team											
Local oversight by local people											
Biosolids applier certification											
Bonding (addressing liability)											
Environmental Management Systems, independent audit											
Contingency funds											
(other?)											
MESSAGES/ KEY TOPICS											
Biosolids recycling puts to use a waste product (that results from the important process of cleaning water).											
Recycles nutrients											

and organic matter to improve soils.											
Biosolids is a natural fertilizer.											
(other?)											

1.5.9 Study Communications, Especially Listening

*** a *most critical* action step**

Bill Toffey, manager of the biosolids program for the Philadelphia Water Department, noted (2000a): “We are at risk of losing our programs and increasing costs of our programs because of our failure to communicate the benefits of biosolids.”

Many public agencies have difficulty communicating the importance of their missions and work. But agencies with primarily technical staff, such as public works departments, often have an added lack of communications skills. Engineers and wastewater treatment facility operators tend to be less skilled at communications, as a group, than, for example, politicians. Their jobs usually don’t require any special training in communications. In addition, this field was traditionally male-dominated—and communications research has shown that, through socialization, women are generally better trained in communications than men and are more focused on relationship-building (Tannen, 1990).

Whatever the reasons for the lack of strong communications regarding biosolids recycling programs, it is clear that things are changing—forced, in part, by conflicts. Many larger agencies now have communications specialists and/or are providing communications training for staff. Training organizations, such as the Water Environment Federation and regional biosolids associations, occasionally offer workshops in communications, media relations, and associated topics. Biosolids managers are now encouraged to ensure that they, or someone on their staff, are good communicators.

1.5.9.1 How You Communicate is Important

The social science field of communications is broad. What is most important for biosolids managers to pay attention to and incorporate into their communications? There are certain concepts or schools of thought worth focusing on:

- Listening is as important as talking; biosolids managers should pay attention to what the full variety of stakeholders, including critics, have to say. Listen for the emotional content. Listening with empathy and caring is important.
- “Risk communications” is a specialized field that helps technical people better understand how others perceive and understand risk; biosolids managers can benefit from studying risk communication (e.g., see Sandman; Covello; or Powell, 1996).
- Communicating in times of crisis (“crisis communications”) is another specialized area in the study of communications; larger, more complex agencies are well-served to have someone trained in how to manage communications with integrity during a crisis (Hyde, 2002).
- Communication involves much more than the information being presented. People respond to particular attributes or styles of communication, and it is helpful for the biosolids manager to know these (Covello and Wolf, 2003; Wantland, 2002). For example, conveying empathy can have as much impact on gaining trust as all other factors combined.
- Effective communications are beneficial for all stakeholders—including the public—because it ensures excellent exchange of relevant information. So long as your communications are sincere and two-way (mutually beneficial), efforts to make them more effective should not be interpreted as “spin.”

- Effective communications involve use of ordinary language, not jargon. Example: don't use "Part 503" to identify the federal regulations, use "federal regulations."
- Effective communications involve many non-verbal cues. Example: When the communicator stands above (on a stage) and distant, he or she is perceived as more intimidating. Instead, arrange a meeting so you can stand closer and at the same level. Example: What a person is wearing can make a difference—less formal clothing will make people more comfortable than very formal attire. Example: How a person responds to questions makes a difference: interrupting or making gestures or faces that suggest "that's a stupid question" is obviously not helpful.
- Communications intended to manipulate or deceive are quickly discerned by the public. Don't do it: it will damage relationships by creating greater distrust and outrage.

1.5.9.2 Apply Survey Findings

The 2002 Biosolids Public Knowledge and Perception Survey (see Chapter 4.0) suggests several things that biosolids managers can do to improve their communications efforts:

- The fact that few people know anything about biosolids/sewage sludge recycling means that there is a need for clear, introductory information.
- Most people see wastewater treatment as a good thing, so discussing how biosolids relate to this important environmental program should help engender positive responses.
- Many people know what kinds of concerns might be involved in biosolids recycling—so effective communications will require expecting, hearing, and addressing such concerns.
- People have established ways of learning about the world, and the biosolids manager's communications efforts will be more effective if they tap into people's existing communications systems (for example, bring your information to existing neighborhood meetings or into existing email networks).
- Telling people in advance of a biosolids land application event and providing important details about what will be happening reduces their level of concern.
- Communications that include opportunities for questions and dialogue with public stakeholders are most effective when done early in the process—and regularly.
- Certain arguments are more effective than others when introducing biosolids recycling. Messages that result in an increased positive response to biosolids recycling are: "biosolids recycling returns nutrients to soils" and "biosolids recycling puts to use a byproduct of necessary sewage treatment."
- Who speaks for a particular biosolids management program is critical. The survey corroborated the fact that some categories of people (academics and sometimes government officials) are more trusted than others. Less trusted are those with a profit motive and wastewater treatment operators who appear associated with the particular biosolids program. Be aware of this and the traits of a good communicator as you decide who will be communicating for your program.
- Advising neighbors in advance of applying biosolids may reduce their concern and increase their trust of the applicator and the process. Some Class B bulk biosolids land application programs ensure that a knowledgeable and articulate local farmer is a central communicator about the local use of biosolids on his or her land and that of other area farmers.

Communications are especially effective if they are honest and direct and do not avoid sensitive topics. Because the public tends to be uneasy about biosolids recycling, in any public forum where such uneasiness is likely to come up, it is important to openly recognize that discomfort. By doing so, you are seen as more trustworthy. Biosolids managers might say things like:

> *I believe that using biosolids recycles critical nutrients and organic matter back to soils and helps us use a byproduct that is created as part of the process of sewage treatment. I know that the idea of taking sewage sludge and carefully treating it so it can be used beneficially like a fertilizer is a troubling concept for many of us. It raises many questionslike "What about all the things—the chemicals—that go down drains? What happens to them? How can this be safe?" There are many safeguards taken to create and manage biosolids. I certainly believe recycling these materials helps society and the environment and is relatively safe, if done correctly. But others disagree, and you may be unsure. I'm glad to discuss concerns and questions you may have.*

Likewise, if a person or audience is interested in learning more, it is helpful to provide information critical of biosolids recycling, as well as information that supports your position, in order to provide the public a chance to understand the various arguments, pros, and cons, and decide for themselves. For example, the survey results clearly show that if there are any industrial inputs to biosolids, public concern is heightened. Therefore, the biosolids manager might best bring up this concern and address it head on. You gain credibility by openly disclosing the variety of information and perspectives on the topic. You lose credibility if you "gloss over" any concerns and/or appear to be hiding anything.

Finally, public outreach and participation around biosolids management programs will benefit dramatically by communicating with and involving the public as early in the process as possible. This cannot be overemphasized. Social science literature on public participation strongly emphasizes the importance of public outreach and participation early in the process.

Within the biosolids field, the focus groups and survey work conducted for the Greater Vancouver Regional District (2000) clearly found that public respondents felt "they needed more time and more information to form an opinion on biosolids use." Why? After hearing the benefits of biosolids recycling, people need to be given a chance to know and think directly about where biosolids come from, so they can wrestle with their initial uneasy reaction. They need time to think about it and they need opportunities to ask questions and obtain answers and additional information. They need to be able to make up their own mind, based on full, accurate, diverse information.

With some creative, proactive planning, biosolids managers have the ability and authority to create project schedules and activities that ensure that critical stakeholders—including neighbors and community leaders—have the time and support for this process of learning. Too often biosolids managers let regulatory schedules dictate when and how communications happen. Such regulatory frameworks are not developed with sensitivity to public concerns in mind. For example, many state regulations require just a letter of notification to neighbors, followed soon after by a public hearing. The state agency then has a limited time before they have to provide the permit or deny it. This time frame is too short and includes no opportunities for constructive dialogue. The letter of notification is a one-way communication tool (although it often includes a way for people to be in touch with the biosolids manager). Further, the public hearing usually is not conducive to developing strong two-way communications—it's too short and it's seen as a one-chance event at which people feel pressured to make their case strongly (see below). Biosolids managers should develop a communications schedule that ensures effective communications and adequate time for the public to absorb information. Then see how to fit the regulatory requirements into that schedule.

1.5.9.3 The Word "Biosolids"

For two reasons, it is a good idea to use the word "biosolids" to describe those sewage sludge materials that have been treated and tested and can be used as soil amendments or fertilizers.

First, as those who helped create the new word a decade ago suggested (Powell-Tate, 1993), the term "sludge" is inexact and may be confusing; it refers to a wide variety of things, including hazardous wastes and what is found in the bottom of automobile oil pans or glasses of chocolate milk. A precise term for treated and tested sewage sludge is useful.

Second, as determined by this project's survey, use of the term "sludge" creates a measurable significant negative response in the general population in comparison to use of the term "biosolids." The use of "biosolids" seems to be particularly important when introducing the concept to people, as their initial impressions may predispose them to either accept or reject information that is offered later, which, in turn, creates the context within which they will form an opinion about biosolids recycling.

However, the term "biosolids" should not be used as a way of hiding the origin of the material. If today's skeptical public senses secrecy and manipulation in the communications of public officials and other authorities, they can quickly become distrustful and angry (see Chapter 3.2.14). Despite the relative newness of the term, there already are concerned citizens and dedicated opponents who bristle upon hearing "biosolids" because they feel its use is a public relations tactic (Stauber and Rampton, 1995). Early in the discussion, therefore, make sure that your audiences know that "biosolids" refers to a product derived from sewage sludge. Emphasize that the term is used to differentiate between those sewage sludges that meet certain standards and those that do not. Biosolids are treated and tested, can be recycled, and provide benefits to soils and crops.

If, during a public meeting, you encounter suspicion of the term "biosolids," you may want to use the term "treated sewage sludge" at least some of the time. The important thing is not to insist that a particular term be used, but rather to work to make constructive dialogue more likely. Remember to ask yourself whether your language will improve your program's relationships with key stakeholders. If exclusively using the term "biosolids" gets in the way, then don't use it exclusively.

1.5.9.4 Remember Whom You Are Talking To and How You Are Perceived

When providing biosolids information to wider audiences, remember that most people will be hearing about the topic for the first time. This large majority is whom you should be speaking to. They form the mass of undecided observers in the middle of the spectrum of opinion on biosolids (these are the "guardians" mentioned above; at the two ends of the spectrum are the staunch proponents and the staunch opponents).

The undecided majority in the center will begin to form opinions about what you are saying fairly quickly. If you are fair, honest, open, interested in the topic, and have a positive presentation style, you are more likely to gain the trust of this group. If you belittle the opposition, appear arrogant, hedge, hide anything, or have a negative presentation style, you are more likely to make this audience skeptical and they may join the opposition. Remember that they just want to hear straight-forward arguments on the merits of your program. They will make their own judgments.

1.5.9.5 Public Meetings/Hearings

Public meetings are often not conducive to effective communications, especially if there are people present who feel threatened, distrustful, and/or angry. To make public meetings or hearings most effective, advance work and planning are required:

- talk to community leaders and representatives of the various perspectives in advance and help develop together a mutually agreeable format for fair and equitable exchange of information;
- determine clear goals for the meeting (e.g., exchange of information, decision-making) and communicate these to all involved in advance and again at the beginning of the meeting;
- arrange the venue so that people are comfortable (providing a break and food can help);
- don't have "experts" stand up in front, on high, and talk on and on;
- ensure opportunities for all perspectives to be shared;
- visibly record concerns or questions to be addressed (e.g. on a large flip-chart);
- answer questions respectfully, promising answers soon to questions you cannot immediately address (and be sure to follow through on those promises!);
- listen and hear;
- have an independent moderator/facilitator in charge of the meeting's process who ensures fairness and respect amongst all participants.

A particular concern that some biosolids managers have raised is that there often seem to be "hidden agendas" behind many public statements made by concerned citizens at public hearings and in the press. Experts on public perception and participation respond to this concern in this way:

- such concern on the part of biosolids managers are not uncommon or unique to the biosolids field;
- in a public forum—at a hearing or in the press—it is best to *take people at their word* and not try to guess at what "hidden agendas" may lurk in the background;
- don't comment publicly about what you guess may be a "hidden agenda"—you will only incite greater distrust, and, if you are wrong, you will have a public relations disaster on your hands; and
- understand the political landscape, what may be motivating particular people or groups, etc.; this information can help you develop better decisions and strategies for public outreach and participation.

For additional advice on preparing for public meetings and hearings, see, for example, Wantland (2002).

1.5.9.6 Powell -Tate and Beyond

In 1993, the Water Environment Federation contracted with the public relations firm Powell-Tate to develop a communications plan for biosolids recycling. The Powell-Tate communications plan, focused around the message "Biosolids Recycling: Beneficial Technology for a Better Environment", has guided many biosolids managers for the past decade. It has been the only carefully developed strategy for the communications, nationwide, of a concept and group of products that involves millions of tons of marketed materials and billions of dollars of infrastructure and operational costs.

For some biosolids recycling programs, the Powell-Tate communications plan helped immensely by focusing efforts on communicating first with "gatekeepers"—individuals who are respected leaders of public opinion (e.g., see Chapter 3.2.1). Developing long-term relationships with key stakeholders has been critical. Those agencies and biosolids managers that had a naturally effective communications style used the Powell-Tate plan in ways that created better relationships.

The Powell-Tate plan, however, has been attacked as an example of manipulative public relations (Stauber and Rampton, 1995). Its focus on gaining "public acceptance" of the concept of biosolids recycling may no longer be a useful strategy. While blatant marketing of commercial products is routine, the public is less accepting of the concept of biosolids recycling being marketed by public agencies (utilities and regulatory agencies) that are expected to be working for the overall public interest.

Used in the wrong situation, the Powell-Tate plan's emphasis on gaining "public acceptance" can incite anger if it makes citizens feel that they have no input into a decision that may directly affect them. Concerned neighbors of land application sites who feel that their health may have been impacted by biosolids do not welcome a "sell" about the benefits and minimal risks of biosolids. Rather, they require understanding, respect, and a compassionate response to their immediate needs—something that the Powell-Tate communications plan does not address.

Despite its shortcomings, the Powell-Tate communications plan provided useful guidance on how to create message points and communicate effectively. However, biosolids managers should go beyond the "public acceptance" approach and involve the public in meaningful ways, especially around decisions that may affect them. A far better model for public outreach and participation is developing within the National Biosolids Partnership's Environmental Management System (EMS) program (see below).

1.5.10 Provide Information Useful to *Recipients*

Much technical literature on biosolids has been developed over the past decade, ranging from overviews of the regulatory requirements for biosolids recycling to details on agricultural management and trace pollutants. U.S. EPA, state agencies, wastewater treatment facilities, public utilities, trade associations, the National Biosolids Partnership, and biosolids management companies have developed fact sheets, websites, reports, and white papers regarding numerous aspects and issues. Many agencies have also developed effective videos, PowerPoint presentations, and/or websites.

Standard helpful education and outreach materials are:

- A fact sheet for the particular biosolids product, which discusses the production process, testing results, recommendations for use, and where to get more information;
- Highlights of the industrial pretreatment program, household hazardous waste programs, and other efforts that protect biosolids quality;
- A state or regional fact sheet on biosolids recycling, which provides context (e.g., the NBMA biosolids folder and fact sheets); and

- For Class A products, small packaged samples of the product.

While such materials are helpful and necessary, there is much more that can be done. One of the reasons for the common emphasis on developing these traditional written public information tools is the fact that many in the biosolids management field perceive an ever-increasing gap in knowledge between "technical experts" and the general public. However, potential audiences exhibit a wide range of reading skills and technical proficiency. It is key to recognize what kind of audience you are developing materials for. Are you creating something for the average citizen who will be overwhelmed by, and distrustful of, a lot of technical information? Or are you creating something for the concerned citizen who is quite knowledgeable and would be offended by an oversimplification of biosolids issues?

In addition, because the topic of biosolids is less than fascinating to the average citizen, many will just want to know the basics and whether or not it presents any potential significant benefits or risks to them personally. This presents a challenge to the biosolids manager, since much of the biosolids literature is overly complex and technical and will not meet the needs of the average citizen. To make matters worse, when conflicts arise, biosolids proponents often get caught up in a "fact contest," burying opponents with technical information and ignoring where people are and what they bring to the discussion.

Instead, biosolids managers should emphasize listening to and learning from stakeholders and the public before attempting to develop and provide information that will answer their questions and concerns. It is even possible to involve the public in developing the informational materials; e.g., by having a citizens' committee help research, write, and produce fact sheets. People absorb information far more thoroughly if they themselves are helping guide the process of learning.

Example: If presenting information to a watershed group that focuses on protecting water and ecological qualities of a river, consider their perspective as you develop messages for a fact sheet or presentation:

- *Their focus*: Water quality is the number one concern.
- *Your complementary focus*: Wastewater treatment is a key component of maintaining good water quality in the river.
- *Their focus*: Certain land uses create run-off that is non-point source pollution in a river; biosolids use may be a land use of concern.
- *Your complementary focus*: Biosolids are a byproduct of keeping the river clean; biosolids must be managed responsibly.
- *Their focus*: Biosolids recycled in the watershed may impact river water and ecological quality if they run off or leach trace pollutants or nutrients.
- *Your complementary focus*: Proper management of biosolids can address these concerns: agronomic rate, buffers and setbacks, slow-release nutrients in biosolids. Biosolids may help reduce non-point source pollution by reducing erosion, run-off, or leaching because they can stimulate healthier vegetation growth and reduce the need for more soluble chemical fertilizers.
- *Your complementary focus*: Biosolids recycling usually plays a very minor role in a watershed, but biosolids managers can be helpful partners in addressing non-point source pollution because of their understanding of nutrients, pollutants, and agricultural and conservation best management practices.

As decades of education literature has made clear, different people learn in different ways, and information must be available that meets the needs of different learning styles. Most biosolids information currently is in the form of technical written information. This information is helpful to a small percentage of the population who are good readers and analytical, linear thinkers. However, many other learning styles are not served by this, and more needs to be done. Biosolids managers can obtain assistance from graphic artists, educators, or others in developing informational materials for those who learn better through visual images, kinesthetic experiences, and other modes.

Even with improved educational efforts, biosolids recycling will remain of minor interest to most people. Rather than trying to educate the public on biosolids as a separate issue, the biosolids industry should focus on how biosolids fit within larger environmental science topics. For example, information on biosolids recycling could be added to middle and high school environmental science units on wastewater treatment, recycling, and agriculture. A good example of this approach is the Mountains-to-Sounds Greenway Trust's education program, "Seeking Solutions to Sustain Forests," which is part of the curricula in Seattle area schools.

Including biosolids information in a wide variety of informational materials will require collaborative efforts with others whose work and perspectives may be quite different from that of the biosolids manager. However, working collaboratively with watershed groups, environmental educators, conservation districts, schools, or similar groups to bring a mention of biosolids into informational materials accomplishes three goals:

- it provides a chance to discuss biosolids with the group,
- it results in biosolids recycling information becoming embedded in a larger context, and
- it establishes a relationship and dialogue with these important thought leaders.

There is one more consideration of importance to developing informational tools about biosolids: biosolids are complex mixtures and their assessment and quality includes some level of uncertainty. This makes it difficult for biosolids managers to specify the quality of a particular biosolids product with 100% certainty. Biosolids risk assessments are based on assumptions and probabilities that are not always persuasive or comforting to the general public. Thus, the biosolids manager's attempts to discuss scientific uncertainty—using words such as "may" or "approximately" or "minimal risk"—may increase outrage.

One way for biosolids managers to deal with public uneasiness with uncertainty is to engage concerned individuals or other stakeholders in joint fact-finding (Susskind and Field, 1996; Susskind et al., 1999) to collect all relevant information. By clearly understanding the limits of what is known, it becomes possible for people to make decisions that account for uncertainty but are not extreme in one direction or another.

1.5.11 Don't Be Afraid of Conflict—Work Patiently Through It

Biosolids recycling is likely to continue to be a controversial subject, at least in some areas. As the survey showed, public uneasiness about biosolids is common and if some pressure is added (e.g., a deadline for a permitting decision), this uncertainty can develop into concerned opposition and open conflict. It is at these early stages that the biosolids manager's actions have the most potential impact. If there are no looming deadlines and there are clear opportunities for discussion, the level of conflict may be reduced by communications, dialogue, and careful listening by the biosolids manager. All too often, as citizens raise concerns and ask questions, biosolids managers become defensive. This heightens distrust and concern on the part of the public and conflict escalates. Biosolids managers who are not trained in conflict resolution may give up and abandon the project. The result is not helpful—no one has learned about sewage sludge management and biosolids recycling and everyone has been left with uncertainty or unresolved hurt. The conflict remains to taint future discourse on biosolids.

A better approach is for biosolids managers to learn more about conflict and be ready for it. Conflict is a natural part of human interactions and can lead to improved understanding and positive change. If and when serious conflict does arise, Sandman (2000) recommends that biosolids managers react to public outrage as follows:

- "stake out the middle, not the extreme;
- acknowledge prior misbehavior;
- acknowledge current problems;
- discuss achievements with humility;
- share control and be accountable;
- pay attention to unvoiced concerns and underlying motives;
- leave views at the door; go into it to problem-solve."

Susskind and Field (1996) encourage the use of what they call the "mutual gains approach," which is based on the following carefully worded principles:

- "Acknowledge the concerns of the other side;
- "Encourage joint fact finding;
- "Offer contingent commitments to minimize impacts if they do occur, and promise to compensate knowable but unintended impacts;
- "Accept responsibility, admit mistakes, and share power;
- "Act in a trustworthy fashion at all times; and
- "Focus on building long-term relationships."

Other dispute resolution experts put it this way (Agency for Toxic Substances and Disease Registry, 1990): Accept and involve the public as a partner; plan carefully and evaluate your efforts; listen to the public's specific concerns; be honest, frank, and open; work with other credible sources; meet the needs of the media; and speak clearly and with compassion.

There is another factor to recognize about conflict. Sometimes, the biosolids manager will not convince the public. As conflict specialist Dr. Juliana Birkhoff (personal communications) notes: "You can have the best communications, excellent technical information…and the public could still say "no" and that's okay. This is a democracy." Biosolids managers should expect that this will occasionally be the outcome. While it may seem like a waste of time and money to go through a process of education and dialogue and still end up without a biosolids recycling project, the resulting relationships and trust developed in the process can be valuable in the future. Entrenched conflict happens. Sometimes, there is just no resolution, at least over the short term.

1.5.12 Monitor Public Perceptions and Public Relationships

* **a *most critical* action step**

As with private relationships, public relationships require routine maintenance. Once you have established decent relationships with stakeholders, you want to protect that investment of time and energy by keeping in touch on a regular basis. Maintenance of public outreach and participation does not take as much time and energy as establishing them—but it is important not to let it fall between the cracks.

Think of it this way: wouldn't you rather be communicating with stakeholders, the media, and the public when things are going well and no one is complaining? Wouldn't you prefer to be openly sharing information about the benefits and quality of your biosolids program on a routine basis rather than communicating only when something goes wrong or someone is upset and the focus is on the negative? If stakeholders, the media, and the public are kept up to date on what is happening with your program, they are more likely to understand the context of problems that occasionally arise and will be more likely to help find solutions and/or give you the benefit of the doubt.

Monitoring relationships means having some mechanism (e.g., a hotline) for hearing complaints or concerns as soon as they arise. You will be able to respond appropriately and in a timely fashion, showing that you understand the concern and are working to do something about it. Many people working at wastewater facilities and biosolids programs describe the benefits of being responsive and caring about neighbors' concerns—even if they can't do much in the short term to change the situation (e.g., make malodor stop). Just by expressing concern and understanding and explaining what might be done and what is being tried usually makes the concerned neighbor feel better. Of course it is critical to be accurate about what can and cannot be done, to set reasonable expectations, and to follow through on what you say you are going to do.

1.6 Building Trust

Biosolids recycling is currently plagued by deep distrust on the part of some vocal opposition and concerned citizens. Biosolids managers, public wastewater utility operators, biosolids research scientists, and biosolids regulators are all finding, sometimes to their surprise, that citizens concerned about biosolids recycling don't trust them.

In addition to the "outrage factors" discussed above (Table 1-3), other factors contributing to distrust of biosolids recycling programs include:

- the self-implementation aspect of the federal (and many state) regulations ("the fox is guarding the hen-house");
- the risk assessment basis of the regulations and management practices (risk assessment involves decisions and assumptions that are hard to understand and are subject to challenge because of potential bias);
- biosolids often come from somewhere else, from a much larger municipality whose people are seen as different and less trustworthy;
- biosolids are often conveyed by private companies that are perceived as having profit motives, making them less trustworthy;
- Class B biosolids are often given away, reducing their apparent value and suggesting there may be something wrong with them;
- rural communities often have little or no say in biosolids recycling decisions made in larger municipalities far away; and
- citizens sometimes receive little or no immediate response from a biosolids manager or farmer when they raise a concern or have a question about biosolids use.

As with other "outrage factors", biosolids managers can reduce the development of distrust by addressing these issues.

Above and beyond factors particular to biosolids management, there are personal attributes and actions on the part of the biosolids manager that will increase trust:

- honesty,
- openness (transparency),
- humility (not arrogant),
- compassion and caring,
- respectfulness,
- association with known, trustworthy people,
- say what you mean and mean what you say, and
- follow-through on promises.

These, and other trust-building attributes and actions, are the same as ones you use in all social interactions to gain the trust of others.

Finally, earning trust is different from gaining "acceptance" or "support." A stakeholder can have trust in a biosolids program while still not accepting or supporting it. He or she can feel confident that the program will operate in a particular way, that staff and management will do what they say they are going to do, etc.—and still not "support" the program. In some situations, the best the biosolids manager can do is to build trust, even if support remains elusive. Conversely, a lack of trust does not lessen the value of, and need for, good communications and predictable, respectful, trustworthy actions. Building trust takes time; losing it takes just one misstep.

Following are additional discussions of aspects of biosolids recycling programs and public participation that will impact the level of trust.

1.6.1 Remember, Most People Don't Know About Biosolids…

As noted above, most people don't know much about biosolids. Therefore, an educational process will almost always be necessary. These communications should begin early in a project. The alternative is to wait for the public to learn about biosolids on their own and risk the likelihood that they will form opinions around negative experiences; e.g., bad odors or a media story that stresses only the negative aspects of biosolids recycling.

How do you know where to start in sharing information about biosolids recycling? As this project's survey also indicated, public support for wastewater treatment is high—almost everyone supports the idea of cleaning up water that society has polluted. Thus, biosolids managers may increase the likelihood of a constructive dialogue about biosolids recycling if they—or, better yet, one of the more trusted information sources (government officials, academics)—reach out to the affected public early in the process to provide information about wastewater treatment and the sewage sludge that is a necessary result of that treatment.

1.6.2 …And Are Uncertain When They Find Out

Some biosolids managers question whether or not the survey conducted for this project (see Chapter 4.0) really measured public uncertainty about biosolids recycling. They say that, in their experience, malodors are what trigger interest in biosolids, negative perception, and opposition. They are right that malodors often trigger initial negative reactions, as the literature and case studies clearly indicate. However, there are other odorous situations, such as manure spreading operations, that do not end up with the same level of public outrage, conflict, or concern. Why is this?

The survey responses clearly indicate an underlying uneasiness about biosolids recycling that makes the public response to malodorous biosolids different from the public response to malodorous manures. One clear reason for this is that biosolids are derived from human wastes, to which humans have an innate aversion developed as a requirement for survival. In addition, biosolids contain other trace contaminants that enter sewer systems. Biosolids are unfamiliar to people, and many will consider them “unknowable” because it is impossible to test for everything that might be in them. Animal manures are also unknowable, in the same way, but, overall, they contain fewer potential contaminants (manures don't have industrial influents), are not of human origin, and are far more familiar.

Public uncertainty about biosolids recycling creates additional concerns that the biosolids manager must be ready to address. Because of the complexity of biosolids’ inputs, treatments, and management, there are hundreds of potential concerns about biosolids’ impacts on public health and the environment. In some situations where staunch opposition has formed against biosolids recycling, these numerous potential concerns are raised one after another. This changing list of concerns presents a moving target for the biosolids manager, and the need to address concern after concern can be frustrating.

Even so, it is possible to pay attention to the larger audience’s (the “guardians’”) concerns and feelings, and address first those issues that are most critical to them. The biosolids manager will find that blatant—and even not so blatant—attempts by politicians or others to use an issue such as biosolids for self-gain are recognized by many people. If the biosolids manager continues to calmly respond to legitimate, important questions and concerns, most people are likely to develop respect and listen to him or her. Extreme views will become marginalized over time—but only if the biosolids manager works patiently to address concerns of most of the diversity of stakeholders. Remember that there is a continuum of diverse perspectives about biosolids. Assume each and every questioner is sincere in wanting to learn more from you; never discount or scoff at questions or concerns—most questions are reasonable to those raising them.

1.6.3 Integrate Local and/or Non-Technical Knowledge and Differing Perspectives

Biosolids managers are advised to value local and non-technical knowledge about the land and local conditions that may impact the biosolids recycling program. The fact is, people in local communities can provide a great deal of insight, critical perspective, and valuable details that can make a biosolids recycling program run more smoothly and avoid careless mistakes. Too often, biosolids programs have gone into communities without any communication with local people, only to be informed in an angry way at a public hearing about a new well or a seasonal wet area on the land application site—or some other glitch. Being informed about legitimate concerns in a public meeting quickly leads to lack of trust or respect for your efforts. As biosolids managers develop plans for new land application sites or scenarios, they can ask questions of the farmer, local political leaders, neighbors, and others and get a sense of local conditions that may be significant.

Most engineers, scientists, and regulators working in the biosolids management field are rational thinkers. When they enter into public forums, they encounter what they see as “irrational” processes. When irrationality is encountered, it is helpful to identify it as soon as possible, understanding that it may require a different approach. For example, if an extreme or irrational viewpoint is hampering constructive dialogue, it may be necessary for the group to isolate (marginalize) the individuals, negotiate with them to gain their constructive cooperation, or publicly expose the weaknesses of their arguments. While it is critical to never be disrespectful, it makes sense for the biosolids manager and other involved stakeholders to insist that public policy decisions, such as about biosolids recycling, be made using rational thought processes.[5] For the biosolids manager, however, the greatest danger in respectfully marginalizing a position is the real possibility that he or she will mislabel something or someone as irrational when in fact they are not. One way to avoid this is to consult with several diverse stakeholders involved in the process to determine whether or not your assessment of the extreme position is shared by others and that others agree that the constructive process is being hampered by that extreme position.

1.6.4 Identify Value Differences

Values underlie some of the conflicts over biosolids recycling. The most notable value differences in the biosolids/sludge conflict in North America are between those who focus on environmental issues, value "natural" things, support the Precautionary Principle, and hope for no degradation of the environment versus those who work to develop practical solutions to complex problems, value risk assessment, and feel that the benefits of modern society are going to cause negative impacts, although these should be minimized as much as reasonably (economically) possible (i.e., they value cost-benefit analysis). This value difference was evident in the conflict over the National Organic rule developed in the late 1990s by the U.S. Department of Agriculture (USDA). Because of biosolids' artificial, human, and industrial sources, more than 200,000 comments were submitted to USDA opposing the use of biosolids in organic production. Likewise, in Kern County, differences in values amongst the various stakeholders helped create the conflict (Chapter 3.2.13).

Elaine Vaughan, Ph.D., (personal communication) a specialist in public conflicts, suggests that biosolids managers entering into dialogue with communities should attempt to identify common values from which they can build their discussion of biosolids recycling. A dialogue that is grounded in identified shared values can lead to constructive discussions of risk perception. Finding areas of shared values prepares the public for closer examination of comparative risks.

At the least, biosolids public outreach and participation efforts should take into account core differences in values. The biosolids manager will gain credibility with environmentalists and communities if his or her actions are determined, in part, by consideration of what values are most important to stakeholders.

Core value differences cannot easily be changed. In most cases, the biosolids manager can only identify and accept them and understand that value differences do not preclude cooperation. Even knowing deep differences exist, it is still possible to work out solutions that everyone can accept.

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[5] Note, however, that "rational" thinking does not include only science. As discussed below, there are other aspects of rational thinking, such as values. All are usually involved in public decisions.

1.6.5 Respect

"We always need to remember that the questions people ask which arise from genuine concern are valid and demand clearly understandable, open and honest responses," wrote Jane Forste (1995), a long-time biosolids manager and developer of public outreach programs. She was talking about respect. Biosolids managers and staff who respect differing points of view and recognize that there are no "stupid questions" will gain greater trust and respect in return.

It is hard to overstate the importance of acting with respect for others. In the U.S., the strongest, most vocal opponents were likely incited to hold their strong positions and remain motivated in their opposition in part because of their experience of not being respected, of being dismissed. Biosolids managers and the organizations who represent them must find ways to disagree with opponents' arguments without being disagreeable and without showing disrespect for the individuals themselves.

1.6.6 Size Projects Appropriately

The public responds with greater concern to projects that are perceived as large and unending. Planners of biosolids recycling programs can reduce public uneasiness by sizing projects appropriately. Consider and respect what the local community's perceptions and reactions might be. How great an increase in truck traffic, or dust, or farm odors would you be willing to have near your home?

With regard to a Class B land application site, for example, it may be better to submit a permit application for a smaller acreage—one field or two—than to include a large number of acres and fields all at once. This may increase the ultimate administrative effort (e.g., if additional permits are required for future expansion of the project), but it may make the difference between being able to go ahead with something and not being able to do anything.

Similarly, biosolids managers should determine how many years a site might be used and clearly state when the biosolids recycling program is expected to end (i.e. after how many years) and the likely schedule for each individual annual application event. Another option is to work with local citizens to gain support for an initial, smaller-scale, trial period, after which a reassessment of the project is conducted before it continues and/or expands. Many state environmental agencies are willing to provide permits for field "trials," recognizing that trials can help develop public experience and confidence.

1.6.7 Siting

Proper siting of biosolids processing and land application programs also affects the level of trust and public support. Sometimes biosolids recycling programs will settle for a marginal site in order to keep the biosolids moving. Any short-cuts of this sort are damaging to public trust (it's probably better, in the long run, to bear the extra cost and go to a landfill).

The siting of facilities that may be perceived as dangerous or, at the least, creating nuisances, has been a well-studied topic of social science research. Whitcomb et al. (1994) reported on the results of a public attitude survey conducted in the fall of 1993 to determine attitudes towards siting a hypothetical composting facility, noting the following:

- ♦ Greater distance from the proposed facility, a perceived increase in economic opportunity, a "waste involvement measure," and (male) gender positively influences the acceptance of a MSW facility in the respondents' community.
- ♦ On the other hand, perceived environmental impacts, lack of trust, and higher income of respondent increase the likelihood of a negative opinion of the proposed facility.

- Important conditions that respondents would like to require of the proposed facility are:
  - Facility monitoring and control procedures;
  - Written specifications as to the future responsibility of the facility; and
  - The community having the power to shut down the facility if problems occur.
- Important Host Community Benefits that were chosen by respondents include:
  - Guaranteed water quality,
  - Property tax credits, and
  - No charge for waste disposal (a clear local benefit).

Lessons from this and similar studies can be applied by biosolids managers to biosolids processing facilities and land application sites.

Susskind (1984) similarly notes that the most impacted individuals—and those taking the greatest perceived risk in accepting some new facility or land application site in their community—are those that are closest to the site. Thus, he suggests, it is reasonable to agree to mitigate or compensate these closest neighbors, if any significant negative impacts do occur. This can be done with "Host Community Benefits," as noted by Whitcomb et al. (1994), or may be even more closely targeted to the closest neighbors. While biosolids managers have tended to be unwilling to provide compensation to neighbors, pay host fees, or post performance bonds, these are all commonly used tools for addressing the different levels of risk and potential impacts experienced by close neighbors versus more distant community members. In short, if you can work out a fair way to make the close neighbors happy, then the strength of the opposition is going to be significantly reduced. People tend to fight hardest when something is close to them and they perceive they may have the most to lose.

1.6.8 Oversight and Enforcement

Over the past several years, a number of significant reviews of the federal U.S. EPA biosolids management program have identified lack of oversight and enforcement as a major problem. U.S. EPA systematically "disinvested" from its biosolids program after the promulgation of the Part 503 regulations in 1993. Given other priorities, the agency curtailed its program to the extent that the U.S. EPA Office of Inspector General (2000, 2002) identified oversight and enforcement as a major problem and major public concern. This concern has been echoed across the nation at public meetings concerned with biosolids recycling. Although the Clean Water Act provides for stiff penalties, the public is not comfortable with the honor system when it comes to biosolids management. And although many states do a great deal more oversight and enforcement than does U.S. EPA, it is still difficult for state and federal agencies to accurately answer questions such as:

- Where exactly were Class B biosolids land applied in the state last year?
- How about the year before?
- How many tons of biosolids were land applied in your jurisdiction?
- What were the levels of arsenic or some other pollutant in these land applied biosolids?
- Are you sure the required setbacks were followed?

Why is oversight and enforcement so important in the mind of the public? Because biosolids recycling involves a large number of potential concerns, including (but not limited to) "heavy metals," chemicals, pathogens, and nutrients. Citizens want to know that someone knowledgeable is making sure that potential risks are being managed properly. They know, as all biosolids managers should know, that the safety of biosolids recycling programs is dependent on proper treatment and management of biosolids from pretreatment through land application. U.S. EPA and other governmental agencies state that biosolids recycling is relatively safe—if applicable laws and regulations are followed. The public is very interested to make sure that “if” happens.

It is time for the biosolids recycling industry—from industrial pretreatment programs to wastewater utilities to biosolids managers to end-users of biosolids—to thoroughly and openly demonstrate compliance with all laws and regulations and attention to all best management practices. This is one of the basic premises of the National Biosolids Partnership’s Environmental Management System program (see more on that, below).

There are two ways of going about this.

The first, more traditional way is to ensure that the state(s) in which you operate has (have) enough staff and funding to allow independent state inspections of your operations. In Washington State, the biosolids industry and public wastewater utilities worked with the state Department of Ecology (DOE) to develop a fee on each ton of recycled biosolids; the funds raised support DOE’s robust monitoring and enforcement program. Another option is for public wastewater utilities and biosolids managers to lobby hard for increased state funding for the state biosolids oversight and enforcement program. The same could be done at the national level, although it seems unlikely that U.S. EPA will substantially increase its biosolids program budget, given other priorities and the fact that states are now looked to as the most reasonable and likely enforcers.

The second way of developing robust, open oversight and enforcement is for biosolids recycling programs to invite public stakeholders to assist. As you develop a new program in a new community, negotiate a systematic program with local officials and concerned citizens that involves them in oversight and enforcement. Work out agreements on operating and performance standards (e.g., odor limits). Invite citizens to communicate concerns through a complaint line or through regular phone calls or meetings. Another option is to provide a user fee that will pay, or partially pay, for a capable independent third-party person or town official to monitor how you are doing; this kind of approach has helped the Washington, D.C. biosolids recycling program for many years. There are program quality certification programs in many fields, and there are independent for-profit and non-profit organizations that provide quality assessments. The National Biosolids Partnership has quality certification in its Environmental Management System program.

Once you know your program is well monitored, be sure to let people see the results of the monitoring. Set up a website to post monitoring reports, hold meetings, provide details in annual reports, get it in the newspapers, etc. Don’t be afraid to openly share failures along with successes—the public does not expect perfection; they do expect honest efforts and an overall record of quality. If you try to “spin” the monitoring story, you will lose credibility and trust. Then excellent reports will be distrusted. Just decide on a protocol for reporting monitoring information and stick to it.

State and federal biosolids regulators have learned in recent years that promotion of biosolids recycling is not an appropriate role for those involved in compliance, oversight, and enforcement. However you publicize the results of oversight and enforcement of your program, be sure to keep it clearly separate from any promotion of your program.

Some biosolids managers complain about lack of oversight and enforcement on the part of U.S. EPA and/or their state. A more productive approach is to develop an independent oversight and enforcement program of your own design as soon as possible. An easy way to do it is by developing an Environmental Management System program through the National Biosolids Partnership (see below). Yes, it will cost something, but if you are creative and work with the community, local oversight and enforcement does not have to break the budget. And the return for this effort can be as significant as any single action you can take. It may make the difference between having a sustainable, stable recycling program and one that is subject to repeated conflict.

1.6.9 Study Stakeholder Concerns

At times, biosolids managers and the biosolids industry as a whole have been slow to understand what critics and concerned citizens have been saying. Yes, many of the criticisms of biosolids recycling seem off-base or even ridiculous, but some of the critiques are valid and provide useful information. Biosolids managers should ask themselves, "Is there something important in that critique? If so, is there something our program could do to make sure this is not and never is a significant issue for us?"

These are the issues that critics talk about today:

- trace metals and chemicals ("pollutants"—all that can conceivably come down the sewer pipe),
- pathogens (organisms that cause human disease),
- odors and other air quality concerns,
- oversight and enforcement,
- surface water and groundwater quality,
- soil and food/crop quality,
- transportation and trucking,
- economic viability,
- changes in demographics and changing expectations,
- emerging issues (e.g., the fate of new pathogens, pharmaceuticals), and
- uncertainty about what is in a particular biosolids product.

The rational approach to designing a beneficial and publicly supported biosolids recycling program is to reduce as many of these public concerns as possible. Of course, the biosolids manager must balance the need for public support against other significant aspects of the biosolids management program, such as technical feasibility and cost.

1.6.9.1 They will Come After Class A Too…

In recent years, biosolids management decision-makers have been noting public resistance to Class B land application programs and have made choices to switch to Class A programs. The rationale is that, in almost all states, Class A biosolids have few, if any, restrictions on their marketing, transport, or use. Generally, no site-specific permits are required.

While the regulatory structure makes sense from a technical standpoint, biosolids managers should not be lulled into thinking that concerned citizens and environmental groups will always support Class A biosolids. Class A biosolids potentially have all of the same issues as Class B, except for pathogens (and there are even concerns expressed about regrowth or recolonization of pathogens and the adequacy of Class A certification tests).

There does seem to be a real advantage, in terms of public acceptability and marketability, to Class A materials that are thoroughly processed and stable. For example, many mature screened compost and pelletized heat dried fertilizer products have strong markets and significant customer and public support. However, if a Class A product has malodor and an unappealing texture or appearance, it may illicit negative responses. And if a Class A product is used in large volume in a neighborhood in which no one has been informed (and especially if it has some odor), it may trigger concerns, just like a Class B product.

Even managers of Class A products may need to pay close attention to biosolids quality concerns, reducing as much as possible any of the objectionable aspects of the material and how it is transported, stored, and utilized. Even for Class A biosolids products, it is critical to establish constructive relationships with key stakeholders—especially customers—and listen to, understand, and respond to customer and community feedback.

1.6.10 Engaging Stakeholders is the Greatest Challenge

Biosolids managers and organizations have experienced some difficulty, over the years, in getting concerned citizens or environmental groups engaged in problem-solving processes around biosolids. Engaging the general public—people who are less directly interested in biosolids—has been even harder.

There are reasonable explanations why people are not willing to commit much volunteer time to working on biosolids issues:

- biosolids are not as clear and attractive an environmental issue as, for example, land preservation or wildlife protection;
- biosolids are a relatively small proportion of agricultural fertilizers and soil amendments and, therefore, may have lesser overall impacts than, for example, manure management; and
- the public has not been widely invited to participate in biosolids management programs.

Because environmental groups and local community members are the ones most likely to become engaged in biosolids issues when they arise, it is critical to find ways to engage them as soon as possible. Biosolids managers, state and regional wastewater and biosolids groups, and national organizations such as the Water Environment Federation and the Association of Metropolitan Sewerage Agencies might increase their outreach efforts to keep up communications and dialogue with environmental groups, as well as other stakeholders such as conservation and farming interests. Establishing relationships with these organizations and key individuals will make it possible to gain their assistance and immediate input when issues arise.

The biosolids management industry needs to become open to greater public input, actively pursuing it whenever there is an opportunity. Peter Sandman (2000) notes that “people are much less desperate to have input when it is clear that they can whenever they want. One of the signs of a good public involvement strategy is relative lack of interest in getting involved.” This kind of “no news is good news” is not the same as having a program that no one knows about (i.e., that is “under the radar”). The only way a biosolids manager can know whether or not people want to be involved is by constantly checking with them and offering the opportunity.

One way of getting people engaged is by developing a time-limited project that either puts biosolids to use to tackle an important local problem (e.g., see Chapter 2.2.4) or is seen as an effort toward a significant shift in policy or in the management of biosolids. Other options are to involve the public in odor assessment work or in developing local research or demonstration projects—efforts that promise to help improve plant operations and/or reduce potential or real impacts on neighbors.

Examples of projects that have gained constructive public input focusing on biosolids *as a tool* to address an environmental need are:

- the collaboration between King County, Northwest Biosolids Management Association, and the Mountains-to-Sound Greenway that utilized biosolids to revegetate areas scarred by past logging activity and protect land (see Chapter 3.2.1);
- construction projects where biosolids compost is seen as a tool to meet the need for minimum soil organic matter content that ensures, infiltration, reduced runoff, and surface water protection; and
- the restoration of mine spoils and mining scars where acid-mine-drainage has created toxic conditions and biosolids serve to reduce the mobility of metals from soils and stimulates stabilizing vegetative growth (e.g., at Kellogg, ID; Leadville, CO; and in Pennsylvania).

Examples of projects that have gained considerable public input around a significant policy or biosolids management concern are:

- Brattleboro, VT's collaborative outreach and planning project involving businesses, citizens, community leaders, environmental groups, and wastewater utility staff in addressing influent quality by stressing the need for awareness about proper disposal of (mostly household) hazardous waste;
- the National Biosolids Partnership's work on developing a system of credible independent audits for its Environmental Management System (EMS) program; and
- the developing collaborative research project on air emissions from biosolids land application sites by the PA Department of Environmental Protection, U.S. EPA, and USDA.

The latter two projects have clearly shown that interested citizens are willing to volunteer extensive time and energy—but only if they are provided with opportunities to provide significant meaningful input and be involved in decisions. For example, public interest and involvement can be energized by opportunities to help wastewater treatment facilities (WWTFs) to manage regional water, nutrient, and organic matter resources. In some locations, WWTFs are becoming recognized as major players in watershed management because they control large amounts of water and often have funds to support watershed projects. Participation of WWTFs in watershed issues can help to ensure that stakeholders address biosolids management needs as well.

In summary, as the wastewater treatment operator and biosolids manager face issues, he or she might consider if the issue offers an opportunity to engage any or all stakeholders in helping address the issue. By framing the issue as a community concern and defining a clear process by which it will be addressed (including a time limit, so people know they are not committing to an endless amount of work), it becomes likely that public stakeholders will become involved in a process that builds dialogue, mutual respect, trust, and relationships.

1.6.11 Information Networks and Regional Biosolids Groups

In most instances, biosolids managers are busy people, and they may have trouble finding time to follow a lot of the recommendations provided here. One source of support is to participate in a regional biosolids partnership or information network. The oldest and most successful regional association is the Northwest Biosolids Management Association (NBMA). This organization has developed, over more than 15 years, a strong cooperative network that exchanges information quickly and efficiently, supports cooperative research and demonstration projects, and aids all biosolids managers in the region with timely information, technical support, and outreach to stakeholders and the public. Active regional associations have also developed in California, Colorado, the Great Lakes, Mid-Atlantic, and New England regions. These groups serve as information networks and encourage cooperative efforts to address common issues.

Because the success of biosolids management programs often depends on local interactions, it is beneficial to have people available quite close to the local level, people who know the region, who can answer questions for local officials and citizens. A New Hampshire town leader, for instance, will not be as trusting of a fact sheet from U.S. EPA or a call from the National Biosolids Partnership as they will be talking with someone who is knowledgeable about biosolids and knows their state. Another benefit of a staffed regional group is that there is always someone in the region to address concerns quickly and with sound information.

1.6.12 You’re Not Giving Up Responsibility or Control

The new emphasis on public participation encouraged in this report does not mean turning over control to non-professionals. It is still the responsibility of each wastewater treatment facility and/or biosolids manager to balance the needs of the various stakeholders for whom he or she works, including users of the sewerage system and biosolids end-use communities (e.g., farmers and neighbors). It is still his or her responsibility to ensure that biosolids are managed in accordance with current scientifically-based practices, thus protecting public health and the environment. It is his or her responsibility to represent and strongly state these interests in public participation forums and debates.

Biosolids managers are (or should be) experts because of education and experience, and the public relies on you for your expertise and advice. Experiences have clearly shown that citizens who become involved in reviewing and giving input to biosolids programs respect and seek the advice of biosolids managers and other experts in the field (e.g., see Chapter 3.2.6).

Working with interested stakeholders will enhance your expertise and experience, but you will remain ultimately responsible for your biosolids management program. As you invite the public into your information-sharing and decision-making processes, be sure to openly discuss this fact. Tell participants at the beginning what they can expect as a result of their participation and input. Will they be making the final decisions? Maybe not. But they may have significant participation and input in decisions, and it should be clear how that input impacts final decisions. If members of the public enter into a public participation process with clear expectations of their roles and the limitations of those roles, they will not be surprised and upset—or become distrustful of you and the process—if all of their input and/or recommendations are not adopted.

1.7 Risk Management and Program Vulnerability

1.7.1 Viewing Biosolids Management from a Risk Management Perspective

Just as risk management is a critical part of decision-making in developing wastewater and biosolids treatment infrastructure, so it is a useful lens with which to look at public outreach and participation.

Biosolids management programs are vulnerable to many external factors: weather, influent quality, etc. But often overlooked factors are the public: the community in which a program operates, the neighbors, and local environmental interests—even though public concerns sometimes create the most costly and intrusive disruptions to biosolids management programs.

The literature, case studies, and survey results suggest that, by increasing public outreach and participation, biosolids managers are likely to reduce program vulnerabilities and the risk of sudden costly setbacks for their biosolids management programs. Why? Because the biosolids manager will have better understanding of the public perceptions of his or her program, some public support, and knowledgeable and constructive public input to address any issue that arises.

In the private sector, corporations pay close attention to assessments of vulnerability and risks associated with the products they market. This has led to large corporate expenditures to address such issues as:

- worker health and safety in foreign manufacturing plants,
- total environmental impacts of manufacturing processes, and
- meeting public demands for corporate responsibility.

From corporate shareholder meetings to environmental groups to business organizations, there has been considerable pressure on large corporations to act responsibly and reduce their vulnerability to legal troubles (suits, regulatory actions) and public perception concerns (e.g., being labeled a “corporate polluter,” “corporate sweatshop,” or being accused of “greenwash”). For example, clothing manufacturers such as Patagonia and The Gap have spent millions to establish strict expectations and contracted protocols for off-shore clothing manufacturing facilities, in order to ensure fair treatment of workers and minimal impacts on local communities and the environment.

Manufacturers in numerous industries, from forestry and lumber to dairy products, have established environmental management systems and independent certifications that encourage managers and employees to take environmental impacts into account in decisions. Besides the fact that these programs can result in cost savings through increased efficiencies, they also serve to reduce vulnerability by addressing consumer and public concerns proactively.

There is evidence that insurance companies and courts treat corporations more favorably if the corporation has taken real, measurable, and proactive steps toward reducing vulnerabilities and liabilities. Recent prominent examples in the U.S. are the nascent efforts by a major food manufacturer and several fast food restaurant chains to reduce the fat and cholesterol contents of their foods while increasing their nutritional value as ways of reducing the potential of being liable in future lawsuits by affected consumers. These are all ways of managing risk and vulnerability in a competitive world.

Reducing vulnerability also makes sense for public utilities. Biosolids managers are encouraged to keep a running, prioritized list of both technical issues and public concerns and perceptions of their biosolids management program. The technical aspects are important, but the focus on this report is on the potential vulnerabilities regarding public perceptions.

An initial list of potential vulnerabilities can be developed by considering items listed in Section 1.4 and in the twelve action steps in Section 1.5. The list of vulnerabilities then needs to be prioritized so that the biosolids manager can focus on the greatest vulnerabilities first. For example, as the survey and literature review indicate, one of the most widespread and significant concerns of the public is the organic and inorganic chemical quality of biosolids products. This vulnerability can be addressed proactively in many ways:

- increase the comprehensiveness of industrial pretreatment programs (be creative in working with industrial and commercial sewerage system users to constantly improve pretreatment);
- step up inspections and enforcement of industrial pretreatment programs,
- invest in and partner with service area hazardous waste management programs to reduce opportunities for improper and/or illegal disposal to sewers or septic systems;
- encourage replacement of consumer products that are known to cause significant negative impacts on biosolids quality (for example, in the 1990s, some utilities identified baby diaper-rash creams as a significant source of zinc in biosolids and worked with cloth diaper washing services to provide consumers zinc-free creams at no-cost to the consumer);
- increase the frequency of biosolids quality testing (many larger producers concerned with biosolids quality for consumer markets test more often and for more parameters than required by regulations);
- have an independent statistical analysis of biosolids quality data with regard to trace chemical and elemental contaminants (the State of New Hampshire, for instance, contracted with a university professor to run statistical analyses of biosolids data to allow statements such as “The chance that a New Hampshire Class B biosolids product will have a level of chromium that exceeds the regulatory limit is less than 5%”);
- work with environmental and community groups to identify chemicals and elements of greatest local concern and work with those groups to address those concerns (for example, get involved in efforts to replace an older medical incineration facility with a more modern and environmentally-friendly medical waste disposal system in order to reduce airborne distribution in the service area of mercury, dioxins, and furans);
- publish test results and provide open, frequent communications with the public about biosolids quality and the steps taken to protect it.

The actions a biosolids manager chooses to take will depend on an estimate of the potential impact of each action on reducing actual and perceived vulnerability and how much each action will cost in money and staff time.

As is evident in the list above, a biosolids management facility’s interests in addressing critical vulnerabilities such as biosolids quality may result in actions beyond the “normal” scope of operations. These activities, however, may be the most efficient way to reduce a vulnerability. As an example, some research indicates that trace elements, such as those widely regulated at the state and federal level, can be removed from biosolids at a treatment facility. But what is the cost of installing and operating such a system in comparison to taking actions upstream, in the community, to achieve the same level of trace element reduction? Cost-benefit analyses can be done to address such a question.

In the water side of wastewater treatment facilities, the use of chlorine has often been replaced with ultraviolet radiation for disinfection of effluent, in part due to concerns about the vulnerabilities associated with storing and using chlorine. Therefore, public utility biosolids managers might increase their knowledge of the polymers used for biosolids treatment, how they are produced, and what alternatives exist.

Another possible avenue for biosolids managers to reduce vulnerabilities is to evaluate the vendors they work with. Evaluating vendors' practices, reputations, and product qualities is becoming standard practice in corporations that have EMS programs. In many situations, before they contract with a vendor, private corporations will ask the vendor to complete and certify their answers to questionnaires about their product quality, business practices, treatment of employees, and environmental record. If the vendor marketplace is highly competitive, some corporations go so far as to require that the vendor they choose has a robust environmental management system and provides routine reports on the development, goals, and accomplishments of that program. The goal is to reduce the potential of utilizing products that may vary in quality and/or to reduce the potential vulnerability of having the corporation's products associated, at some future date, with a vendor whose products or practices are the target of public outrage and legal challenges.

Perhaps most critical for public utilities' biosolids management programs is an evaluation of the contracted hauling and use or disposal of biosolids. Private biosolids management companies manage a large portion of the biosolids beneficially used on this continent. Most utility biosolids managers already pay close attention to biosolids management companies' activities, ways of doing business, quality of staff, and reputations.

But, in many cases, these assessments are not as thorough as they could be. Some contracts have only a few specified requirements regarding the quality of the biosolids management program, including such things as having back-up use or disposal options at all times, ensuring sufficient short-term storage capacity, addressing trucking issues and potential impacts on communities, and detailing best management practices for land application. Many contracts with biosolids management companies do not include anything about public outreach and public participation.

Through the NBP EMS for biosolids program (Section 1.7.2), attention is directed to the quality of the entire "biosolids value chain"—all those aspects and inputs to a biosolids product and program that affect biosolids and program quality, environmental impacts, and public perceptions and support. Some public utilities are beginning to rewrite their standard requests for proposals (RFPs), bid documents, and contracted services contracts to incorporate greater attention to overall product and program quality. They are dictating higher standards for private contractor operations.

Encouraging this approach throughout the biosolids management industry (e.g., by sharing these kinds of enhanced documents and encouraging their wider adoption) will help advance the overall quality of biosolids management programs by ensuring that those few private contractors that operate by cutting corners and ignoring public concerns are weeded out. As part of this approach, public utility biosolids managers need to ensure there is a robust system of accountability detailed in contracts and that the utility regularly checks on contractor performance (including, for example, how they approach local communities). Some public biosolids managers have considered requiring the biosolids management company with whom they contract to develop its own EMS.

1.7.2 Environmental Management Systems

An important means of reducing potential program vulnerabilities is to adopt an environmental management system (or other enhanced management system) that focuses on continual improvements in overall product and program quality. The National Biosolids Partnership's (NBP) Environmental Management System (EMS) is based on the Deming quality management model of constant improvement. An EMS program can be an organized, rational, step-by-step process that leads to the reduction of vulnerabilities and liabilities in all aspects of a system or program.

A good environmental management system program, such as that of the NBP, allows considerable flexibility and tailoring to the local situation. Thus, there are a limited number of requirements for what has to be in the NBP EMS. Instead, local biosolids managers determine the focus of their EMS and its actions through a step-by-step cyclical process of assessment, prioritization, action, and evaluation. Key components of the NPB EMS include (National Biosolids Partnership, 2002b):

- **Independent program audit**, including tracking of actual environmental impacts of the biosolids management program with the intent of reducing negative impacts.
- **Public participation (Element 6):** EMS guidance requires organizations to "select and implement a proactive public participation approach to involve interested parties in its Biosolids Management Program and EMS planning process." The approach must include a plan for third-party verification of conformance with NBP standards.
- **Communications (Element 9):** Organizations are required to "establish and maintain a proactive Communications Program that provides ongoing information about its Biosolids Management Program and its EMS to interested parties and the public, consistent with local circumstances, the method of biosolids management, its public communications history, and degree of current interest in its biosolids management activities." The program also must "make available a summary of its independent, third party EMS verification audit results to the public."

To become a certified NBP EMS program, the biosolids manager and staff are required to go through a rigorous assessment of vulnerabilities ("gap assessment"). They then prioritize those vulnerabilities and commit, on paper, to constant improvement through addressing each vulnerability, starting with those of highest priority. At least once a year, the program is evaluated, its successes and failures are noted, and new commitments for the next year are made. Once the EMS has been in operation for at least six months, an independent audit can be requested by the utility. If the audit results are satisfactory, the EMS becomes certified by the NBP.

The NBP EMS program requires a level of "transparency" and public participation that was developed with input from several environmental group representatives expert in environmental management systems. Thus, having an NBP-certified EMS for biosolids should enhance public participation and support and serve to reduce liability and vulnerability around biosolids management. Aspects of the program that build trust and enhance public perceptions are:

- The EMS requirement of continual improvement, which encourages *a willingness to make changes based on public input and participation*.
- The EMS emphasis on attending to details at all localities where the biosolids management program interacts with the public, which encourages *accountability at the local level*, where the biosolids meet the soil.
- The EMS emphasis on covering the entire biosolids value chain, which encourages biosolids managers to adopt a *systems thinking approach*. In relation to communications and public participation, a systems thinking approach can lead the biosolids manager to consider the impacts of each part of the biosolids value chain on public perceptions and relationships (it may be useful, for example, to diagram the biosolids value chain and identify and record the likely impacts of each part of the value chain on public perceptions and relationships).

Just as significant, a few new and developing NBP EMS programs have already experienced some cost savings through the identification by the EMS process of ways to increase efficiency. For example, the Washington, DC Washington Area Sewerage Authority estimates it will save a million dollars annually through an efficiency in biosolids treatment that, the operators believe, would not have been identified without the EMS process.

The NBP EMS program for biosolids is not the only way for public wastewater utilities and biosolids management organizations to develop quality management or an environmental management system. In fact, a few public wastewater utilities (e.g., Lowell, MA) have developed EMS programs under the internationally recognized ISO 14000 standard. Those facilities that have gained ISO 14000 EMS certification have achieved cost savings and reduced environmental impacts through such aspects of their operations as pump efficiency and saving on electrical costs, which also reduce the facility’s need for energy and its related impacts on the environment. These kinds of savings and reduced environmental impacts are less likely to be realized in the NBP EMS program, because of its narrower focus. However, an NBP EMS is less cumbersome and costly to create and operate, an important consideration for public utilities whose budgets are tight. In addition, the detailed process of the NBP EMS can start the utility or company management and staff on the environmental management mode of thinking, which means that the same process can subsequently be applied to other aspects of the wastewater utility or company operations.

1.8 Addressing Conflict at the National Level

1.8.1 Public Participation in Development of Policy

In the U.S. and Canada, the development of public policy usually includes significant requirements for public review and comment. This is a natural development in any democratic society. However, public review and comment processes often are streamlined in an attempt to balance the needs of those proposing something and those who may wish to comment.

Biosolids managers are used to public hearings and meetings to inform the public of actions that may impact them and that offer them a chance for review and comment. Most biosolids managers also are well aware of the shortcomings of such meetings—they can increase the dissemination of erroneous information, increase extreme positions, and increase conflict. There are several reasons for this:

- Public hearings are often the one and only chance for the public to vocally comment on a proposal, so they feel pressured to strongly state their position;
- Public hearings are usually scheduled soon before a final decision is made, which leaves the public little time to learn about the proposal, ask questions at the hearing, and/or provide substantive comments;
- Public hearings are large group meetings where experts usually stand in front of "non-experts," creating an imbalance of power and authority to which the public can react with uneasiness and outrage;
- Public hearings tend to encourage simplified, vocal, exaggerated arguments and grandstanding more than conscientious, constructive dialogue that leads toward better mutual understanding; and
- Because of the above, public hearings are often dreaded by presenters and many others involved in them, which heightens tension.

Despite these shortcomings, social scientists who study constructive public participation in the development of public policy agree that the legally required public hearing and comment processes are necessary. What these researchers encourage, however, is the use of informal processes, such as consensus building, *in advance of* or *parallel to* the formal, legal process.

Biosolids managers are encouraged, for example, to hold smaller meetings with neighbors and others in the community and take other proactive relationship-building steps in advance of a required public hearing. In addition, people developing regulations are encouraged to consider alternative dispute resolution processes, such as consensus building, to address conflicts and come to adequate resolutions in advance of schedule-driven, formal policy-setting processes.

The time has come for the biosolids management industry to consider ways to address the growing conflict over biosolids policy at the national level. Experience over the past several years has clearly demonstrated that this conflict is having a significant impact on local biosolids management decisions in many parts of the country (e.g., see Chapter 3.2.13). Decisions being made in the midst of heated conflict may not be in the best interests of society or the environment. Creating a forum for dialogue amongst people representing the wide variety of viewpoints may be necessary to avoid the costly mistake of hasty decisions driven by public outrage or reactions to public outrage.

In order to create a meaningful public policy dialogue, it will be incumbent on leaders in the biosolids management field to find ways of involving a wide variety of interests, including concerned citizens (but not just the most concerned opponents). Environmental, agricultural, and public health organizations should be involved, as well as representatives of the stakeholder groups currently active in biosolids management (e.g., farmers, research scientists, regulatory agency staff, and biosolids managers). Getting this variety of groups involved is a significant task and will take considerable time, money, and effort. It is likely that such an effort will only succeed at a national level if the national leading wastewater and biosolids organizations commit to it.

Models for diverse public participation that have been developed around other controversial issues may be useful for biosolids management. For example, a national stakeholder group was formed in the mid-1990s to help the wind energy industry deal with public concerns about the siting of windmills and "wind farms." This group, the National Wind

Coordinating Committee (NWCC), has had as many as 50 members (some only work in one or more of five smaller workgroups). The NWCC facilitates decision-making around wind energy facility siting, technical issues, research agendas, and more. Stakeholders include wind energy development companies, financial institutions, landowners, neighbors to wind farms or proposed wind farms, and environmental groups. The NWCC is organized and facilitated on an ongoing basis by Resolve, a Washington, D.C.-based nonprofit that specializes in conflict resolution and consensus building. Resolve has two full-time staff, one half-time secretary, and a half-time mediator supporting the NWCC. The NWCC runs workshops around the U.S. and jointly develops informational products. Much of its funding is from the U.S. Department of Energy, which provides about $500,000 a year. Evaluations of the NWCC's work have shown considerable support and appreciation from diverse participants (National Wind Coordinating Committee, 2002 and personal communication).

What seems clear, is that, in the absence of any further concerted efforts to address the national conflict around biosolids recycling (especially around Class B land application), the national conflict will continue to negatively impact local biosolids management programs. Which is more costly, the accumulating local restrictions on biosolids recycling programs and associated costs of litigation or a proactive concerted effort to address the conflict and public concerns on a national (or possibly regional) scale? It will take some expert analysis to find the answers to these questions.

And while there have been some experiences with dialogue amongst parties in the biosolids conflict (e.g., the so-called "New York Roundtable") that have been seen as failures, there are many examples of situations in which biosolids managers and concerned members of the public have found things they can agree on and work on together (e.g., see the first few case studies in Chapter 3.0 on the accompanying CD-ROM). The same could be done on the national or regional level.

As Lawrence Susskind emphasizes, it is best if those in the biosolids management field always strive to learn more about biosolids and about biosolids management. Part of this striving for more information and understanding is learning from those with different points of view.

1.8.2 Public Participation in Biosolids Research

The National Research Council (NRC) report of July 2002 recommended stakeholder involvement in biosolids research and risk assessments. Why? Because decisions about what to study and what assumptions to apply are necessarily biased by one's experiences and perspective. Therefore, when making such decisions it makes sense to ensure representation of the variety of perspectives and experiences related to biosolids management.

In response to the NRC report and other similar recommendations, U.S. EPA, USDA, and the Pennsylvania Department of Environmental Protection (PA DEP) created an Information Sharing Group (ISG) of concerned citizens to be involved in a large cooperative study of air emissions from biosolids and other land application sites. Development of a quality assurance project plan was undertaken in 2003. The ISG has provided useful input to the development of the research process protocols. However, there has been tension and some of the scientists have found that public input requires more work. For their part, the ISG participants are understandably frustrated in their limited role of providing comments and asking questions; they were not involved in the original design of the project, in funding, or in project staffing decisions. Thus, this formal involvement of concerned public citizens in a biosolids research project did not match the ideal model for public participation. But it was a significant step in the direction of increased public participation in research in the biosolids field.

Similarly, the Water Environment Research Foundation (WERF) has decided to bring public input into its research processes, especially in areas, such as biosolids, that are the subject of considerable public interest. WERF created a July 2003 national biosolids research summit to help determine a biosolids research agenda for the next five or more years—and, for the first time, this biosolids research agenda-setting process included diverse public input in the planning and production of the summit, as well as at the summit itself.

These developments are grounded in the principle of "joint fact-finding" (Susskind et al., 1999)—people with differing opinions and perspectives working together to establish mutually-agreed-upon facts and data. Over the past 10 years, this aspect of alternative conflict resolution has become a significant subject of social science investigation and experimentation. Joint fact-finding offers a means of avoiding "dueling science," where people on each side of an issue cite those researchers and scientific papers that they believe support their position. Although debate over data and conclusions is part of the scientific process, dueling science in a policy debate leads to increased public uncertainty about where "the truth" lies. It confuses policymakers and the public. It adds to divisiveness, reduces trust, and reduces the possibility of constructive, long-term relationships.

Instead of working on the science separately, "joint fact-finding" or "collaborative research" involves working on the science *together*:

- Work together to determine research needs, establish a research process that is credible and technically sound in the eyes of all involved (or almost all), and thereby establish credible data. In short, develop a common data and knowledge base.
- It is understood from the start that the way in which the data are interpreted and applied in policy may differ among the parties, depending on their viewpoint—and this is okay.

The benefits of joint fact finding include:

- Working together increases the scientific knowledge and understanding of all participants.
- Joint fact finding helps identify the most accurate objective information and its limitations.
- Working together means that the process of coming up with the data is known to all, witnessed by all, is much more "transparent," and thus less likely to be misunderstood or the target of criticism.
- Joint fact-finding can be helpful in increasing understanding of scientific uncertainties and how they may be dealt with.
- Working together provides the possibility of enhanced dialogue, mutual understanding, greater sense of fairness, increased trust, and improved relationships.

1.9 Conclusion

Biosolids management in North America may be at a critical juncture. Either biosolids recycling programs will develop better understanding, communications, dialogue, and relationships with the public—or the expansion in biosolids recycling of the past several decades may end amidst increased public outcry.

The authors of this report have learned from experiences in other fields that there are concrete actions that can be taken to

- improve public perceptions and acceptance of biosolids recycling and
- improve the quality of biosolids management programs.

Such actions are not new and include the same actions required in all relationships: showing respect, ensuring fairness, developing trust, establishing two-way communications, sharing appropriate information, and showing commitment.

Biosolids managers can work today, through small or large action steps, toward improving their public relationships with the diversity of stakeholders involved in or affected by their biosolids management programs. There are many tools and resources available—not just in this report, but in workshops, conferences, books, and other publications.

As you proceed , remember the one key question you can ask yourself in any situation before you take action or say something:

> *"What will be the impact of my next action on our program's relationship(s) with key stakeholders?"*

If the impact will be negative, think of something better to say or do.

CHAPTER 2.0

LITERATURE REVIEW

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2.1 Literature Review Process and Scope

The first task of this project on biosolids public perception was to conduct an extensive literature review to collect and summarize divergent thoughts regarding the public perception of biosolids recycling, its public acceptability, and the experiences of public participation around biosolids recycling programs. The review included published documents, as well as gray literature and conference and workshop presentations, and concentrated mostly on experiences within the biosolids industry. Additional collected documents, however, relate to public knowledge, perceptions, opinions, and behavior around related environmental issues such as solid waste management, recycling, and energy. The results of the literature review should inform future efforts to develop public education, outreach, and participation for biosolids recycling programs.

The literature search took advantage of the libraries and resources available through New England Biosolids and Residuals Association (NEBRA), E & A Environmental Consultants (now of Tetratech), and Northwest Biosolids Management Association (NBMA), U.S. Environmental Protection Agency (U.S. EPA), Water Environment Federation (WEF), and National Biosolids Partnership (NBP) publications, as well as Internet and standard electronic library bibliography search engines and academic libraries. Extensive newspaper coverage was collected from several sample regions, especially California, New Hampshire, the Northwest (Washington & British Columbia), and Pennsylvania.

In addition, in order to ensure that a wide variety of cases, experiences, and perspectives were included in the scope of this literature review, and to ensure that no significant report or gray literature was overlooked, the project team contacted all U.S. EPA regional biosolids program coordinators and regulators in the 50 states, Puerto Rico, and regulatory officials in eastern and western Canada. Initial email contact was followed up with telephone calls to selected contacts; conversations were focused around the following four questions:

1. Who in your state or region, besides you, has thought about, worked on, and/or written about biosolids public acceptance issues? (Get contact phone number(s) and follow-up with them.)
2. Over the past 10 years, what factors and/or events in your state or region have had the most significant positive or negative impact(s) on biosolids recycling

programs? Are there any written materials you can send us that discuss public acceptance issues around these local factors or events?

3. What happens to the biosolids from the largest POTWs in your state (or region)? Do any of those POTWs (or their private contractors) have significant public outreach, public relations, or education programs regarding biosolids recycling? Who is the POTW person to contact for that information? (Get contact phone number(s) and follow-up with them.)
4. What do you think creates public acceptance or lack of acceptance of biosolids recycling?

These efforts yielded response and information from about 40% of those contacted. In addition, the contacts and interviews helped provide a pool from which to choose case studies and gather additional information for the second part of the project. The scope of the Literature Review was delimited as follows:

- For biosolids-related information, mostly literature published in 1990 through 2002. For literature regarding public knowledge, perceptions, opinions, and behavior around environmental issues, papers and books published in 1980 or later.
- Literature pertaining to a) public knowledge, perceptions, opinions, and behavior about biosolids recycling, and b) the most significant and summary literature regarding public knowledge, perceptions, opinions, and behavior around related environmental issues (e.g., siting of facilities, solid waste management, energy, new technology).
- Mostly from the United States and Canada.
- Wide variety of perspectives; e.g., a variety of program outcomes, materials written by those in favor and those opposed to biosolids recycling, and by regulators, media, industry, environmental groups, etc.

Review of the behavioral and social science literature focused on research relating to risk perception and communication; trust, equity, and fairness; public participation; conflict resolution; and general public attitudes toward the environment and technology. The literature review included approximately 900 news and journal articles, books, and other publications. Example references are discussed in the section below, and the full set of annotated literature references is part of this report's CD-ROM..

2.2 Literature Review Findings

The following sections describe literature directly related to public knowledge, opinion, and behavior regarding the recycling of biosolids—treated sewage sludge. Since the late 1980s, this literature has been generally described as literature regarding biosolids "public acceptance."

The significant social science literature related to public knowledge, opinion, and behavior regarding other environmental issues (e.g., solid waste management, recycling, energy) is the topic of Section 2.2.3.

2.2.1 Public Perceptions and Acceptance of Biosolids Recycling—Overall History

2.2.1.1 Overview

Biosolids recycling in the United States has increased, in terms of percentage—from approximately 20% in the 1970s to close to 60%—to a total quantity of more than 3.3 million dry tons per year as the 21st century begins (National Research Council, 2002). The increase in biosolids recycling rate was stimulated in the early 1990s by the Congressional act that ended ocean dumping at about the same time that many of the major coastal communities were required to upgrade their POTWs to full secondary treatment (McKinney et al., 1990).

The steady increase in biosolids recycling means that more people have become aware through involvement in programs or through impacts from biosolids recycling projects—including negative impacts from poorly managed programs. This has resulted in increasing media attention, especially on problems or conflicts associated with biosolids recycling programs.

2.2.1.2 Prior to Federal Part 503 Sludge Rules

As far back as the late 1960's, the U. S. Environmental Protection Agency (U.S. EPA) and its predecessor agencies, along with other Federal agencies, supported demonstration projects to develop effective sewage sludge management practices, including a variety of land application practices: use for crops, use in reclamation of disturbed lands, forest applications, etc. With the establishment of the Construction Grants Program under the "Clean Water Act" of 1972, U.S. EPA construction funds began to be used more frequently for biosolids management projects. These projects were required to go through facility planning processes that involved active public notice and participation in project facility siting and development. This basic form of public participation in biosolids facility siting has continued to the present day and provides some basic public participation around those facilities where biosolids are produced and processed (Robert Bastian, personal communication). There have never been similar requirements at the federal level for public notice and participation around the siting of end uses of biosolids; this has mostly fallen to state and local jurisdictions.

Early U.S. EPA program guidance documents, such as the *Municipal Sludge Management: Environmental Factors* (U.S. EPA, 1977) and the *Land Application of Municipal Sludge Process Design Manual* (U.S. EPA, 1983a) recommended public participation in biosolids management programs, although little was mandated by law or regulation. Many U. S. land grant colleges and universities (e.g., Cornell University, Penn State University, Michigan State University, Ohio State University, University of Wisconsin, University of Minnesota, University of Washington, and University of California at Riverside) conducted research and extension (education outreach and training) programs that helped develop and disseminate the latest information on effective land application practices—but most of this information was targeted at farmers and others using treated sewage sludges, not neighbors or the general public. At the same time, organic and other farmers and gardeners (with research leadership by the Rodale Institute and the U.S. Department of Agriculture (USDA)) put sewage sludge to use in compost (Minnich et al., 1979; New Hampshire, 1978).

In 1976, the League of Women Voters, a public interest group, developed a pamphlet exploring sewage sludge management issues: "Municipal Sludge: What shall we do with it?" (League of Women Voters, 1976). For the most part, however, sewage sludge management was only discussed within the wastewater management field and among the small number of scientists involved in research on sewage sludge. Debates occurred within the agricultural and scientific community over such things as the effects of sewage sludge recycling on soils and appropriate precautions, restrictions, and management practices. Such debates have been going on since the 1970s. For example, in 1973, the first major conference on land application of wastewater and sewage sludge held at the University of Illinois at Champaign/Urbana included debates between Dr. Rufus Chaney of USDA's Agricultural Research Service (who at the time was conducting greenhouse studies with Dr. Donald Lisk at Cornell) and Dr. Thomas Hinsely of the University of Illinois (who had been conducting full scale field trials); the hot topic was whether greenhouse pot studies have relevance to biosolids recycling or not. Similar debates have occurred up to the present (Robert Bastian, personal communication; Harrison et al., 1999; Chrowstowski et al., 2002; European Union, 2000).

But then, as more sewage sludge was recycled in increasingly formal programs in the 1980s, "public acceptance"—whether or not there was public support for the activity of sewage sludge recycling—began to be noted as an important factor in the success of recycling efforts (U.S. EPA, 1980, 1986). In or around 1982, the engineering firm CH2M Hill commissioned a study, *Sludge Management: Public Perceptions and Politics*. Consumer Concepts, a management consulting firm, conducted interviews with biosolids management staff of 12 sewerage agencies across the U.S., including those in some of the nation's largest cities (New York, Los Angeles, Chicago, Boston, Houston, Philadelphia, St. Paul, St. Louis, and San Diego) and several smaller cities (Centerville, VA; Madison, WI; and Salem, OR). The study found that public concerns or opposition are "costly and can delay both the planning and the construction phases" of biosolids management programs. Effective public outreach and education efforts were being conducted in many of these cities, but their experiences made clear that more could be done. The report outlines critical do's and don'ts for developing public acceptance (CH2M Hill, 1982).

2.2.1.3 The 1990s—A Decade of Focus on Biosolids "Public Acceptance"

As the 1990s began, U.S. EPA was finalizing the federal 40 CFR Part 503 regulations. Public acceptance of sewage sludge recycling was becoming a topic at sewage sludge management conferences (McKinney et al., 1990; Wagner, 1990; Racey, 1991) as problems or perceived problems with wastewater and sewage sludge management began to make headlines (Scruton, 1991; Smith, 1991).

The development of the federal 40 CFR Part 503 Rule created a national forum for the discussion of scientific and public health issues surrounding the recycling of sewage sludge (Donovan, 1993; U.S. EPA, 1994a-c; U.S. EPA, 1995). Public awareness of environmental issues was growing in every part of society; even wastewater treatment and sewage sludge management had become significant issues to a couple of major national environmental groups (Natural Resources Defense Council, Environmental Defense Fund) involved in supporting the Ocean Dumping Ban Act of 1988. Despite the "tacit support" of these organizations for land application as the preferred management option (Rockefeller, 1999), local conflicts became more common as demand for land for recycling increased.

Technical (scientific and public health) issues still dominated biosolids recycling literature during the late 1980s and early-mid 1990s. Efforts on the part of U.S. EPA and biosolids management were still focused on disseminating technical information regarding research and risk assessment (Bastian, 1993; Chaney, 1990a,b; U.S. EPA, 1994a-c; U.S. EPA, 1995). But conflicts over the use of biosolids on land were smoldering, mostly as local issues. As far back as the mid-1980s, some researchers were discussing the need to improve public acceptance of land application of biosolids (e.g., Dr. Terry Logan cited in Logsdon, 1987).

By the time the federal Part 503 rule was finalized, several biosolids recycling programs had gained considerable local or regional public or media attention due to concerns of neighbors, especially the cases of:

- Ray and Linda Zander and Weyerhaeuser in Washington State;
- the use–beginning in 1992–of New York City biosolids on rangeland at Sierra Blanca, TX;
- the failure to properly manage perfectly good processed biosolids at "Mount San Diego, CA;" and
- alleged harm to animals in North Carolina, Oklahoma, and Vermont (Bleifuss, 1995; Haag, 1992a,b; Merriman, 1991; Water Environment Federation and U.S. EPA, 1997).

In some of these cases, small local environmental or citizen groups formed around, or took interest in, the biosolids recycling issue, but only rarely did national environmental organizations show much interest. A Water Environment Research Foundation 1993 summary, *Document Long-term Experience of Biosolids Land Application Programs,* discussed public acceptance issues, noting the following (Stukenburg et al., 1993):

- "The technical problems associated with a land application program are generally small if high quality biosolids are used at agronomic rates. However, a technically well designed and executed program can still fail because of community opposition."
- "Opposition is generally stronger against larger projects, projects that cross political boundaries, and projects in urban and suburban areas."
- "Two approaches to dealing with the public have been observed. Some programs seek active community involvement, while others try to keep a low profile."
- Suggestions for gaining public acceptance included visibly involving the community in the design of the program, having the highest standards for program quality, keeping odors to a minimum, fitting into the farmer's program, collaborating with researchers and the media, and publishing results.

In response to growing public concerns, biosolids managers and regulators published additional scientific and public health information to underscore their understanding regarding the safety of biosolids recycling (Chaney, 1990a,b; Canody, 1997; King County, WA, 2000; Logan, 1995, 1997; National Small Flows Clearinghouse, 1998; New England Interstate Water Pollution Control Commission, 1994; Stukenberg et al., 1993; U.S. EPA, 1994a-c, 1995; Water Environment Federation and U.S. EPA, 1997). The NBMA began a resource library of scientific and technical papers and, from them, created extensive literature reviews (Northwest Biosolids Management Association, 1997-1998). Biosolids stakeholders' and researchers' understanding of public concerns tended to focus on the public's level of scientific understanding: "Fear is highest when the public only has enough information to know that a risk exists but not enough to understand the extent of that risk, or that management controls are in place to limit them," postulated Logan (1995).

The ultimate scientific response to public concerns came in the form of a scientific peer review of the U.S. EPA programs for the recycling of biosolids and reclaimed water. America's most prestigious peer review body, the National Research Council (NRC) of the National Academy of Sciences found that "the use of these materials in the production of crops for human consumption, when practiced in accordance with existing federal guidelines and regulations, presents negligible risk to the consumer, to crop production, and to the environment" (NRC, 1996, p.13). The report also noted, however, that "the public is concerned about the health and environmental risks associated with beneficial land application of sludge…. Some of this concern is not scientifically supportable and should be addressed with education programs…" (National Research Council, 1996; Krauss and Page, 1997).

But the NRC report went further, noting that there was a need for more than just education about biosolids recycling. They recommended that biosolids recycling program managers pay attention to "early public involvement in the design of land application programs"; support of strict enforcement, oversight, and best management practices; demonstration programs; indemnity of farmers; and empowerment of local and state officials to address and enforce nuisance and other complaints.

In 1996, recognizing the growing importance of "public acceptance," the Water Environment Federation (1996) published a "digest" of papers on the topic that had been presented at WEF residuals management specialty conferences. A variety of public acceptance themes are evident in this collection: public participation and outreach, "doing things right," working with "gatekeepers" (individuals who are seen as leaders to whom communities turn for opinions and guidance on a particular issue), and communications.

The importance of good communications in and around biosolids recycling programs was becoming a common theme and was emphasized by Mendenhall (1991a-d; 1992); it has since been restated many times (e.g. Miller et al., 1996; New England Biosolids and Residuals Association, 1999a,b). At times, biosolids recycling practitioners have seen themselves as unsuccessful at communicating the benefits and safety of biosolids recycling: "We are at risk of losing our programs and increasing costs of our programs because of our failure to communicate the benefits of biosolids" (Toffey, 2000a).

The largest and most significant effort regarding how best to communicate with the public about biosolids recycling was the Water Environment Federation-sponsored *Communication Plan on Biosolids* (Powell-Tate, 1993) and the development of the term "biosolids" (Machno et al., 1996; Machno and Forste, 1997; O'Dette, 1994; Reardon, 1998). The "Biosolids 2000 Program" was developed to articulate the goal of making biosolids recycling “publicly acceptable” throughout the globe by the year 2000 (Loken, 1994; Machno and Forste, 1997). Further developments in defining the "biosolids message" and related communication strategies, including occasional small efforts at providing media relations training to biosolids personnel (Rocky Mountain Water Environment Association, 1995; Greenwood, 1997) have continued up to the present (Lang, 2000). In the late 1990s, the National Biosolids Partnership (NBP) was formed, in part to develop information and communications for public consumption (Hadeed, 1999). Forste (2000) and others discussed the importance of communication within the NBP Environmental Management System (EMS) program, the NBP’s most significant initiative.

As biosolids recycling was increasing throughout the 1990s, negative publicity occurred in scattered locales based on accusations of harm (e.g., Billings, 1997; Merriman, 1991) and poorly managed programs such as "Mount San Diego" (American Broadcasting Company, 1995). Concerned citizens were becoming more vocal and, in an attempt to address concerns in one state, representatives from U.S. EPA, USDA, and the New York Department of Environmental Conservation held meetings with representatives of the Cornell Waste Management Institute (CWMI) and the National Sludge Alliance (NSA)—the so-called "New York Round-table"—but resolution was never reached.

In 1995, the publication of *Toxic Sludge Is Good For You* (Stauber and Rampton, 1995) marked a significant upturn in public concern. Although the book was from a small publisher, several articles in the national alternative press quickly followed (Bleifuss, 1995; Bisogno, 1995). Stauber's and Rampton's exposé of the development of the Powell-Tate communications plan for biosolids fostered distrust of U.S. EPA, the Water Environment Federation, and the entire biosolids recycling industry. CNN's airing of *Hazardous Harvest* (Cable News Network, 1997) likely caused an additional increase in public concern, although some biosolids managers reported little impact to programs where local public knowledge and understanding had previously been developed.

This media attention was an indication of growing controversy. Researchers at the Cornell Waste Management Institute (CWMI) had begun to publish strong statements of concern about the growing trend of land application (McBride, 1995), including Cornell Extension publications warning farmers to be aware of potential risks of using biosolids. The National Sludge Alliance had formed, with members from around the country who were concerned about myriad aspects of biosolids recycling and many alleged cases of harm that they believed were caused by biosolids (e.g., National Sludge Alliance, 1997a-g).

In response to these events, the Water Environment Federation and U.S. EPA (1997) published fact sheets regarding detailed investigations of cases where biosolids were accused of causing harm, but, according to the fact sheets, were found not to have done so—at least in those particular cases where proper management practices were utilized. There have been instances of harm from improperly managed sewage sludges. U.S. EPA sent letters to CNN, the NSA, CWMI, and other groups, providing rebuttals and corrections of scientific facts (included in Water Environment Federation, 1999b).

In August 1997, CWMI published on the Internet "The Case for Caution" (Harrison et al., 1999), which stated, "based on their analyses, the authors do not suggest a prohibition of land application; but rather significantly more restrictive use." "The Case for Caution" was an example of the power of high-speed information dissemination via the Internet (Beecher, 1999b). This publication quickly became–and has continued to be–an oft-cited reason for local restrictions or bans on biosolids recycling (e.g., Fraser, 2000). It was updated and published in a journal in 1999. The Water Environment Federation and USDA each responded with short point-by-point fact sheets. More thorough scientific rebuttals were developed by Rowland of the New York DEC and Chrostowski et al. (2002); the former was finalized and made part of the record by the State in 2002 (New York State Department of Environmental Conservation, 1997, 2002). The impact of "Case for Caution" continues to be felt; for example, it was a central subject in a California court's decision in favor of a state environmental board that had rejected the paper's findings due to lack of scientific basis (Sacramento Superior Court, 2001).

Also in 1997, the Worldwatch Institute published a bound paper and magazine article underscoring the importance of organic waste recycling in building sustainability, but cautioning about the potential problems with pollutants in recycled sewage sludge (Gardner, 1997).

In the late 1990's, ongoing biosolids recycling programs in many areas began to experience increased public and media scrutiny and concern, especially as a result of several new allegations of harm caused by biosolids (Anderson, 1999; Braile, 1998; Inlow, 2000; Kliewer, 1999; Maddocks, 1995; Randall, 2000; Sierra Club, NH Chapter, 1999; *USA Today*, 1999). At the same time, news reports regarding benefits of biosolids recycling programs were not as common (e.g., Lopez, 1995; *The Maui News*, 1998; Mittelstadt, 1999a, b). Perhaps the most balanced analysis of the developing biosolids recycling public policy debate was captured by science writer Jane Ellen Stevens (Stevens, 1998).

2.2.1.4 Entering the 21st Century—Increasing Conflict

In 2000, national attention was brought to biosolids recycling, including within U.S. EPA and the U.S. Congress. In March, the U.S. House Science Committee held a hearing (U.S. House of Representatives, 2000) and the U.S. EPA Office of Inspector General released a report condemning the Office of Water for lack of oversight of biosolids management programs (U.S. EPA Office of Inspector General, 2000). In the summer, the National Institute for Occupational Safety and Health (NIOSH) published a "Hazard Identification" concerning potential pathogen risks to people working with Class B biosolids at land application sites (NIOSH, 2000). Two years later, this document was replaced by a less controversial "guidance" to workers (NIOSH, 2002). U.S. EPA's Office of Water and its biosolids management program responded to all of these events, as did the Water Environment Federation and other stakeholders (Kirk and Gray, 2000), but support within U.S. EPA was being shaken (Lewis, 2000b). U.S. EPA requested the National Research Council to re-evaluate the current science of biosolids recycling. The year's events—including further restrictions to biosolids recycling in places like Kern County, California—had ripple effects, spreading public interest and concern to other areas (Mahr, 2000; Tuohy, 2000; *USA Today*, 2000).

In 2001, the debate amongst a few scientists spread further into public policy debates between proponents of biosolids recycling and citizens concerned about biosolids recycling. The year began with presentations, by a variety of experts and perspectives, to the National Research Council panel that had been formed at the request of U.S. EPA (e.g., Lue-Hing, 2001). In late spring, Dr. Robert Hale of the College of William and Mary reported in *Nature* his research findings regarding the presence of brominated di-phenyl ethers (BDEs) in biosolids and fish (Hale, 2001; Mulvihill, 2001; Truini, 2001a); no cause and effect relationship was claimed by the author, but he implied a relationship, which triggered defensive responses from biosolids industry people (Beecher & Toffey, personal communication). Several larger newspapers and magazines reported on this and other concerns; noted the Washington Post: "sludge-spreading raising concern over health fears" (Kunkle, 2001; Snyder and Kunkle, 2001). The Pennsylvania Environmental Network and other opponents to biosolids recycling stated their concerns more clearly than ever (Pennsylvania Environmental Network, 2001). In November, Hale and other researchers concerned about potential negative impacts of biosolids recycling (especially Class B land application) held a one-day conference at Boston University (Boston University, 2001).

Those most involved in managing biosolids, led by the nation's largest biosolids recycling company Synagro, began to respond more strongly to critics and what they considered a small minority of scientific opinion by developing white papers and reports (e.g. Chrostowski et al., 2002). One white paper critical of Dr. David Lewis's theories (see below) was, in turn, critiqued by a paper from the National Whisteblower Center with which Dr. Lewis works (National Whistleblower Center, 2002). Several court cases ended with rulings favorable to biosolids management companies and farmers who use biosolids (Hassell, 2001). The Water

Environment Federation and other organizations supportive of biosolids recycling published articles on such things as “Laymanization: An Engineer’s Guide to Public Relations” (Harding, 2001) and “Winning Trust Through Open, Honest Communication Helps Reduce Neighbors' Fears of Biosolids” (Pearlman and Frank, 2001).

In the face of changing scientific and public views, biosolids management programs have continued to adapt: California and New Hampshire began to experience the effects of new regulations (Stoddard, 2001; Kern County, 2002). New York City ended its contract with Merco, a land application company, and, after many years, New York biosolids stopped being land applied in Sierra Blanca, Texas (Truini, 2001b; Carlile and Gillane, 2001). In Maine, a local newspaper noted “Lyman's Sludge Debate is Likely to be Repeated” (Blethen Maine Newspapers, 2001).

In 2002, as the nation and its allies adjusted to a new world perspective developing in the wake of the terrorist attacks of September 11, 2001, the small but intense biosolids recycling debate continued, even as more biosolids were put to use. Early in the year, the U.S. EPA Office of Inspector General issued its second report on the Agency’s biosolids management program and found inadequate enforcement and oversight, too little data, and a wide variety of levels of management and oversight on the parts of the various states (U.S. EPA Office of the Inspector General, 2002; *Providence Journal*, 2002; *Sludge*, 2002; Solomon, 2002a, b; *Waste News*, 2002). Not long after, the national Sierra Club became the first well-known environmental group to develop a significant statement on sewage sludge management, issuing a guidance document to all club chapters and members that called for suspension of current land application practices (Sierra Club, 2002a).

In 2002, the National Research Council released its critique of the U.S. EPA biosolids regulatory scheme and the science on which it is based (National Research Council, 2002). Debate flared up anew, as critics and proponents of biosolids recycling sparred over what the report meant; in the end, a clarification from the Chair of the NRC panel (Burke, 2002; Clean Water Report, 2002a) was necessary to help clarify the report’s “overarching” findings that…

> There is no documented scientific evidence that the Part 503 rule has failed to protect public health. However, additional scientific work is needed to reduce persistent uncertainty about the potential for adverse human health effects from exposure to biosolids. There have been anecdotal allegations of disease, and many scientific advances have occurred since the Part 503 rule was promulgated. To assure the public and to protect public health, there is a critical need to update the scientific basis of the rule to 1) ensure that the chemical and pathogen standards are supported by current scientific data and risk-assessment methods, 2) demonstrate effective enforcement of the Part 503 rule, and 3) validate the effectiveness of biosolids management practices.

At about the same time, Dr. David Lewis, a whistleblower at U.S. EPA and a critic of the federal sewage sludge management program, published papers in two journals outlining his theories regarding health problems amongst neighbors and others exposed to air emissions from land applied Class B biosolids (Lewis and Gattie, 2002; Lewis et al., 2002). The NRC report, coupled with Lewis’s work, triggered more press coverage of biosolids recycling—although still less than that accorded to many other environmental issues. Tom Henry (2002) of the *Toledo Blade* provided a balanced review of the issues and debate. In contrast, *U.S. News and World*

Report published a less balanced story reporting Dr. Lewis's and citizens' concerns and mostly those aspects of the National Research Council report that were critical of biosolids recycling (Barnett, 2002). The *Vacaville* (California) *Reporter* headline was "Growing Question: Are Biosolids Safe? Sludge Concern Spreads" (Massad, 2002). And Jessica Leeder (2002), writing for the Canadian paper *National Post* cited Lewis's work extensively in her unbalanced article "Human Fertilizer Poses Cancer Risk." Likewise, Cherry, writing for *Insight on the News,* stuck to her staunchly critical perspective on sludge (Cherry, 2000a-c).

In 2003, U.S. EPA developed a response to the NRC's 2002 report, first in draft form, to which comments were taken. Numerous comments were received from a diversity of perspectives, which further illuminated public concerns. Later in the year, the rise in vocal opposition continued, culminating in a petition to U.S. EPA seeking an "emergency moratorium" on the land application of biosolids by the Center for Food Safety and 72 other, mostly small, local citizen and environmental groups (Center for Food Safety, 2003). The U.S. EPA denied the petition's request for a moratorium and provided detailed rebuttals to each of the allegations in the petition (U.S. EPA, 2003b). Shortly after, U.S. EPA finalized its response to the NRC report, committing to several specific research efforts and policy reviews (U.S. EPA, 2003c).

2.2.1.5 Seeking New Ways to Address Concerns

Just as Logan (Logsdon, 1987) and the first National Research Council (1996) report noted, there has long been a dual response from the biosolids management industry to "public acceptance" challenges:

- defend biosolids recycling on scientific and public health grounds and educate the public about the quality of biosolids products and programs (as discussed above) and
- encourage further improvements in the quality of biosolids products and programs.

There have been many calls from within the wastewater and biosolids management industry for addressing public concerns by improving the quality of biosolids products and programs (Brobst, 1994; Sasser, 1993). Growing awareness within the industry of what Machno (2000) describes as "dumb mistakes" led to significant and far-reaching efforts to improve the quality of biosolids recycling programs, including by the Northwest Biosolids Management Association (Sullivan, 1999), the California Water Environment Association (1998), the National Biosolids Partnership (Canning, 1999; National Biosolids Partnership 2000a,b; National Biosolids Partnership, 2001). The development of training programs in California, the Pacific Northwest, and Pennsylvania (1999) were also intended to improve biosolids recycling program quality, and thus, improve the chances of gaining public support. Similarly, the importance of "doing things right" has resulted in programs for certifying biosolids managers in the Carolinas (West, 2000). British Columbia also has a new set of regulations and best management guidelines (McDougall et al., 2002).

The National Biosolids Partnership has furthered such efforts on a national level in the U.S. through its efforts to establish Environmental Management Systems (EMS) at wastewater treatment facilities and biosolids management programs (more on the EMS program, below). And best management practices is a topic that remains front and center at conferences and in industry periodicals (e.g., Toffey, 2002).

Gaining public trust, acceptance, and/or support of biosolids management programs is something that will likely have to be worked out at each of the nation's 16,000+ municipal wastewater treatment facilities–as, indeed, it always has been. As the 21st century begins, the public's perceptions of biosolids recycling are more complex than ever. Stier (2000) clearly confirms what many biosolids managers have begun to note: scientific and technical arguments may or may not have any impact on public knowledge, opinions, and behavior. The number of potential scientific and public health issues around biosolids recycling has grown and continues to grow (Bynum, 1999). Debate about the concept of biosolids recycling has deepened so that it often involves underlying environmental philosophy and values, creating a deep division between those involved in the practical day-to-day resolution of environmental challenges (e.g., wastewater treatment operators) and those who have embraced a broader environmental philosophy such as the "precautionary principle"—an approach to environmental policy that encourages avoiding actions or the adoption of any policies or technologies that involve some level of scientific uncertainty concerning potential negative impacts on the environment or public health (Beecher, 1999b; Krogmann and Harrison, 1998; Rockefeller, 1999). The result is that biosolids managers face an almost overwhelming assortment of issues: "The tremendous breadth of responsibilities we in the biosolids/residuals business assume on technical, community, and research issues demands that we find better ways of getting these jobs done,..." states Bill Toffey (2000e) in a discussion of the need for regional information networks (regional associations).

At the same time, leading biosolids management stakeholders have come to recognize that public participation in the development and implementation of biosolids recycling programs will be critical in the future (Ammons and Hill, 2000; National Biosolids Partnership, 2000b; Oerke et al., 1998). Understanding how to foster public participation and improve communications and mutual understanding while continuing to manage day-to-day biosolids operations is creating new stresses on biosolids personnel, forcing them to seek help from other fields where complex environmental issues have been debated and principles and findings of social science have provided understanding of the nature of public knowledge, opinions, and behavior with regard to similar issues.

2.2.2 Specific Topics in the Biosolids Recycling Public Acceptance Literature

Following are summaries of selected topics that are found in the biosolids "public acceptance" literature, including…

- scientific and public health issues,
- examples of biosolids recycling programs that gained public acceptance,
- biosolids program communication and outreach,
- how much and what type of biosolids information does the public need?
- who should speak for biosolids recycling?
- public outreach and participation efforts by biosolids managers,
- political and legal efforts,
- public opinion surveys and biosolids marketing analyses,
- addressing issues through Environmental Management Systems
- the roles of third parties and media, and
- literature expressing concerns about biosolids recycling.

2.2.2.1 Scientific and Public Health Issues

There are numerous specific technical, scientific factors involved in the recycling of biosolids that impact the public's knowledge, perceptions, opinions, and acceptance of biosolids recycling. The most significant technical issues, as reported by people with diverging opinions about biosolids recycling, listed in order of significance, are

- trace metals and chemicals ("pollutants"),
- pathogens (human-disease-causing organisms),
- odors and other air quality concerns,
- oversight and enforcement,
- surface water and groundwater quality,
- soil and food quality,
- transportation and trucking,
- economic viability,
- changes in demographics and changing expectations, and
- emerging issues and uncertainty.

Trace metals and chemicals (“pollutants”)

In the literature that describes concerns about or opposition to biosolids recycling, it is the “pollutants” (the term used in the Part 503 rule) in biosolids–the myriad trace metals and chemicals that are inevitably present in at least trace amounts—that are the number one concern (Adams, 1998; Anderson, 1999; Bleifuss, 1995; Bynum, 1999; Cable News Network, 1997; Dahl and Smith, 1998; Denver Publishing Company, 1998; Fitzcharles, 2000; Gardner, 1997, 1998; Haag, 1992a,b; Harrison et al., 1999; Hirshorn, 1992; Lewis et al., 2000; Orlando, 1999a,b; Rachel's Environment & Health Weekly, 1997; Rockefeller, 1999; Sewage Sludge Homepage, 2000; Sierra Club New Hampshire Chapter, 1999). Kliewer (1999) reports that in Monaville, Texas, county officials and local residents were worried about a proposed land application site: "one woman who’s land is “next door to the disposal site fear[s] the sludge will be contaminated with hazardous materials." *Sludge* (2000a) reported that citizens in Pennsylvania are concerned about the application of New Jersey biosolids in their town, especially because they are “worried that there are heavy metals present in the biosolids." Such concerns naturally reduce public acceptance of biosolids recycling programs.

Much has been done to try to communicate to the public the scientific studies and assessment of risk that was completed regarding trace metals and chemicals in biosolids (Alpert, 1999; Chaney, 1990a,b; Chaney et al., 1999; Goldstein, 2000; Logan, 1997; Logsdon, 1992; National Research Council, 1996; Northwest Biosolids Management Association, 1997-1998; Outwater, 1996; Sacramento, 1999; Stukenberg, 1993; U.S. EPA, 1995; Virginia, State of, 2000; Water Environment Federation and U.S. EPA, 1997). However, scientific research continues (National Research Council, 2002), especially about the long-term impacts of trace pollutants in land-applied biosolids, and this concern will not soon be overcome (Harrison, 2000).

Pathogens (human-disease-causing organisms)

Another top public concern about biosolids is the potential and/or actual presence of pathogens (human-disease-causing microorganisms), especially in Class B biosolids. Although there is much more to be learned before it can be decided if there are true health effects from odors, reactions to strong noxious odors can induce feelings of nausea and other symptoms in some individuals (Schiffman et al., 2000), symptoms that are similar to those caused by infection by gastrointestinal and respiratory pathogens; therefore, odor concerns can lead to concerns about pathogens (e.g., Behun case: see Inlow, 2000; Pennsylvania Environmental Network, 1999; *USA Today*, 2000).

Downing (1997) reported that a small grassroots group became convinced that septage land application had led to outbreaks of diarrhea, vomiting, abdominal pain, fever, and nausea in Chippewa Township, OH, although there was no proof linking the sickness to presence of the septage. The National Institute for Occupation Safety and Health (2000, 2002) warned about risk from pathogens to Class B biosolids workers.

As with the issues regarding trace metals and chemicals in biosolids, there remain unanswered questions—and research is continuing—concerning pathogens. Dowd et al. (2000) presented a risk assessment model for bioaerosols moving from Class B biosolids land application sites; this paper, which relied on "worst case" models, created increased concern amongst some concerned citizens about pathogen risks and is now cited as a reason for further restrictions on uses of Class B biosolids. Co-authors of the Dowd et al. (2000) paper found signicant errors in one equation that resulted in a large overestimation of risk (Brooks et al., 2004).

Odors and other air quality concerns

The potential for creation of odors is a given when it comes to managing any moist organic putrescible material such as sludge or biosolids. Odors may vary in importance, from causing nuisances to possibly causing health effects (Schiffman et al., 2000). Hodson (1996) suggests "odor is probably the public's second largest concern next to contamination." As Goldfarb et al. (1999) put it: "Although land application of sewage sludge can substantially improve land productivity, and also represents a cheap and technologically viable option for many communities, it has limits and risks. Odors are the most annoying problem for neighbors of farmers who apply sewage sludge." Much has been written about the impacts of odors on public acceptance of biosolids recycling because odors have not been thought of as a technical health and environmental issue (as are metals), but as a "nuisance" and "perception" issue. This perspective is changing (Lewis et al., 2000; Schiffman et al., 2000; National Research Council, 2002).

Within the biosolids recycling industry, there is a strong and widespread impression that emissions of noxious odors are the most significant initial cause for public rejection of any particular biosolids recycling project. "Perception very often defines public acceptance and for biosolids, perception is often directly related to what we smell instead of what we read or see or hear" (Rosenfeld, 2000). Bad smells can instinctually create fear. The literature reports that many biosolids recycling facilities or sites have been severely criticized and/or shut down because of odor concerns (Anderson, 1992; Associated Press,1999; Beecher, 1996; Goldstein, 2000; *Similkameen Spotlight*, 2000; Staudinger, 1999; Stowe, 1999). Even writers who support biosolids recycling projects will sometimes note concerns about potential malodors (Bosomworth, 1992).

McCance (1998) describes a typical reaction to odors that occurred in Goochland County, VA. Speakers at a public meeting described "the overpowering stench associated with the lagoon and agricultural fields where sludge had recently been applied" and stated that "uncertainties about the safety of the kind of sludge applied here and the smell alone are enough of an intrusion on their normal lives to warrant the ban."

Likewise, in Pennsylvania, residents and community leaders were trying to prevent a New Jersey business from spreading biosolids (*Sludge*, 2000a). They cited strong, foul odors as an impetus for their opposition. The biosolids management company agreed to incorporate the biosolids shortly after application and to provide increased setbacks from adjacent homes and a 30-day notice of application. But the community still remained cautious; they feared the odors would be similar to a nearby malfunctioning wastewater treatment facility.

Addressing odor concerns is the subject of many papers (Buckley and Muirhead, 1994; Freeman, 1995; Mahin et al., 2000; National Biosolids Partnership, 2000b; Rosenfeld, 2000; Rynk et al., 1992; U.S. EPA Office of Wastewater Management, 2000d). Hodson (1996) suggests that "public education efforts help in this area….If the public understands the odors are not permanent and will be a minor inconvenience for short periods of time, usually they are more cooperative." U.S. EPA and USDA collaborated on the Guide to Field Storage of Biosolids, which includes many odor control recommendations (U.S. EPA Office of Water and Office of Wastewater Management, 2000a).

Buckley and Muirhead (1994) describe how Professional Services Group (PSG) assumed responsibility for the Schenectady, NY wastewater treatment and compost facilities, with a directive to address odor concerns. The facilities instituted technical measures to control odor and "these changes were complemented by the development of a community relations program designed to keep the treatment plant neighborhood informed of [the] activities, expected results, and the milestones" achieved. "Feedback… on the effectiveness of PSG's odor control program is used to modify management practices and operational procedures at the compost facility." The operators distributed a newsletter to area residents and reported on the progress of the program to the local newspaper.

Regarding paradigms—ways of thinking—about odor, Bill Toffey of the Philadelphia Water Department writes: "Could it be that the issue of odor acceptability is negotiated politically and socially? So we need to tell people what they are to expect with odors and what the meaning of the odor is, early. Second, there are new tools being developed to measure the odor intensity scientifically, so we need to move the industry toward employing these tools, so we can try to have a firm basis of comparison to accepted practices" (personal communication, January, 2001).

Perceptions and reactions to odors are variable (Rink, 1996) and may change over time. DK Recycling Systems operates yard trimmings composting sites in the Chicago area. In 1989, a 5.4-acre composting facility was opened in a high income community (City of Lake Forest) and had several years of trouble-free operation while exclusively composting only city yard waste. This encouraged them to accept non-city yard trimmings, which was great "until the summer of 1994 when the site had severe odor problems….The site is surrounded by a number of nearby developments, all within 1000 feet…include[ing] a school,… a new subdivision…, and a 10 year old subdivision ... filled with $1,000,000 plus homes." Many of the neighbors didn't even know the facility existed until there was a problem. By October of that year, the odors were brought under control—but now there was a new problem: "The threshold for odor complaints was much, much lower." Tensions between the facility and neighbors continued. DK Recycling eventually worked with public health officials and government agencies on a study of bioaerosols around the site. The results of the study revealed that there was "no imminent hazard to the surrounding community…the committee recommended that the site be able to continue operations and that a goal be created to evaluate an alternative for the future."

The author made the following recommendations to odor-generating facilities: “Reach out to your neighbors and community early and often. Educate them about the …process and reassure them that they can call you if there are odor problems. Distribute information widely… and don’t hesitate to contact the media." He recommends taking these actions when things are going well, not waiting until times are bad and communication becomes more difficult. When it comes to perceptions, "odor problems can quickly become public health problems…. Consider the logic: Something that smells really bad cannot be good for you."

In 2002, the National Research Council noted the potential impacts of air emissions from biosolids facilities and land application sites and suggested further research into anecdotal claims of health effects from air emissions (National Research Council, 2002, Brooks et al., 2004).

Oversight and enforcement

Oversight and enforcement of the Part 503 regulations is not always perceived as consistent or effective. Cherry (2000c), citing other critics, challenged the legitimacy of the federal Part 503 biosolids regulations and U.S. EPA's oversight. Quoting the U.S. EPA Office of the Inspector General's report (2000), she noted “EPA does not have an effective program for ensuring compliance with the land application requirements of Part 503. Accordingly, while U.S. EPA promotes land application, U.S. EPA cannot assure the public that current land application practices for biosolids are protective of human health and the environment." Likewise, two *USA Today* articles (Tuohy, 2000) stressed that U.S. EPA and state agencies cannot be trusted. U.S. EPA responded to these publications, noting that state monitoring and enforcement provides substantial assurance regarding compliance of biosolids recycling programs (U.S. EPA Office of Inspector General, 2000).

But similar concerns about monitoring and enforcement have been voiced. In an article about Ohio septage, Downing (1997) quotes U.S. EPA's John Colletti: “Septage in Ohio is ‘essentially unwatched’…even the dumping that officials know about is not closely monitored…. Without any immediate oversight, it is difficult to hold anyone accountable for problems." An advocate with the Citizens Clearinghouse for Hazardous Waste is also quoted: “Septage is a huge problem if no one is closely regulating, monitoring and being accountable for it."Karen Mancl, an Ohio State University professor and septage expert responded, "We don’t have environmental police in Ohio and the authorities cannot be everywhere. Septage is managed by a self-reporting system like many other environmental areas."

Likewise, McCance (1998) reported that in a debate about a biosolids recycling ban in Goochland County, Virginia “speakers complained that oversight of the application and monitoring has been inadequate." Goldfarb et al. (1999) stated: “The popularity of local bans on sewage sludge land application is due primarily to the common perception that state control over the Part 503 process is insufficient to protect local health and safety."

In 2002, the National Research Council underscored the seriousness of public concerns about oversight and enforcement (National Research Council, 2002).

Some biosolids managers have recognized the importance of enforcement and oversight: “Along with the regulations, regulators must have active compliance and enforcement programs. With a ‘self-implementing’ regulation like 503, it will be very easy for someone to complain that it’s analogous with the fox watching the hen house" (Draman, 1995).

Surface water and groundwater quality

Large volumes of organic residuals have the potential to generate leachate and surface water runoff containing pollutants. Therefore, groundwater and surface water may be impacted by storage, processing, or land application of biosolids, unless adequate measures are taken. Guidance in designing leachate and run-on and run-off control measures has been provided by published best management practices and other documents (e.g., U.S. EPA Office of Wastewater Management, 2000a).

Water quality concerns have had an impact on public acceptance of biosolids recycling programs in several instances, including at Maui where the concern is high about the limited and vulnerable freshwater aquifer (Englebow, 1992). Protecting groundwater resources has been a concern in New Hampshire, where the application of biosolids and paper mill residuals has been ongoing for more than a decade (Sierra Club of New Hampshire, 2000). Use of biosolids in British Columbia raised citizen concerns about impacts to surface water due to the possibility of flooding. Arguments were made for taking extra precautions regarding local conditions and climate when siting a biosolids recycling site (*Keremeos Review*, 1999a,b). Similar concerns were voiced in Monaville, Texas, where one resident said, "area residents should expect pollutants to poison their wells as well as local streams and creeks" (Kliewer, 1999). Water quality has been central to concerns about Class B land application in DeSoto County, FL (M. Hollingsworth, personal communication).

As with the technical issues discussed above, water quality issues can become significant enough to affect public acceptance of a particular biosolids recycling program or proposal.

Soil and food quality

The safety of food grown on biosolids has not been as high a priority concern as the impacts of trace pollutants on the environment. However, researchers at the Cornell Waste Management Institute (Harrison et al., 1999) and others dispute points of the federal risk assessment on which the 40 CFR Part 503 regulations are based and suggest that, especially, subsistence growers using large volumes of metal-laden biosolids could be threatened by the metals and chemicals that enter their produce. These same concerned scientists argue that soil ecology may be threatened if the levels of accumulated trace metals and chemicals are allowed to reach the levels set by federal limits. Although a few relatively-long-term studies have been done, those encouraging caution suggest that true long-term data is not yet available.

Food and soil safety are concerns that stem from concerns about trace pollutants in biosolids. While the scientific debates continue, the fact that there is some debate has created enough negative public perception of biosolids that dramatic actions have been taken to curb the use of biosolids, most notably by county officials in Kern County, CA (and, subsequently, in other California counties). However, the concern "wasn't so much about the health effects of land application, but that it would harm the public's perception of the agricultural industry" (*BioCycle*, 1997).

Some of the strongest criticism of biosolids recycling has come from the organic food and farming community, despite the fact that early uses of untreated (and more highly "polluted") sewage sludges were explored in the 1970s by leading organic farming interests (Minnich et al., 1979). Organic-oriented farmer Gene Logsdon (1995) stated "Unfortunately, organic farming organizations, after much debate, have disapproved the use of pre-treated, composted sludge on certified organic farms. To me this was a stupid move which I think springs from our silly fear of our own excrement." Today, many organic farmers reject this reasoning--

they are comfortable with reusing human body wastes, but they are leery about what else may be in large-scale urban wastewater (Rockefeller, 1999).) Organic farmer and environmental writer Donella Meadows wrote in 1996 “The No. 1 rule of the debate is: Sludge Happens. It has to go somewhere. You don’t get to say ‘not here’ without saying where, or personally agreeing to stop producing it.... As long as there is not too much of it, plants love sludge. Land-spreading is by far the best solution. It recycles nutrients back into life. It improves soils. It replaces manufactured fertilizers, reducing fossil fuel use and water and air pollution....”

Likely one of the greatest single recent impacts on biosolids recycling public knowledge, opinions, perception, and behavior came in the late 1990s when the U.S. Department of Agriculture (USDA) developed and proposed a national set of regulations for the production, processing, and marketing of organic produce. This "organic rule" had been developed with stakeholder input over many years. When it was proposed, USDA was encouraged by U.S. EPA to request public comment on whether or not the use of "sewage sludge," irradiation, and genetic engineering should be allowed in organic-certified production, processing, and marketing. More than 200,000 comments were submitted by email and other formats, overwhelmingly denouncing the proposed inclusion of these three notoriously “bad” things (Burros, 2000; Rembert, 1998). Biosolids stakeholders point out that the comments were encouraged by organized "get-out-the-comment" campaigns and that little comprehensive debate about the relative benefits and risks of biosolids recycling occurred (Motavalli, 1999). They also discredit the organic movement as having less to do with impact on true risk and more to do with marketing, citing findings that challenge claims that organic food is of better nutritional value and is safer (*UC Berkeley Wellness Letter*, 2000). But with the adoption of the final organic rule in 2001, from which biosolids use is excluded, the understanding of many consumers is now that sewage sludge/biosolids recycling is in some way detrimental to food safety or the environment. As noted above, the same impression has been created through prohibitions on the use of biosolids by several large food processors.

Transportation and trucking

The potential impacts of transporting large volumes of bulk biosolids to processing or land application sites has been, on occasion, a significant issue impacting public acceptance of biosolids recycling. Bosomworth (1992) described a citizen, who spoke in support of biosolids use, stating concerns with odors and transportation. Many in the biosolids field recognize the significance and legitimacy of this issue.

Economic viability

From another angle, biosolids transportation costs affect the viability of biosolids recycling programs. For instance, there are many prime remote sites available for biosolids land application in Nevada, but the costs of transporting biosolids to those sites is much higher than other current options for end use or disposal; i.e., landfilling for $10/ton in that state.

In the end, scientific and public health and economic issues—such as trucking costs—often dictate the viability of biosolids recycling programs. The viability, or lack of viability, can, in turn, impact public acceptance. It is helpful for the public to learn about these factors. Understanding such factors involves summarizing the variety of strategies and associated costs wastewater treatment facilities can choose from as they decide how to manage biosolids. A good summary of biosolids recycling practices in the West was written by Fondahl (1999).

Changes in demographics and changes in expectations

Many biosolids land application or facility managers note that biosolids projects have often been successful due to the site of the project being remote and far from any neighbors (e.g., Empire Farms, Nevada).

On the other hand, with population growth, and development of land in rural areas, there comes the inevitable potential for conflicts based on values, lifestyle (resource/land-based "native" farmers versus suburban or urban "transplants" who work in non-resource based jobs), and expectations (such as differing views of what an active farm field is good for and how it should smell). Biosolids recycling can often become a part of such ongoing tension amongst neighbors (Hansen, 1995). Pick (1996) observed this in Pennsylvania: “Composting complaints may only reflect the larger issues involved with suburbanization of traditionally rural areas."

Miller et al. (1996) described the situation in Fort Collins, CO, which had a successful windrow composting facility until City staff became concerned about its viability as a long term site. “There were concerns over the possibility of nitrate migration into the shallow groundwater [as well as] [u]rban development…encroaching on the facility, bringing along with it citizen concerns over odors and the appropriateness of the facility’s location."

Kelsey and Singletary (1996) discussed the situation in Chester County, PA, the most productive mushroom growing county in the country. Mushrooms grow on farm-prepared compost that is created through a process that “closely resembles municipal composting operations and requires large, flat open areas and heavy machinery to turn the windrows….The machinery generates noise and rain may produce runoff from the windrows." There were an increasing number of complaints and the farmers thought that the composting was the root cause of these complaints. However, to objectively determine the cause, “[a] survey was sent to all the mushroom growers in Chester County focusing on the types of complaints the farmers receive." Approximately 67% of the farmers in the area responded. Of those respondents, 41% of them received “complaints about odors, noises, runoff, and the ethnicity of their workers." The factor that seemingly influences the number of complaints is “the productive output of the farm and the density of homes nearby." It turns out that the act of composting itself was not a significant cause of complaints.

Emerging issues and uncertainty

Because of their origin, biosolids continue to be open to many questions. Concerns can be raised about anything that might be disposed of somewhere down the drain, potentially negatively impacting biosolids quality. Environmental concerns about any anthropogenic or natural substance can be turned on biosolids, because whatever toxic effect has been noted somewhere, that same effect might possibly be found in biosolids, according to biosolids recycling critics (e.g., Orlando, 1999a,b). Currently, the impacts of traces of hormone-mimicking chemicals (endocrine disruptors), prions (linked to "mad cow" disease), and trace remains of drugs have been noted as new reasons for concern about biosolids use (Sierra Club, 2002a,b).

2.2.2.2 Examples of Biosolids Recycling Programs That Gained Public Acceptance

Within the biosolids recycling literature, there is a clear subset of literature about biosolids recycling successes—and how “public acceptance” was gained. There is decidedly less about what the biosolids industry would consider “failures.” This may stem from human nature, but it is also a strategy in promoting biosolids recycling: witness the lengthy WEF compilation of "Success Stories" (Water Environment Federation, 2000a).

The following examples of public outreach and participation programs are described in the industry literature as examples of programs that proved effective in "gaining public acceptance" of biosolids recycling. See also the first nine Case Studies in Chapter 3.0.

Egigian-Nichols and Lekven (1998) describe the extensive Sacramento, California, biosolids outreach and education project intended to create a general positive awareness of biosolids recycling. Core messages of the education effort included a clear association of the term biosolids with the natural processes of cleaning wastewater and recycling. "The program was founded on the premise that our greatest obstacle to successful land application/recycling of biosolids is negative public perception." The program targeted farmers and the interested, technically sophisticated public in the County. The outreach focused on three major themes: 1) the nutritive value of biosolids, 2) the goal of reducing landfill disposal, and 3) the promotion of the recycling ethic. Sacramento later created what is considered to be the most thorough set of biosolids recycling fact sheets in the nation (Sacramento Regional Wastewater Treatment Plant - Biosolids Program, 1999).

The Metropolitan Waste Control Commission in St. Paul, MN, incorporated many public education programs into its biosolids recycling program including: "field days at local demonstration farms, school classroom programs, demonstrations at the Science Museum of Minnesota, development and production of prepackaged planter kits, participation at agricultural extension events, and display at booths at environmental, county and state fairs." Farm demonstrations have been most successful in gaining the interest of farmers as well as informing local officials of the benefits of biosolids. In fact, a county near the Twin Cities that had banned land application reversed the ban after three field day demonstrations that generated interest among local farmers. All these efforts have succeeded in "changing peoples negative perception of sludge by convincing them that sludge is a beneficial natural resource" (Stark, 1993).

Others have reported on the importance of these kinds of one-on-one outreach efforts (Beecher, 1999b; Machno, 1996). Racey (1991) discussed the approaches taken by a biosolids management company (Biogro) which he felt had led to successful land application programs across the country. The company works from the inside out, training and educating staff, then developing programs and learning materials that are used to educate and promote outreach to the public. Support is initially sought from farmers, so staff time and technical resources are dedicated to assisting potential biosolids users with technical resources. Once the farmers are full participants in a project, the company then identifies and meets with "key individuals in the local communities—county administrators and managers, county elected officials, state legislative representatives, environmental organizations, community associations, and civic groups." The company also works closely with the biosolids generators to develop their role as community liaisons. To foster community acceptance, it is imperative for the company to present biosolids as a resource, rather than a waste material, keep communication lines open, keep interested parties well informed, and prevent the spread of misinformation using such methods as media contact, written and audio visual materials, public meetings, tours, and having a regulatory liaison.

2.2.2.3 Biosolids Program Communication and Outreach

Much has been written about the importance of communications for biosolids recycling programs, and it is a major topic in social science research into public knowledge, opinions, perceptions, and behavior around other environmental issues. Communications was explored some in the public opinion survey conducted for this research project—see Chapter 4.0.

There are many other specific communications issues that have been noted in the biosolids recycling "public acceptance" literature. Forste (1995) states one important communications tenet: "We always need to remember that the questions that people ask, which arise from genuine concern, are valid and demand clearly understandable, open and honest responses."

Mendenhall (1991c) also encouraged sensitivity to legitimate concerns: "To increase public confidence, we must continually tell them what we do and how we do it…. We must work hard for communication rather than confrontation with environmental groups and find common ground to achieve our mutual goals to protect the environment…. Moreover, there is a risk element in environmental communication. People fear what they don't understand. They don't understand risk and fears are played upon by special-interest groups, media, and citizen's groups by saying pollution is bad for them and that polluters are bad. The public should know about environmental protection and public health. Educating them gains support and understanding of what we do and why we are doing it."

Communications amongst professionals who are involved in biosolids recycling programs is also important and one of the primary reasons for the formation of regional information networks (Touart, 1997). For instance, the Northwest Biosolids Management Association (NBMA) reports that many Northwest residents are aware of biosolids recycling. They can see the benefits demonstrated in projects across the region and the collaboration that biosolids stakeholders have created with regulators and local environmental groups. These efforts to create a regional network—embodied in the NBMA—has gained the Northwest biosolids industry widespread credibility and support.

Thompson and True (1994) note that Northwest state regulatory agencies, which are strongly committed to biosolids recycling (Idaho, Oregon, and Washington all recycle 90% or more of their biosolids) rely heavily on public input, members of opposition groups, and competing contractors as additional sources of information about concerns and need for oversight. They see complaints (most are related to odors) as a resource. Northwest biosolids recycling stakeholders rely heavily on the public information/public acceptance efforts of NBMA and the regional Water Environment Federation member association.

Finally, communications issues also include basic concerns about the use of specific language. An example is the Water Environment Federation effort to use the term "biosolids" to describe those sludges that have been treated and tested and found to meet standards for beneficial use (Logsdon, 1992). "Sludge," the reasoning goes, is commonly used to describe many different things (e.g., see Clines, 2000). On the other hand, this was seen as a public relations sham by some (PR Watch, 1995; Rampton, 1998).

2.2.2.4 How Much and What Type of Biosolids Information Does the Public Need?

Biosolids recycling is a practice grounded in a large volume of technical information. How to present information is a critical question for biosolids outreach and education programs. This question was addressed in the public opinion survey conducted as part of this research project—see Chapter 4.0. Following is some of what has appeared in biosolids recycling literature regarding how to present information to the public.

The challenge of developing public understanding of biosolids was perhaps best described by farmer and writer Gene Logsdon (1992): "How do you go about teaching a subject of great complexity (i.e., the impossibility of zero risk) to a public culturally brainwashed into believing that excrement disappears when the toilet is flushed; who is ecologically illiterate?"

Much has been written about this question in the biosolids recycling “public acceptance” literature. Some authors stress the importance of proactive communications, noting that often the first message people hear is the only one they have time and energy to absorb (Beecher, 1999). Providing a lot of information, early on, to surrounding residents of proposed land application sites helped gain public acceptance in two cases in Washington state: the City of Everett's wetland project (Thompson, 1995) and the City of Eugene's greenbelt project (Wihtol, 2000).

Pick (1996) noted that the topic of public health as it relates to composting is complex and involves a multitude of concepts, including politics, science, emotion, perception, composting methodology, regulation, fear, and more. The apparent contradictions between these themes are what make the public health issue so challenging to manage. However, it is imperative that composting site operators, both private and public, and the industry in general be prepared to face this issue and manage it productively.

Alexander (1993) reported that survey results indicated that “some people are very concerned about threats to human health and the environment from various sludge management strategies, but are not knowledgeable enough to evaluate the strategies, and that they ‘believe that sludge management issues are becoming important, feel that citizens should have meaningful involvement in sludge management issues, are interested in learning more about sludge management, and hold opinions about many sludge management strategies’."

Logan (1995) stated that “Fear is highest when the public only has enough information to know that a risk exists but not enough to understand the extent of that risk or that management controls are in place to limit them." He suggested that, to gain public acceptance, the public needs to know these three things: 1) “state and Federal laws regulating the use and disposal of biosolids are protective of human health and the environment;" 2) "biosolids quality is higher than it has ever been;" and 3) "use, rather than disposal, of biosolids offers substantial societal benefits, including reduced … costs to farmers and improved soil conditions, increased longevity of landfills… and improved reclamation of degraded lands."

Sarber (1994) discussed "strategies" for disseminating information, suggesting that strategies used for influencing voter support in political campaigns are increasingly being adapted by specialized professionals in developing environmental projects. Environmental campaign professionals approach project development with the same sensitivities to the media, the public, and the political dynamics as do their political consultant counterparts. Political campaign techniques that can be used to develop biosolids or recycling projects include public polling and tracking information, demographic identification, direct mail and video outreach, media imaging and shaping, grassroots coalition building, press crisis management, and a cadre of other activities. Specialized environmental campaigns are characterized by these types of proactive positioning tactics and are meant to create positive momentum for a project. These types of campaigns can overcome predictable obstacles to project sitings as seen in the recent successes of out-of-state biosolids land application programs and the siting of a pelletization facility in an urban setting. In summary: "Controlling the flow of information from the start is the most important aspect for managing the first impression the public receives about a project."

Forste (1993) discussed the limits of the usefulness of information: “Scientific data and information about risk assessment do not necessarily result in public acceptance.” She argues that even though there have been extensive studies and detailed compilation of data over at least 20 years, there continues to be a negative perception towards the use of biosolids. “Part of the answer lies in lack of understanding—the result of a very common and natural human apprehension….The average citizen knows little or nothing about wastewater treatment, the pretreatment programs which protect the integrity of this process and the biological and chemical composition of the treated solids."

Touart (1997) stresses the importance of consistent, reliable information presented by the various knowledgeable biosolids recycling stakeholders. There have been many reported instances of contrasting messages being disseminated, resulting in confusion on the part of the public. Building regional associations to create a unified regional voice can help gain scientific consistency and credibility.

Much social science literature addresses the difficulties of communications around scientific and technological issues (see “Social and Behavioral Issues,” below).

2.2.2.5 Who Should Speak For Biosolids Recycling?

As noted below, who is most effective in communicating to the public about a particular environmental issue is an important question. This question has been discussed some in the biosolids “public acceptance” literature. It was also addressed in the public opinion survey conducted for this project; see Chapter 4.0.

Machno and Forste (1997) stress that "gatekeepers" are key individuals and organizations whose opinion on an issue is valued by the public because of their expertise, authority, or position. Public and elected officials often defer to their opinions on complex matters, so it is essential to educate them in biosolids recycling in order to gain public acceptance. Working with gatekeepers was a central tenet of the recommendations of the Powell-Tate (1993) communications plan for biosolids (see below).

Viewpoints differ as to whether or not it is best for public utility officials themselves to go out and speak with the public. On the one hand, it shows residents that they are taking responsibility for their product. And most biosolids managers agree that having a "middleman" or contractor go out to the public isn't a good idea, because they are distrusted because of perceived profit motives. But many biosolids managers have begun to recognize that engineers and technical professionals may not be well-equipped to speak for the wastewater treatment industry—their language and presentation style are too technical. Talking about biosolids issues to the public requires both scientific knowledge and communication skills.

Vaughan et al. (1994) described the City of Wichita, KS, Biosolids Management Plan for land application, which included "two coordinated programs: a public acceptance campaign and a facilities improvements program.” The public acceptance campaign “outlined and pursued a public education and acceptance program for the affected agricultural community” by establishing “credibility and an understanding working relationship." An important component was a “series of public meetings in the … community where the city’s staff and consultants honestly described the nature of the biosolids and the complications inherent in its handling." The city brought together key groups for information sharing and educational processes, including agricultural professionals, potential land application program participants, area governing bodies, and the media. A public meeting was held for “presentation of the biosolids reuse plan to the affected public." Approximately 50 invitations were hand delivered to residents. In attendance were “agricultural professionals from the Extension Service and the SCS [Soil

Conservation Service] regulators from the KDHE and EPA Region 7." Questions were encouraged from the audience and the overall tone was that the meeting was a success in "selling the land application program and calming the fears of health risks that the audience brought to the meeting." According to the authors, this increased the city's credibility with the public.

Are regulators helpful communicators? Most biosolids program regulators strive to remain unbiased and to provide only information that supports the protection of public health and the environment (Beecher, 1999; Cooper, 1995). But providing scientific/technical information almost inevitably involves some element of value judgement. Some regulators rely on facilities, farmers, and citizen groups to do initial outreach and then provide information upon request. People often don't trust the government. When New York biosolids were applied in Arizona, citizens started to believe that the government had paid off the farmers.

Having an unbiased research scientist provide biosolids information and research findings can be important in gaining public acceptance for biosolids reuse (Logan, 1995; *Similkameen Spotlight*, 1992; Touart, 1997). Alexander (1993) noted: "[T]he extension service can be a tremendous asset in the area of public education and in providing unbiased, scientifically-based answers to the general public and the green industry." For examples of cooperative extension literature on biosolids, see Evanylo (1998, 1999).

Biosolids managers tend to believe that the public tends to trust independent researchers, but a threat to biosolids public acceptance has arisen as the public has become more aware of the debate within the biosolids recycling scientific community (Stevens, 1998). Biosolids managers believe that the tendency, furthered by the requirements of "balanced journalism," has been to view the debate as balanced, rather than what they believe is the reality: a larger majority of the scientific community accepting of biosolids recycling versus a minority who oppose it.

Forste (1993) emphasizes "[T]he farming community" as "the obvious choice and first source of allies in the effort to gain and keep public acceptance…. Agricultural organizations, extension agents and individual farmers can all help to provide the strong local support which makes programs work."

For the City of Everett, Washington's wetland project, staff went out after work hours to meet with neighbors one-on-one to discuss the project and find ways to integrate their interests into the project. A citizen advisory group was created and they contacted other residents to tell them about the positives of this project (Thompson, 1995). Likewise, *Sludge* (1995) described how King County's biosolids program worked through private citizens to introduce biosolids in eastern Washington. Instead of a group of governmental officials trying to convince the public of biosolids safety, individuals and firms from within communities explained the projects." Doherty (1999) told how a rancher encourages concerned citizens to learn more about biosolids before judging them. After researching himself and visiting a biosolids facility, he found he could strongly support biosolids reuse.

But, obviously, the influence of "gatekeepers" can work both ways. Haag's 1992 article (Haag, 1992b) had a significant influence in raising concerns about farm use of biosolids, since it appeared in one of the largest and most influential agriculture magazines, *Farm Journal*. Soon after the publication of this article, Logsdon (1992) wrote: "There is no doubt among sludge scientists in general that their long and arduous efforts to convince society of the safety of sludge has been set back a few years."

2.2.2.6 Public Outreach and Participation Efforts by Biosolids Managers

For many decades—indeed, reaching back to 1926 when the City of Milwaukee, WI, first marketed Milorganite®—biosolids producers and managers have been producing outreach materials in support of their efforts to distribute biosolids and influence public opinion in favor of biosolids recycling: brochures (New England Interstate Water Pollution Control Association, 1995; Water Environment Federation, 1990, 1994d), videos (Jefferson County, 2000; Merrimack, 2000, Northwest Biosolids Management Association, 1998a; Water Environment Federation,1994c); fact sheets (Austin, City of, 2000; Northwest Biosolids Management Association, 1998a; Rocky Mountain Water Environment Association, 1996; Sacramento, 1999), and advertisements (many, e.g. Nature's Blend, 2000), and websites (www.biosolids.org, www.glbma.org, www.mabiosolids.org, http://www.dep.state.pa.us/dep, http://dnr.metrokc.gov/WTD/biosolids/BMP1.html, www.nebiosolids.org, www.nwbiosolids.org, www.wef.org). On the Internet, the keyword "biosolids" will find most of the websites of companies, agencies, organizations, and municipalities that manage biosolids or provide information on biosolids.

Some stakeholders have cooperatively created outreach materials for distribution; for instance, the Colorado Department of Public Health and Environment, Water Quality Control Division and U.S. EPA Region VIII created "Questions and Answers About Biosolids Recycling in Colorado." A few regulatory agencies and state university cooperative extension offices provide considerable information on biosolids recycling through fact sheets and websites (Maryland Department of the Environment, 1998; Missouri Extension, 1996; Pennsylvania Department of Environmental Protection, 2000; Virginia Cooperative Extension, 1999; Washington State Department of Ecology, 2000; Washington State University Cooperative Extension, 1998).

Some facilities hold land application tours. For instance, the City of Portland, OR holds tours every year at their Madison Farms site to educate surrounding residents, local media, regulators, university contacts, and other interested parties. Organizing tour programs has been a focus for organizations such as the New England Biosolids and Residuals Association and the Northwest Biosolids Management Association (Beecher, 1999; Touart, 1998). This is considered a way to communicate the beneficial aspects of biosolids recycling, as well as ensuring that interested individuals understand exactly what biosolids recycling involves. In New Hampshire, stakeholders successfully encouraged the Governor to declare a "Biosolids Recycling Day" (Shaheen, 2000) and the legislature to incorporate the term "biosolids" into regulatory language.

Educational kiosks and demonstration gardens have been used successfully to provide basic biosolids recycling information in such places as Puyallup and the Pack Forest, WA (Washington, University of, 1995); and Bunker Hill, ID.

Finally, several significant outreach efforts have addressed the language used to describe "sludge" or "biosolids", including use of the term "Clean Water Facility" instead of "wastewater facility" (Wolz, 2000). Some of this word play resulted in reaction from biosolids recycling opponents (Rampton, 1998).

2.2.2.7 Political and Legal Efforts

Political efforts to restrict biosolids recycling have occurred with increasing frequency during the 1990s. In some local areas or regions (e.g., California, New Hampshire, Virginia), there has been some success in restricting biosolids recycling (Associated Press, 1999; *Bakersfield Californian* ,2000; Reed, 2000; Shields, 1997; Sierra Club, NH Chapter, 2000;

Sludge, 2000b; United States District Court for the Western District of Virginia, 1995), but the legality of such restrictions is still being determined through political debates and legal cases (Hassell, 2001). In a few places, local or state elections have involved sludge/biosolids as a campaign issue (Connelly, 2000; Rubens, 2000).

But even in regions where biosolids public acceptance has been relatively strong, such as in Washington state, opponents continue “to apply political pressure on politicians that rely on their votes resulting in regulatory staff time being dedicated to respond to concerned politicians on both the State and local levels" (Thompson and True, 1994).

Several suits have been brought by opponents to biosolids recycling (Water Environment Federation and U.S. EPA, 1997). A wrongful death suit in New Hampshire was settled when plaintiffs failed to construct a reasonable scientific basis on which to connect biosolids land application to the death of Shayne Conner of Greenland (Lewis et al., 2000; *USA Today*, 1999; Wheelabrator Water Technologies, 2000; New England Biosolids and Residuals Association, 2001). This suit, however, is frequently cited by opponents of biosolids recycling as evidence of the hazards associated with land application.

2.2.2.8 Public Opinion Surveys and Biosolids Marketing Analyses

Biosolids recycling has not been the subject of many public opinion or social surveys, but there have been a few research efforts:

In 1993, Alexander noted some compost market surveys had found that "some people are very concerned about threats to human health and the environment from various sludge management strategies, but are not knowledgeable enough to evaluate the strategies," and that they "believe that sludge management issues are becoming important, feel that citizens should have meaningful involvement in sludge management issues, are interested in learning more about sludge management, and hold opinions about many sludge management strategies."

University of New Hampshire researchers (Whitcomb et al., 1994) reported on the results of a public attitude survey conducted in the fall of 1993 to determine attitudes towards siting a hypothetical composting facility. They noted the following:

- Distance from the proposed facility, economic opportunity, a “waste involvement measure,” and gender positively influences the acceptance of a MSW facility in the respondent's community.
- On the other hand, environmental impact, lack of trust, and higher income increase the likelihood of a negative opinion of the proposed facility.
- Important conditions that respondents would like to require of the proposed facility are:
  - Facility monitoring and control procedures;
  - Written specifications as to the future responsibility of the facility; and
  - The community having the power to shut down the facility if problems occur.
- Important Host Community Benefits that were chosen by respondents include:
  - Guaranteed water quality,
  - Property tax credits, and
  - No charge for waste disposal.
- Acceptance of the siting of the hypothetical facility increased with increased distance of the respondent's property from the facility.

Facility siting has also been discussed by others such as Susskind (1984).

The Water Environment Federation employed the public relations firm Powell-Tate to produce "a road map for the Federation as it set out on its mission of educating the public and gaining its acceptance of biosolids" (Powell-Tate, 1993, p. 1). This included the first known significant national survey of public knowledge and attitudes regarding biosolids recycling, but the sample was small (about 100). The resulting communications plan has retained favor to the present day and includes an emphasis on communications with "gatekeepers," individuals who hold significant positions of influence such as agricultural advisors, public officials, and end-users of biosolids. Several key positive messages were provided and incorporated into one phrase: "Biosolids Recycling: Beneficial Technology for a Better Environment." Recycling and the benefits to crops, soils, and the environment were to be emphasized, as was the safety of the practice.

Frederick Schneiders Research (1998) subsequently conducted a larger (700 respondents) and more statistically valid survey of public "awareness of and attitudes toward biosolids recycling." Awareness of, and a reasonable level of knowledge about, biosolids recycling was found in just 1% of the population surveyed. Respondents were found to be significantly influenced by positive or negative messages about biosolids recycling and found a message about the fertilizer value of biosolids to be the most appealing. Finally, university scientists were identified by respondents as the most credible sources of information, followed by environmentalists. Respondents identified U.S. government officials as least credible.

The *Results of the Marketing Assessment of Biosolids* was completed by Spirit West, a consulting group, and released by the NBMA in 1999 (Northwest Biosolids Management Association, 1999). This report assessed the possible markets for biosolids products and evaluated successful Pacific Northwest biosolids projects and lessons learned. The objective was not to develop a specific marketing strategy, but to communicate the experiences of others and to develop ideas for future marketing programs.

With branches in Montana, Idaho, Colorado, California and Hawaii, EKO Compost has been developing a marketing strategy for their products. *The Marketing of Nature: The Nature of Marketing* (Hegedus, 2000) discussed the marketing of compost in general, but mentioned that it is important to be forthcoming and honest when questions arise regarding negative perception of biosolids when selling it as a composted product.

Public facilities such as the City of Tacoma and King County have composted Class A biosolids products that are available to everyone (TAGRO and GroCo). Papers regarding the marketing of these products have been included in the annotated bibliography (Behnke and Amundson, 1993; Hennig, 1995).

In 2000, the GVRD in British Columbia arranged for focus groups and triads of environmentally-conscious citizens and personnel of companies that work with soil products. Their task was to evaluate the local biosolids recycling program, Nutrifor (Greater Vancouver Regional District, 2000). The findings? Participants in the study said they wanted to act in "environmentally friendly ways." They knew about different types of fertilizers (chemical vs. organic). The citizens were not aware of what biosolids were, but the company people who dealt with soil products knew about them. Most respondents reacted negatively at first when they found out about what biosolids were and tended to distrust government in providing information about them. They said that they would trust a recommendation by someone they respected (a well-known public person or environmentalist). Most interestingly, the report noted that respondents felt "they needed more time and more information to form an opinion on biosolids use."

2.2.2.9 Addressing Issues Through Environmental Management Systems

As noted above, all of the scientific and public health and technical issues of biosolids management must be carefully addressed if there is any chance that a biosolids program is going to be perceived favorably by the public. As Goldfarb et al. (1999) noted, "if sewage sludge is improperly handled, pollutants and pathogens in sewage sludge could potentially contaminate soils, crops, livestock and even humans," which would obviously cause a negative response from the public.

More and more biosolids managers have come to see the need to "do the right thing," to follow best management practices, to work with communities, to seek public input. This recognition led to the development of the National Biosolids Partnership (NBP) Environmental Management System (EMS) program (Canning, 1999).

Because of the number and complexity of potential social, scientific, and public health issues surrounding biosolids recycling, the National Biosolids Partnership (NBP) chose to create a structured environmental management system (EMS) program that allows for local flexibility. As Logan (1997) had noted: "Where local problems are chronic, public sensitivity remains high," which means local solutions are required. The NBP EMS program was developed based on input from a wide variety of sources and experiences (e.g., Walker et al., 1997) and the NBP itself operates, to the fullest extent possible, on a consensus basis.

The three major components of the program were drafted in 2000: a *National Manual of Good Practice For Biosolids* (National Biosolids Partnership, 2000b) to cover principles of wastewater solids and biosolids management, beneficial use programs, incineration and material management, and solids disposal programs; a set of common "elements" for preparing and implementing an EMS (National Biosolids Partnership, 2002b); and a plan for an on-going program of independent third-party verification of every official NBP EMS program nationwide (National Biosolids Partnership, 2002a). The Code of Good Practices—a pledge to "do the right thing"—was created in 1998 (National Biosolids Partnership, 1999).

"The Partnership is committed to implementing environmentally safe, sound, and sustainable municipal biosolids management practices that build public confidence within local communities. In 2000, the Partnership, an alliance of the Association of Metropolitan Sewerage Agencies (AMSA), the Water Environment Federation (WEF), and the U.S. Environmental Protection Agency (EPA), created an environmental management system (EMS)…. The Blueprint for this EMS contains common components that can be used by publicly owned treatment works to implement biosolids management practices that go beyond the regulatory minimum; improve communications with the general public; ensure protection of public health; and tailor biosolids management practices to community needs and environmental performance concerns" (National Biosolids Partnership, 2001).

The EMS effort is intended to address many of the concerns noted by those who have thought extensively about and written about biosolids recycling public acceptance; for instance, Forste and Machno (1994) noted "While people are responsive to the *concept* of land application, concerns about safety, standards and regulations erode support." An EMS is intended to ensure that the public is involved and understands how safety is addressed and how regulations are constructed to protect public health and the environment. Through an EMS program, required public participation may include local oversight and enforcement or other public involvement that builds public confidence.

Despite the considerable progress made to date (e.g., National Biosolids Partnership EMS program manuals, 2000), the actual impacts of the EMS initiative are yet to be determined. A potential weakness in the development of the EMS program was the difficulty attracting significant participation from environmental groups and others with widely diverging opinions regarding biosolids recycling. The development of the independent third-party verification system in 2000 and 2001 saw the first significant involvement of such perspectives (Ross & Associates Environmental Consulting, 2000).

2.2.2.10 The Roles of Third Parties and Media

The Powell and Tate (1993) communications plan for biosolids stressed the importance of "gatekeepers," individuals and groups that have significant potential for influencing public knowledge, opinion, and behavior. This includes third-party perspectives such as agricultural advisors, regulatory staff, and public health officials. Public acceptance may be stronger in regions where such people are knowledgeable about and supportive of biosolids recycling, such as in the Pacific Northwest (Cogger and Sullivan, 1991). In areas where key gatekeepers are less informed, such as in New Hampshire in the late 1990s, lower public acceptance may be expected (New Hampshire, University of, 1998). Public concern was heightened when another gatekeeper, the National Institute for Occupational Safety and Health (NIOSH), published a "Hazard Identification" regarding the safety of workers exposed to Class B biosolids (2000). This document was later withdrawn and replaced by a more useful and accurate “guidance” to Class B biosolids workers (NIOSH, 2002).

The news media is another "gatekeeper." Local newspapers have played a significant role affecting public knowledge, opinions, perceptions, and behavior around local biosolids recycling programs. These purveyors of local news often provide the first information about biosolids recycling to residents of a town where a biosolids facility or end use is proposed. It is instructive to examine the development, over several days or weeks, of a biosolids recycling story as reported in local newspapers (*Keremeos Review*, 1999a,b; *Keremeos Review*, 2000; *Similkameen Spotlight*, 1998a,b; *Similkameen Spotlight, 2000*).

Many past newspaper and magazine stories can be found on the Internet (Bleifuss, 1995; Bedell, 1999; Lloyd, 2000; Tuohy, 2000). The media have generally played only a limited role in shaping public opinions of larger audiences to date, focusing only on specific sites or state regulatory issues instead of the broader scientific or policy issues of wastewater treatment and biosolids recycling and their role in environmental protection (Lindsay et al., 2000). Stevens (1998) wrote a rare example of a balanced discussion of the core issues and perspectives. However, during 2001 and 2002, several national news stories underscoring concerns about biosolids recycling (*USA Today*, 2000; Kunkle, 2001; Barnett, 2002) may indicate a growing interest and influence of the national media on public perceptions of biosolids recycling.

Lindsay et al. (2000) wrote about the factors that influence resident attitudes regarding biosolids land application: “Perception of the potential economic impacts and the negative impacts from land application can be very influential in achieving public acceptance…. When residents were able to read or hear more from the various media outlets, they were less supportive of land application…. [There is a] need for sound educational programs that explicitly disclose and describe the economic benefits and negative impacts that typically occur with land application .…This will minimize views that may be based on misinformation." The authors urge the media to make it a priority to present accurate and balanced reports.

Understanding how to work with the media has become an important aspect of any biosolids recycling program. Guidance on this topic was developed by the Rocky Mountain Water Environment Association (1995) and in the Water Environment Federation's *Survival Guide* (Wantland, 2002). The Social Issues Research Centre, in partnership with the Royal Society and the Royal Institution of Great Britain (2001) brought together health scientists and professionals with news reporters to develop mutually acceptable guidelines for communicating with the public about health topics. The motivation for this effort was the fact that misinformation delivered to the public about health issues can cause real harm.

2.2.2.11 Literature Expressing Concerns About Biosolids Recycling

Besides *Toxic Sludge is Good For You* (Stauber and Rampton, 1995), discussed above, many articles and reports have been published by opponents to biosolids recycling with the intent to influence public opinion against biosolids recycling. Many are by individuals or small, mostly local, environmental or citizens groups formed around the biosolids/sewage sludge issue. Many are available on the Internet. They describe the potential risks from use of biosolids and the alleged harm to people, farm animals, and the environment that they believe has been caused by sewage sludge recycling (Environmental Working Group, 1998a,b; Pennsylvania Environmental Network, 1999; Shields, 1998).

A report that typifies publications opposed to biosolids recycling is the Vermont Public Interest Group's *On The Ground* (1999). It relies heavily on *The Case for Caution* (Harrison et al., 1999) and emphasizes the potential impacts of the maximum allowable trace contaminant levels. Sludge (biosolids) recycling, VPIRG states "[e]ntails many serious risks to environmental sustainability and public health… is economically short-sighted, given its potential to contaminate the land . . . . Many citizens oppose it on grounds ranging from issues of local control, to public health fears, to aesthetic concerns." The VPIRG report stresses the perceived lack of requirements for testing of potential chemicals. "A system of regulation that aims at allowing increasing amounts of toxics from sludge is not protective of the environment or public health," it concludes.

Montague (1999), in a national environmental magazine, goes further, echoing the themes of distrust voiced by Stauber and Rampton (1995) and Lewis (2000b): "The EPA, the latest in a long line of authorities tackling a serious problem in a short-sighted way, decided that the expedient thing to do with sewage sludge is to plow it into the land. [After the Ocean Dumping Act went into effect in 1992] the U.S. EPA renamed toxic sludge 'beneficial biosolids' and began aggressively campaigning to sell it to the American public as fertilizer…. The EPA has overlooked, perhaps deliberately, two important differences between modern sludge and . . . human waste: 1) "most of the nitrogen in sludge in human waste is in the urine and is water-soluble so it is not captured in the sludge;" and 2) "when you add a lot of sludge to soil, you are also adding a lot of toxic metals and a rich (though very poorly understood) mixture of organic chemicals and very likely radioactive wastes as well." These are the kinds of concerns most commonly expressed by opponents to biosolids recycling (Beecher, 1999; People Against Power's Sludge, 1999; Rockefeller, 1999): some display misunderstanding of wastewater and biosolids processes (1 above), while others are based on legitimate concerns (2 above) that have been or need to be addressed by regulations and/or best management practices.

Distrust of public officials and the biosolids industry is expressed even more strongly by Cherry (2000a-c); this author calls into question the integrity of the U.S. EPA and the Water Environment Federation, noting the accusations of U.S. EPA whistleblower David Lewis and the Office of Inspector General report regarding oversight of the federal biosolids program (U.S. EPA Office of Inspector General, 2000).

An Internet search using the keyword term "sludge" will access a wide variety of information, much of which pertains to biosolids recycling, but some of which is about other kinds of sludge (Pearce, www.nosludge.org, 1997; Pennsylvania Environmental Network, http://www.penweb.org, 1999; Rockefeller, www.riles.org/paper1a.htm, 1999; Sewage Sludge Homepage, . http://www.enviroweb.org/issues/sludge/, 2000; Sierra Club, Pennsylvania Chapter, http://pennsylvania.sierraclub.org/ moshannon/fctryfrm.htm, 2000 a,b). Many articles on the Internet are not peer reviewed or backed with citations to scientifically-defensible work and commonly repeat the same information as is found in similar articles (circular references). Nonetheless, this gray literature is perhaps the most instructive for understanding the true perceptions and concerns of those opposed to biosolids recycling (several of the most instructive of these documents are included in Appendix A.) Also note that the use of the Internet for quick dissemination of information intended to affect policy occurs in all fields: "While the ADA [American Dental Association] says there shouldn't be any dispute about flouridation, those opposing flouridation have been using the Web to put out their views" (*Sludge,* 2000d).

Biosolids managers can gain a solid understanding of critics' most legitimate concerns by reading *The Case for Caution* (Harrison et al., 1999) and the Sierra Club guidance (Sierra Club, 2002). A sense of the level of concern and outrage of some critics can be obtained by reading Bill Addington's viewpoint on the Sierra Blanca biosolids recycling project and the statement of the Pennsylvania Environmental Network (2001), both of which are reprinted in Appendix A.

2.2.3 Social and Behavioral Issues

2.2.3.1 Background

A considerable amount of research has been conducted over the past two decades concerning the public's knowledge of technical and environmental issues, including people's opinions, attitudes, and behaviors. Prior to 1978, however, there is scant literature on these topics; prior to the late 1970s, public attitudes and perceptions about the environment were not matters of concern to any but a handful of social scientists.

The psychosocial elements of "environmental behaviors" were not examined until the years following the energy crises of the late 1970s, a time during which the federal government elevated the visibility of energy and environmental policies in response to the creation of the Mideast OPEC cartel. For the first time in American history, the cost of energy began to play a role in international economics and strategic planning. As interest in energy policy grew, observers looked at public responses to government actions. Several observers noted the failure of federal programs to significantly reduce American consumption of energy resources, despite the expenditure of millions of dollars and a national security mandate from the White House. The Residential Conservation Service required every gas and electric utility to provide homeowners with on-site assessments to enhance energy efficiency, access to low interest loans and a listing of qualified contractors and suppliers. Given that reductions in household energy use of 50% were possible, the 2-3% savings that actually occurred could only be seen as a failure (Hirst, 1984).

The federal government and utility industry subsequently funded research to find out why the public did not respond to the energy crisis and government efforts encouraging reduced energy use. They found that traditional educational programs did not necessarily lead to actual changes in behavior. They found that existing conceptual models regarding public behavior—the "Rational Economic Model" and the "Attitude-Behavior Model"—could not explain the societal failure to attain potential energy savings.

Social scientists sought to uncover the keys to behavior change and to better understand the relationships between the public's knowledge of a subject and their attitudes and perceptions and behavior. What they found was that public perceptions about energy and the environment were not shaped exclusively by technical or scientific information. The public was becoming more skeptical of new technologies and their perceptions were not the same as those of the "experts" (i.e., scientists, engineers, government agencies). It was clear that the process of instituting new technologies and educating the public about them would have to be more carefully understood and developed.

2.2.3.2 Overview

There is an increasingly robust body of literature regarding how the public understands new technology and perceives its impact on their lives. Such literature, and principles of risk perception and communications, can help guide the development of biosolids outreach programs to enhance public perceptions and participation around biosolids recycling. From a comprehensive search of literature in the behavioral and social sciences related to the environment, seven areas of research have been chosen for inclusion here; they should provide useful information to help understand and anticipate public reactions to biosolids recycling and guide public outreach and participation programs. These are:

- risk perception,
- risk communication,
- trust,
- equity and fairness,
- public participation,
- conflict and conflict resolution, and
- general public attitudes regarding the environment and technology.

2.2.3.3 Risk Perception

How people perceive and evaluate risks in their lives, and how they behave based on those perceptions and evaluations of risk, has been an active field of social science research over the past two decades (e.g., Douglas, 1992).

Several writers in the biosolids field have noted that when it comes to understanding how an individual develops knowledge, forms opinions and perceptions, and behaves with respect to a particular public policy matter, "perception is reality." Biosolids managers express frustration about this fact: "Whether we like to admit it or not, public perception is *reality* especially for those groups or individuals emotionally involved with issues or projects that relate to the environment…. It is difficult.…to have an objective dialogue with them, because it is similar to an argument over religion" (Draman, 1994). She argues: "People must recognize that biosolids are no more sludge than gasoline is crude oil. The idea must come through to them loud and clear that an undesirable substance has been transformed into a beneficial material."

A major finding in the social science research on risk perception is the considerable disparity in risk perception between technical “experts” and the lay public. For examples, this disparity has been demonstrated with respect to perception of ecological risk assessment for water resources (McDaniels et al., 1997) and the relative safety of organic foods versus the safety of conventional foods (Gray et al., 2002). People tend to perceive a lower risk regarding things they are expert about, while non-experts perceive a higher risk. In short, experts may not be the best individuals to evaluate the public’s potential response to introduction of a new technology such as biosolids recycling.

In addition, things are perceived as presenting higher risk if they…

- present a potential for catastrophic impact,
- involve dread,
- are novel,
- are not natural,
- are not contacted voluntarily or in an equitable manner, and
- involve an unknown level of risk (there is uncertainty).

Risk can be expressed in terms of worry. Worry may motivate people to take protective action (Baron et al., 2000). The term “environmental worry” is now used in a wide variety of literature to describe an increasing general public concern about the state of the natural environment.

Perceptions are imbued with individuals' values and philosophies, and it has been hypothesized that value differences have led to intractable conflicts about biosolids recycling (Beecher, 1999). The impacts of value differences in public policy conflicts—and how to deal with value differences—is addressed by Susskind and Field (1996).

Risk perception is influenced by personal values, and an individual mix of personal values and worry can result in differing interpretations of data. For example, Belkin (2002) examined the concept of “coincidence in an age of conspiracy.” Humans tend to want to see trends or meaning in purely coincidental happenstances. But statisticians know that coincidences are to be expected, and that we tend to notice only certain ones, often creating conspiracy theories or assigning to them undeserved significance.

Talbot (2002) looked at the impacts of excessive worry in her discussion of small outbreaks of itching, rashes, and other minor ailments at a variety of schools around the U.S. and the theory that many of the cases were “sympathetic,” psychogenically developed. Just as many people expect and experience physiological manifestations of well-being from, for example, meditating, so, Talbot argues, we should accept that sometimes the human mind will trigger physiological responses such as itching and other minor ailments.

Another area of social science research interest has been trying to understand the public’s reaction to new technologies, such as biosolids recycling. The public’s reaction will be influenced, to a greater or lesser degree, by each individual’s rational (cognitive) thought process, including how they understand such things as risk assessments and site-specific plans of land application programs. Such rational, cognitive approaches to conveying information and understanding were traditionally effective in convincing people of the value of a new technology.

However, the effectiveness of the rational, cognitive approach has been declining since the 1980s. Public concerns over the risks of new technology have grown dramatically, to the point that public skepticism about a new technology can dominate decision-making and dictate the selection of technologies (Freudenberg, 1996). Efforts to carefully, rationally explain the “real“ risks of a new technology end up failing because they ignore the public’s eroding support and understanding of science. Indeed, basing decisions only on rational evaluations of risk may well result in public anger, since it does not address public skepticism and discomfort regarding science and technology. Such risk-based decision-making may lead to further decreases in credibility for science and technologies as a whole, as people perceive science to be monolithic and unreceptive to their personal perceptions of risk.

The introduction of new technology is complicated by the fact that risk assessment is an uncertain practice (Slovic, 1999). People are generally disturbed by uncertainty, and they view science (often incorrectly) as fixed and immutable. An accurate presentation of risk assessment—which necessarily includes mention of some degree of uncertainty—will often undercut efforts to reassure the public about the relative safety of a new technology and may even stimulate outrage (Slovic, 1993). To overcome this possibility, the risk assessment process should include stakeholder participation—see Slovic, 1999. Sandman et al. (1993) and others have defined outrage as “a function of whether people feel the authorities can be trusted.” Promoters (government agencies, trade groups, developers, etc.) of new technology must be careful to present probabilistic risk assessment accurately while acknowledging that a discussion of uncertainty may undercut the objective of creating a sense of safety. The National Research Council (1996) proposed that risk assessment should involve stakeholders and impacted parties in the risk assessment process.

Another area of research regarding risk is comparative risk. Comparative risk studies have examined perceived versus “true” risk in several settings—indeed, during the 1980s, U.S. EPA encouraged comparative risk studies at the federal and state level. For example, the New Hampshire Comparative Risk Project (1997) had a panel of 50+ public officials, environmentalists, business people, and citizens rank 53 perceived risks. The goal of this project was to better understand which environmental and public health threats posed the greatest true risks. This information would be useful to policy makers who choose which issues warrant the greatest amount of attention in the allocation of limited resources. "Sludge and septage" management was on the New Hampshire list of perceived risks, but was found to be of low risk (46th out of 53). U.S. EPA has long held that biosolids management presents a relatively low risk (U.S. EPA Office of Inspector General, 2000).

The drawbacks of using comparisons of risk is discussed by Kamrin et al. (2000): “[R]isk comparisons must be used with great care. Often, an involuntary risk is compared with a voluntary one (e.g. the risk from nearby chemical plant emissions is compare with smoking…)…If such a comparison is done in the spirit of minimizing the importance of the involuntary risk, it will generate anger….Several types of risk comparisons are generally more useful than comparing involuntary risks with voluntary ones. These are: comparisons with similar risks, comparisons of risks with benefits, comparisons of alternative substances/methods, comparisons with natural background levels, [and] comparisons with a regulatory standard.”

The Harvard Center for Risk Analysis analyzes a wide variety of public health and environmental risks in order to improve policy decision-making and allocation of resources (Ropeik and Gray, 2002).

The problem with risk comparisons, however, is that they often do not have the intended effect of reducing people’s worry about a particular risk or new technology—and they may generate frustration or anger, especially if they are created only by technical experts and do not incorporate public or stakeholder input. Powell (1996) recommends carefully developing and testing risk comparison messages. Communications specialist Mary McDaniel advises against the use of risk comparisons (McDaniel in Water Environment Research Foundation, 2002).

2.2.3.4 Risk Communication

The way in which risk is communicated to the public will go a long way towards determining their perception of risk, and a considerable amount of social science work has been focused on risk communication. A communicator must understand the way in which a message is being heard by the listener—a simple recommendation that is widely misunderstood or ignored. One possible strategy of risk communication is to provide only the information the listeners need in order to make a judgment; this requires the communicator to know how much the public knows and how much they need to know (Fischoff, 1999). A second strategy would be to adapt the message to the cognitive process itself, which requires an understanding of how the public digests information. The purpose of selecting one strategy over another is to configure the message so that it enhances trust and the credibility of the communicator. Peters et al. (1997) argue that because successful risk communication rests on these factors (trust and credibility), it is important to know the characteristics that lead to their development—that is, the perception, on the part of the listener, that the speaker is…

- ♦ expert and knowledgeable,
- ♦ open and honest, and
- ♦ concerned and caring.

Furthermore, displaying some of these specific characteristics may be critical to countering stereotypes that impede the cultivation of trust. Industry, for example, that cultivates public perceptions of concern and care will increase perceptions of trust and credibility. As a result, the public perception of risk to a new technology they present may be reduced.

Researchers suggest that the context within which judgments about new technologies are made can be cultivated by the application of a consistent and well-developed communications plan. The tools of behavior change (McKenzie-Mohr, 1996) hold some promise for short-term gain. The longer term prospects for public acceptance of new technologies require promoters to constantly monitor the public pulse, provide accurate and complete information, respect public involvement, attend to the public's sense of fairness, and, in all instances, respond honestly to public inquiries.

Powell (1996) provides a useful summary of the literature on risk communication and perception of risk. He also notes the criticisms of risk communication brought forth by Jasonoff, who sees risk communication as a "'dangerously misleading term' because it suggests that communication by experts is the key to trust. She argues that the experts themselves need to be educated about their own biases and about the existence of competing cognitive systems for evaluating risk." Others agree: Powell notes that a scientist at the Environmental Defense Fund "charged that risk communication is a 'shield for inaction.'" Powell addresses these concerns by noting that "the goal of risk communication is policy decisions and public discussion based on the best information available, rather than a process for manipulation of public opinion." He goes on to note that, even with proper risk communications, people will still disagree, sometimes irreconcilably.

Sandman, a leader in the development of understanding of public “outrage” and strategies for risk communication, notes that the biosolids industry has not taken seriously the “hue and cry” of biosolids critics. He developed the equation for risk perception, risk = hazard + outrage. He recommends that biosolids managers pay far more attention to reducing public outrage, even as they continue to reduce the true hazards of biosolids recycling by using proper management practices. Ways to reduce outrage include:

- “stake out the middle, not the extreme;
- acknowledge prior misbehavior;
- acknowledge current problems;
- discuss achievements with humility;
- share control and be accountable; and
- pay attention to unvoiced concerns and underlying motives” (Sandman, 2000).

Interestingly, PR Watch (1999b) criticized Sandman’s efforts to reduce outrage, advising“outrage can be good; hold on to it.”

Hyde (2002) discusses the communication of risk during crisis events, when, he advises, it is necessary for the communicator to have clear goals, to provide accurate information in a timely way, to tell people what they can do, and to provide regular updates and keep in touch.

The health field has developed considerable expertise regarding communicating risk. For example, the Agency for Toxic Substances and Disease Registry (1990) provides a “primer on health risk communication principles and practices,” that includes such advice as “accept and involve the public as a partner; plan carefully and evaluate your efforts; listen to the public’s specific concerns; be honest, frank, and open; work with other credible sources; meet the needs of the media; and speak clearly and with compassion.” Similarly, Freimuth et al. (2000) provide an overview of how to go about developing a communications plan—in this instance, for “communicating the threat of emerging infections to the public.” The keys are to 1) know each audience by conducting focus groups and other research and 2) develop messages and communications channels that work for each audience.

One other aspect of social science research that may be helpful to the biosolids field comes from study of communications styles and the differences between how men and women communicate. Deborah Tannen has written extensively on this topic (e.g., Tannen, 1990). In general, girls and women learn early in life to communicate in ways that enhance relationships, whereas men learn to communicate in ways that establish hierarchies. Given that the wastewater treatment and biosolids management industries, including engineering, have been traditionally dominated by men, the perspective provided by Tannen’s work may be helpful in understanding how to improve communications and public relationships.

2.2.3.5 Trust

As people learn about something new, they decide what and whom to trust based on myriad factors. Many media stories about biosolids recycling reflect concerns about trust, both in their form (most news stories give both sides and suspend judgement) and content (e.g., many news stories describe concerned citizens who are unsure about what and whom to trust) (Anderson, 1992; Cherry, 2000a-c; Culos, 2000a,b; Inlow, 2000; Mayer, 1999; Nesmith, 1996; Norman, 1995; Orlando, 1997; Smith, 1991; Tackett, 1994; *USA Today*, 1999).

Lack of trust regarding biosolids recycling is naturally stimulated by unknowns and "what if’s:" What if someone dumped a 55-gallon drum of some chemical down the drain? What if it is found that trace levels of whatever in soil cause real harm? Nationally syndicated columnist Jack Anderson wrote: "Pat Costner, who owned and operated a small wastewater analysis lab before taking her current job with Greenpeace, told our associate Ashley Barker that 'very few industries know what's in their discharge. They will know fairly broad parameters, but they won't know every chemical that's in there. If a city has a pretreatment program, it will only address a fairly limited number of chemicals" (Anderson, 1999).

Trust issues are central in many discussions of biosolids recycling public perception and acceptance (Beecher, 1999; Bynum, 1999; Harrison, 2000; Lewis, 2000; Matthews, 1997; National Research Council, 1996; Rocky Mountain Water Environment Association, 1995; Rubin, 1998; Stauber and Rampton, 1995; Water Environment Federation, 2000a). The small amount of public opinion survey research that has been completed within the context of biosolids recycling has included questions about trust: the Powell-Tate (1993) communications plan emphasizes "gatekeepers" as people whom others will trust and listen to. The Frederick-Schneiders (1998) and Greater Vancouver Regional District (2000) surveys determined that there are certain "messengers" who are trusted more than others (e.g., university scientists, known public figures, certain environmentalists) and those that are trusted less than others (e.g., those likely to benefit financially).

Draman (1994) notes the importance of gatekeeper influence, citing the food industry "policy not to grow any of their foodstuffs on land that has ever received biosolids," which is understood by those supportive of biosolids recycling to be based on marketing concerns about public perception, not actual risk (National Research Council, 1996). "The concern wasn't so much about the health effects of land application, but that it would harm the public's perception of the agricultural industry" (BioCycle, 1997).

Forste and Machno (1994) discussed the Powell-Tate (1993) survey findings, noting that most of the 100 surveyed people in geographically and demographically different communities "do not believe that sludge or biosolids are well regulated. All groups, including some public health and elected officials, are distrustful and skeptical about government and its regulatory abilities."

Distrust of biosolids management programs also grows from the presence of a profit-motive. Private contractors that manage biosolids recycling programs for municipal wastewater treatment facilities are distrusted especially because their profits are derived from "getting rid of the stuff" in as efficient a manner as possible (*Daily Commercial News and Construction Report*, 1994; Fondahl, 1999; Hirshorn, 1992; Inlow, 2000; Kimantas, 2000; Tackett, 1994).

Distrust of the scientific basis for biosolids recycling has grown in recent years, culminating in the July 2002 report from the National Academy of Sciences (National Research Council, 2002), which recommended updating the science and data behind the federal Part 503 biosolids regulations. Critics of biosolids have pointed out the limitations of science in general and of the science on which biosolids recycling is based (Harrison et al., 1999; Sierra Club, 2002). Social science literature has noted the limitations of science and the particular difficulties inherent to conflicts that involve a lot of science and scientific uncertainty (Ozawa and Susskind, 1985). Susskind and others stress the value of joint fact-finding as a way of dealing with scientific uncertainty and differing perceptions of risk (Susskind and Field, 1996; Ehrmann and Stinson, 2000).

The effect of changing regulations on levels of public trust has also been reported. Lang and Jager (1996) provided details about how the state of New Hampshire decided not to regulate biosolids programs after the passage of the federal 40 CFR Part 503 rule. “This approach had a negative impact on the public perception of land application programs,” because it meant the abandonment of stricter state regulations. With no regulations other than the federal ones, out of state biosolids were commonly land applied in New Hampshire, which also brought contractors who brought unstabilized biosolids and stockpiled them at application sites. Lime stabilized products were the cause of many odor complaints. Additionally, the public’s “inability to stop the practice using State regulations heightened their concerns. The perception was…[that] NH … bec[a]me the biosolids ‘dumping ground’ and under the 503 Rule nothing [could] be done to stop it." Land applied biosolids were subsequently blamed, by biosolids opponents, for the death of Shayne Connor (New England Biosolids and Residuals Association, 2001).

Several critics of biosolids recycling have discussed another angle on regulatory involvement in biosolids programs: a sense that the U.S. EPA and many state environmental (and, in some instances, health) agencies are promoting the concept of biosolids recycling at the same time they are supposed to be overseeing and enforcing regulations (Sierra Club, 2002). This perception has had a significant impact on public trust of biosolids programs. The adequacy of oversight and enforcement has been identified as a leading public concern (Beecher, 1999; National Research Council, 2002).

Researchers and practitioners alike have addressed trust issues, but in different ways. Wagner (1990) wrote: “It is apparent that engineers and scientists alone do not have the skills to respond in this area (addressing the public need to be assured that their concerns are considered and that decisions are not based solely on convenience or cost) and educators and public information specialists are to be given greater roles in these programs." Another effort that addresses trust issues is the National Biosolids Partnership’s Environmental Management System program (see above), because trust can be developed, to a large extent, from biosolids program quality and credibility.

Orange County, CA biosolids manager Michael Moore has said to concerned citizens, "You can't trust me now, at first, but maybe we can build trust." He began saying this after realizing that trust may not be possible, at least at first, and yet that fact cannot preclude further discussion—an independent corroboration of the findings of Trettin and Musham (2000).

An angle of social science research that is of particular importance to biosolids recycling is work on understanding trust and fairness issues involved in siting facilities. It is well documented that there has been a deterioration in the public’s trust of agencies and institutions that deal with environmental hazards and specific facilities (Lester and Bowman, 1983). A new set of acronyms has even evolved to describe public resistance to government initiatives: NIMBY (“not in my backyard”), OMDY (“over my dead body”), LULU (“locally undesirable, locally unwanted”), BANANA (“build nothing anywhere, anytime”), and NIMTOF (“not in my term of office”).

Case studies by Davis (1993) and others illustrate the difficulty of promoting public sites or technologies that may be accompanied by some degree of risk. The failure of traditional democratic discourse is, some authors argue, a direct result of declining trust in government. They further suggest that the following factors reduce the level of trust:

- preexisting public sensitivity,

- media interference (Mazmanian and Morell, 1990), and
- differential framing of issues (Pellow, 1999).

Siting of facilities is a topic around which much has been written, both in the biosolids recycling field (e.g., *BioCycle*, 1990; Culos, 2000a,b; Libby, 1995; New England Interstate Water Pollution Control Commission, 1995; Sarber, 1994) and in the field of social sciences (e.g., Mazmanian and Morell, 1990; McAvoy, 1999; Susskind, 1984). Smyth (1994) describes the siting of a biosolids drying facility in a sensitive populated area in King County, WA.

2.2.3.6 Equity and Fairness

No discussion of trust can be complete without reference to the growing body of literature on issues of equity around environmental issues. Equity and fairness can be central to building trust and gaining public acceptance. It was noted above that there are issues of equity and fairness in relation to risk perception (McDaniels et al., 1997; Baron et al., 2000)—in general, people perceive a higher risk if they believe it involves inequity or lack of fairness. Over the past decade especially, there has been a dramatic growth of the environmental justice movement, based on issues of fairness regarding the disproportionate siting of environmental and public health hazards in and near lower income and minority communities.

In the biosolids literature, Culos (2000a,b) reported how a local resident felt betrayed by having a big city "dumping on rural folks." A similar reaction, widely echoed across the continent, occurred to a program that brought biosolids from industrialized Lowell, MA, to rural areas of New Hampshire. Smith (1991) quoted a Native American speaking out about a biosolids recycling project in the West: "Another example of the white man putting his smelly burden on land housing native Indians." Many biosolids debate stakeholders believe that the perception of “big cities dumping on rural communities” is a major issue.

“Equity is a major factor," explains Wagner (1990), "it drives bans against waste imports across political boundaries and resistance to urban sludge products applied to rural lands. One approach is to maximize the use by the generators of the sludge." Because of its very nature, biosolids recycling will always be faced with this difficulty: the nutrients in biosolids are contributed mostly in urban centers and are needed mostly in rural areas. Hodson (1996) reports the observation of a biosolids project manager: “Parks attributes some of the public fears to former sludge disposal abuses... The cities generating the sludge don’t have the land to apply it within their borders. So they have to take it out to rural areas... Rural communities do not want the big city problems."

Fairness is also involved in how federal, state, county, and local governments share responsibilities and liabilities. Legal challenges have erupted over issues of local control and local and county ordinances (Connelly, 2000; Hassell, 2001). Wardell (1994) reports on work by the Springfield, Massachusetts Farm Credit Council and others in addressing concerns about farmer and lender liability around the use of biosolids. Their concern was “over potential liability, should a farmer accept biosolids and have problems later arising from that application….” This led to a policy, set by the Council in the fall of 1993, that provides some protection to the landowner/farmer: "The clause provides that a land applier/generator guarantee that the biosolids being used are of the quality stated and that they are being applied in accordance with the Part 503 rule currently in existence. If not, the applier/generator will hold the landowner/leaseholder harmless and will indemnify him/her against loss" (New England Interstate Water Pollution Control Commission, 1994).

2.2.3.7 Public Participation

Analyses of public trust issues have stimulated experimentation and development of new participatory models, some of which hold promise for stimulating increased public trust. Through public hearings, open meetings, referenda, mediated participation, consensus building decision making, and other models which encourage some level of public participation or which directly share decision-making power, the public has greater access and control than ever before to express their policy preferences (McAvoy, 1999).

Throughout the public policy and environmental world, recognition is increasing regarding the potential value of new public communication and public participation models. For example, in discussing composting, U.S. EPA (1994c) noted that public information programs should “foster realistic expectations [as well as] …provide honest and detailed information about issues such as: odor, portion of the waste stream that can be [recycled], and the cost of [recycling]." Once the public has been made aware and informed about a proposed recycling program, “the next step is to provide avenues through which [they] can express their concerns.”

U.S. EPA went on to underscore the importance of being open and responsive to concerns. In Columbia County, WI, county officials were dealt a public perception and credibility problem from the start. County officials selected a site for a co-composting facility in Pacific Township. Meanwhile, the Township Board exercised its authority by enacting an ordinance that gave them authority to approve the siting of a solid waste facility. When the County went ahead and purchased the option on the property before getting Township approval and applied for a Department of Natural Resources (DNR) permit, Township citizens felt that the county was forcing them to accept the site. “To avert further misunderstanding, the county notified residents in the area surrounding the proposed site and organized public meetings on the matter.” The County did in fact get the permit from the DNR, on the condition that the facility take into account certain clauses requested by the local citizens; “to put a plastic membrane lining under the tipping floor of the MRF and to provide free collection of the Township’s garbage…. Township also obtained authority to inspect the facility any time during business hours and issue citations if anything was out of order."

There are many examples in the biosolids literature regarding public participation processes associated with biosolids management programs (see many of the Case Studies in Chapter 3.0).

Wardell (1994) describes how one public participation process proceeded. At the beginning of the process, speakers at the first meeting of a New York and New Jersey Information Sharing Group identified the following impediments, including several that had to do with trust, fairness, information needs, and communications:

- lack of knowledge on the part of the public,
- inability of those within the biosolids utilization community to effectively communicate the degree of risk,
- concerns over farmer or lender liability,
- lack of direction at the state level in terms of policy or regulatory intent,
- distrust of regulators and generators by the environmental community or public at large,

- perception of some state regulators of gaps in the data and a feeling that long term impacts are not understood, and
- potential impacts on sensitive ecosystems which exist in this region.

The importance of efforts in the local area around a specific biosolids recycling site has been stressed repeatedly. Logan (1995): “the most effective [biosolids recycling] programs are local; there must be leadership provided by individual agencies (universities, regulatory agencies) or consortia (NBMA) and there must be a commitment to responsible biosolids management." Forste (1993) note that positive beneficial use programs start with local acceptance, rather than aiming at the “general public." States Rodgers (1994): “Providing local citizens with a level of involvement that decreases miscommunication and increases public confidence can actually assist in achieving” the goal of “utiliz[ing] a beneficial waste by-product in an environmentally sound manner."

Sarber (1994) noted that “First, not everyone in the community participates in the decision making. Polling data shows that while a lot of people are supportive of a concept, they just don’t show up at meetings or write letters... Second, most people don’t really want to be educated on the nuances of biosolids recycling. They just want to know that one of their friends or opinion leaders they trust took the time to learn about the issue and told them it is environmentally safe... Third, public participation implies that everyone is playing by the same rules and there is some agreed-upon body of information that will be used in making a decision."

McKinney et al. (1990) reported that, prior to Congressional action, Nassau County, NY, sought to develop a land-based plan for biosolids, in order to terminate their ocean dumping. The problems that the public had with the program were not related to its merits, rather there was a pervasive view that “1) the rapidity of the County’s planning process... did not allow adequate time for public scrutiny and siting studies, and 2) concern over the environmental impacts due to barging sludge on waterways." Clearly, the level within government (federal, regional, state, county, or local) and the speed with which the decision-making process proceeds may shape public opinion about the sincerity of the program to truly involve the public.

Several papers discuss difficulties with the process of public participation. It can be hard to find a way to have constructive discussions and decision-making around biosolids recycling projects. In Vermont, a formal, state-mandated, court-like environmental review process ("Act 250"), including the calling of "witnesses" and extensive review of technical information, led to a resolution in support of the proposed siting of a composting facility in East Montpelier, but the process was arduous and confrontative and may not have achieved any improvement in human relations around the project (New England Biosolids and Residuals Association, 2000).

Some have reported that public hearings and informational meetings, while necessary, are often confrontational and not conducive to constructive information exchange and dialogue. In addition, Gilbert and Hennig (1996) noted that public attendance at such meetings "may have nothing to do with acceptance or approval." Others report that proposed biosolids projects sometimes enter into existing local conflicts, such as those between a farmer and neighbors.

Goldfarb et al. (1999) noted that increased public “awareness has in turn sparked local interest in programs that affect the quality of the local environment. Increased participation by local government in the environmental arena can enhance environmental protection... but on the other hand, local governments are particularly sensitive to public outrage, and may thus exacerbate the ‘not in my backyard’ (NIMBY) syndrome."

Behnke and Amundsen (1993) discuss ways to address local NIMBY concerns by developing demand for the products and programs within the local community. The British Columbia Lung Association (2000) describes the change in perception that happened at Princeton, BC: there was opposition while the project was happening, but even the "naysayers who were adamant did a complete turnaround," once they saw the results (see Case Study 4, in Chapter 3.0). Thompson (1995) also addresses overcoming the potential NIMBY reaction to the siting of a biosolids recycling program.

Miller et al. (1996) described how, in Fort Collins, CO, the City decided to seek an alternative site for biosolids processing. The city decided to purchase a 2,500-acre prairie and went to work on a public participation technique called the "Systematic Development of Informed Consent" (SDIC) which is used to "ensure that all potentially affected interests are aware of the city's plans in advance and are given the opportunity to provide input." The basic tenets of the SDIC are:

- ♦ Any large, complicated project can be effectively stopped by the public, no matter how necessary and vital the project or how thorough the engineering plans;
- ♦ Any large, complicated project will likely hurt someone;
- ♦ Seek consent, not consensus;
- ♦ Establish and effectively communicate your organization's mission; and
- ♦ Pursue parallel efforts of technical work and citizen participation."

By following these tenets, the city was able to buy the new ranchlands with a "minimum of public concern and each stage of the project has met with increasingly less opposition." Although citizen attendance at meetings dwindled as time went on, the city continued to "nurture rapport, share information…and seek their input."

There are varying levels of public participation, from gaining public input through two-way communications to giving the public decision-making power.

Michael Rainey (1998), a New Hampshire state biosolids regulator presented a set of case histories about New Hampshire towns that found ways to address local concerns about the local land application of out-of-town biosolids while still allowing the land application to occur. "What is critical to the local acceptance process is not only a town or community's ability to understand the rules or the science but their commitment to learning, to going through that educational process. There are towns... that have simply decided they don't want to learn about biosolids recycling—it's easier to ban land application. The ability to understand is important, but to commit to learning is more important."

McKinney et al. (1990) raise an additional interesting point in stressing the mutual responsibility of public participation: "The public has a right as well as an obligation, to become involved with the planning process so that the technology implemented is compatible with the public's perception of their quality of life."

One could also say that a biosolids recycling program has a responsibility to continue to the end of any debate it has begun--all too often, controversy leads to withdrawal of a recycling program permit application and shifting to another town where public acceptance may be better. The problem with this is that the public is denied the opportunity to learn more and decide, based on full information, what they think of it.

The formation of regional information networks such as the Northwest Biosolids Management Association (NBMA), the New England Biosolids and Residuals Association (NEBRA), the Mid-Atlantic Biosolids Association (MABA), the Great Lakes By-products Management Association (GLBMA), and the Rocky Mountain WEA Biosolids Committee came about to a large extent because of the need for attention to the specific needs of local communities (Beecher and Toffey, 1999; Touart, 1997). While regional and industry trade associations tend to involve mostly people with similar perspectives (i.e. industry people), an interesting model for developing policy and practices that are potentially controversial was outlined by the National Wind Coordinating Committee in *Permitting of Wind Energy Facilities, A Handbook* (National Wind Coordinating Committee, 2002). In this model, an independent facilitator brought together stakeholders representing many divergent perspectives; these people discussed the siting of wind energy facilities and came up with approaches that could help address all the divergent needs and wishes of everyone involved in, or potentially impacted by, a new facility.

Public participation in public policy has been a growing focus of research (Berry and Scherer, 1990; Chess and Purcell, 1999; Cohen, 1995; Hartley, 2003; International Association for Public Participation, 2000; National Research Council, 2001; National Wind Coordinating Committee, 2002; Renn et al., 1995; Rich et al., 1995; Rowe and Frewer, 2000; Rosenbaum, 1983; Scherer, 1993b; Tuler and Dietz, 2001; U.S. EPA Office of Policy, Economics, and Innovation, 2001). Several key findings were expressed early on (1980's), such as the benefits of early public involvement in decision-making processes around potentially contentious policies or decisions. But, more recently, there has been an effort to better understand how the specific details of public participatory processes impact the effectiveness of the particular public participation process (Chess and Purcell, 1999; Renn et. al., 1995).

While there are several schools of thought and many alternatives strategies for gaining public participation, the focus within the biosolids management industry has been on addressing public outrage, since that has been the most distressful problem experienced by most biosolids managers. Thus, the work of Peter Sandman (2000) has been sought out and absorbed by some biosolids managers. Models that involve the public more deeply in biosolids management programs are slowly being introduced to the biosolids management world, for example, through a WEFTEC conference workshop (Water Environment Research Foundation, 2001). Similarly, the American Water Works Association (2001) recently published *Guidance to Utilities on Building Alliances With Watershed Stakeholders*. The workshop conducted as part of this project focused on the work of Susskind and Field (1996). The workshops conducted by WERF at WEFTEC focused, in part, on aspects of work by Chess and Hartley (2002).

The International Association for Public Participation (2000) is further developing strategies and tools for use in fostering public participation in any field. And in 2001, Seth Tuler and Thomas Dietz compiled an extensive review of the literature on "Factors Influencing the Success of Public Participation in Environmental Decision-Making." The same year, U.S. EPA published *Stakeholder Involvement & Public Participation at the U.S. EPA: Lessons Learned, Barriers, & Innovative Approaches*. And U.S. EPA's extensive experience with public participation around hazardous waste sites and facilities is summarized in a recent brochure (U.S. EPA, 2002) and associated documents that stress establishing trust, dialogue, and ensuring the community's well-being.

Evaluating new models or institutions designed to address public participation issues, however, is proving difficult. There are few objective benchmarks against which the new public participation models can be measured. Rowe and Frewer (2000) recommend the application of certain criteria to make a model more acceptable to the wider public:

- representativeness,
- independence,
- early involvement,
- influence, and
- transparency,

They also recommend process criteria that he believes make a model more likely to be effective:

- resource accessibility,
- task definition,
- structured decision making, and
- cost-effectiveness.

Renn et al. (1995) have also evaluated models of citizen participation, noting that "more and more decision makers and affected parties engaged in solving environmental problems are recognizing that traditional decision making strategies are insufficient. Often heavily shaped by scientific analysis and judgment, these kinds of decisions are vulnerable to two major critiques. First, because they de-emphasize the consideration of affected interests in favor of "objective" analyses, they suffer from a lack of popular acceptance. Second, because they rely almost exclusively on systematic observations and general theories, they slight the local and anecdotal knowledge of the people most familiar with the problem and risk producing outcomes that are incompetent, irrelevant, or simply unworkable. Citizen involvement in decision making has been widely acknowledged as a potential and partial solution to these problems."

Regardless of what model of public outreach and/or public participation is employed, public resistance to new technology remains more a response to loss of control, respect, justice, or courtesy than to the technology itself (McAvoy, 1999). And the effectiveness of any decision-making model is complicated by the reluctance of the technical and engineering culture to acknowledge these factors and adequately explain the intricacies of risk, which is both a moral and practical consideration (Herkert, 1994).

2.2.3.8 Conflict and Conflict Resolution

A significant branch of social science research has grown up around conflict, ways to address conflict, and the related field of negotiation. Birkhoff (in Water Environment Research Foundation, 2002) notes that "conflict is normal and healthy," and is an important part of democratic decision-making. Conflicts develop in predictable ways and there are specific factors that intensify conflicts, for example, if people are not provided opportunities to have their interests addressed. Couch and Kroll-Smith (1994) note that conflict is different in different situations; e.g., facility siting versus toxic contamination concerns.

An early milestone in addressing public conflicts was Fisher and Urey's 1970s book, *Getting to Yes*, a primer on negotiating agreements despite conflict. This, and subsequent work at Harvard and the Massachusetts Institute of Technology (MIT) led to the development of the "mutual gains" approach of negotiating and "consensus building" for addressing conflict (Susskind and Field, 1996; Susskind et al., 1999, 2000; Pellow, 1999), which are also useful models for public participation.

2.2.3.9 General Public Attitudes Regarding the Environment and Technology

It is impossible to conclude a discussion of social science research on public attitudes and processes without pointing to some of the general trends in perceptions of the environment which frame these issues. Public perceptions of the environment and environmental issues are constantly changing, although some fixed notions about sustainability appear to have taken hold (Jolman, 1994). There is widespread public support for environmental protection, regardless of age, gender, economic status, level of education, or political persuasion (Jones and Dunlap, 1992). Perceptions about the environment will always reflect to some degree the socioeconomic and demographic (Berger, 1997) characteristics of the affected publics, but the seeds of support for environmental protection are firmly rooted in the public mind.

Changes in public perceptions about the environment are often the result of dramatic events such as Chernobyl, Three Mile Island, the New York City Garbage Barge, the Exxon Valdez oil spill, Love Canal, Times Beach. Although these types of events are accompanied by widespread media coverage, they influence public perception because they reinforce an existing undercurrent of concern—environmental worry—and present an immediate catastrophic threat, accompanied by sensational images that illustrate that threat. The actual influence of the print and electronic media is generally overstated—the media carries less actual influence than most think it does. In a similar vein, today's knowledge-oriented "environmental education" does not significantly alter the conditions under which the public assesses environmental risk (Pooley and O'Connor, 2000).

2.3 Appended Documents: The Perspective of Concerned Citizens

Appendix A includes several written statements and documents that express outrage and concerns typically found in literature critical of biosolids recycling. This is included so that biosolids managers have the opportunity to look closely at the concerns, positions, and interests of their critics in order to gain a better understanding of the perceptions and concerns that they must be prepared to address.

CHAPTER 3.0

CASE STUDIES

Authors listed at end of chapter.

3.1 Introduction

3.1.1 Overview of Case Studies

This chapter consists of fourteen case studies that portray a variety of biosolids recycling program experiences around North America (Figure 3-1).

Many people in the biosolids industry have noted the long-standing success of the biosolids recycling programs of King County, WA (the Seattle area). That story leads off this chapter. It stresses the importance of partnering with different stakeholders, taking the extra time and effort to establish relationships with people in the local community where biosolids are to be applied, and paying attention to details that help ensure the program is a good neighbor.

The second case study briefly describes Milorganite's 70-plus years of successful marketing of a Class A heat-dried pellet fertilizer, stressing the importance of developing an appealing and effective biosolids product that meets the needs of customers.

The third case study notes that one successful biosolids project does not necessarily ensure a second one. Jefferson County, Alabama, had good public support for its "Beltona" Class B land application project, but found a second project needs to win public support on its own merits. At the "Beltona" project, and at the fourth case study site—Princeton, British Columbia—a key aspect of gaining public support were the convincing demonstrations of local benefits to the environment and the community. Both projects restored severely disturbed lands to productive uses, enhancing the local environment. The Princeton project case study highlights the importance of good communications with the media and diverse members of the local community.

Chicago has recycled biosolids in Fulton County, IL since the early 1970s. As the fifth case study emphasizes, this long-standing program has only moderate local support, despite few problems and the significant tax money and jobs it provides to the community. If this long and mostly successful experience cannot create stronger public support for Class B biosolids land application, is "becoming part of the landscape" and gaining only grudging support the most biosolids managers can hope for? (See Chapter 1.0 for more discussion of this kind of question.)

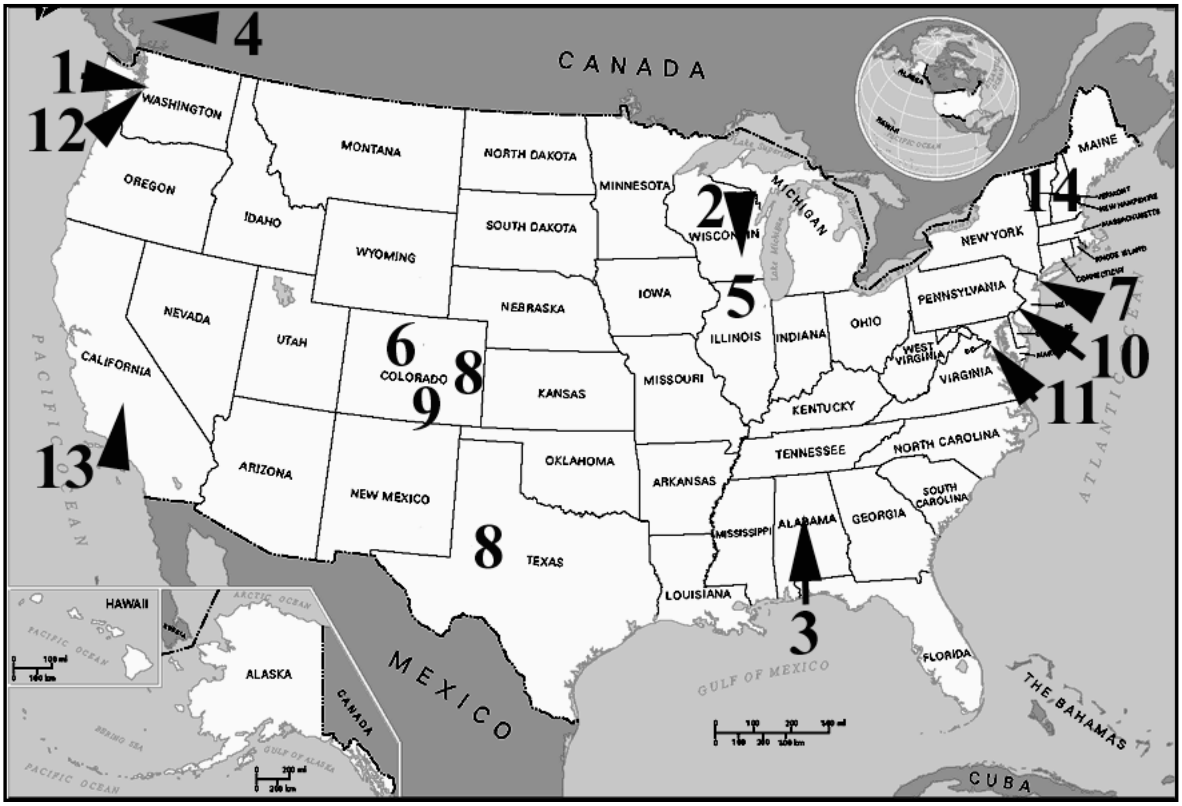
The sixth case study reviews the careful process of dialogue and education that followed public controversy regarding a Boulder, CO Class B land application project. The same kind of process involving diverse stakeholders is the topic of the seventh case study. The New York City Citizen Advisory Committee provided significant input to decisions about biosolids management and continued to support the City as the program was implemented. The eighth case study describes the use of New York's biosolids in distant, western communities: Sierra Blanca, TX and Prowers County, CO. The fact that these Class B land application programs were able to operate for many years indicates how extensive the outreach, education, and public relationship building efforts were—and how significant the benefits of the projects were to local agriculture and local communities.

Similar lessons were learned in the ninth case study of the Denver, CO Class B land application program at their “MetroGro Farm.” Long-term relationships with people in the local community around the land application site are critical. “There is no easy, canned solution to gaining public support.”

Whereas the reclamation of disturbed lands in Alabama and British Columbia created significant public support, in the tenth case study, Philadelphia’s experience shows that even with such demonstrated benefits, there is a need for constant, close attention to local and regional social and political factors, open communications, addressing questions and concerns, and understanding the interests of concerned citizens.The eleventh case study notes the importance of careful siting of biosolids management facilities and how, over time, demographic changes can affect the viability of a facility. The twelfth case study highlights similarly intense social and political developments regarding Everett, Washington’s failed attempt to develop a forestry biosolids land application program on a Native American reservation.

Social and political developments fueled by classic biosolids management mistakes that created public outrage are discussed in the final two case studies. When Kern County, CA banned Class B biosolids land application in the late 1990s, the decision was driven by a lack of available information, use of biosolids from distant cities, perceptions of scientific uncertainty regarding safety, competitive contractor practices that led to cutting corners, and fears of creating consumer dread of farm produce because biosolids were used in the region. In New Hampshire, a parallel period of public concern and outrage occurred at about the same time, triggered mostly by a lack of oversight and enforcement that led to management of biosolids land application programs that paid little attention to public nuisance concerns.

Figure 3-1. Case Study Locations.



3.1.2 Selection and Development of Case Studies

The project team developed an initial list of possible case studies based on the results of the biosolids recycling literature review. A list of 24 recommended cases, including a rationale for each choice, was provided to the project steering committee and the biosolids stakeholder review panel. Approximately 20 of the reviewers provided input on the case study choices at a February, 2001 meeting in San Diego and/or in writing. With the help of that input, the project team members made the final choices. Many other biosolids recycling programs that were not included in full case studies are discussed briefly in the literature review (Chapter 2.0). The final set of 14 case studies was chosen to include a range of:

- Program outcomes (more or less public support, see Figure 3-2),
- Public acceptance issues identified in the literature review (see Table 3-1), and
- Public acceptance strategies used by biosolids managers (see Table 3-2).

In reviewing the literature and speaking with stakeholders across the continent, it was clear that different biosolids recycling projects have experienced differing levels of public support and acceptance (Figure 3-2). Some programs are perceived as positive and have gained significant public support. Others have gained little support or are—or were at one time—strongly opposed. But, perhaps more interesting, are those biosolids recycling projects that lie near the middle of the continuum of public perception and acceptance--including ones that have, in recent years, been watched closely as their viability hangs in the balance, dependent on which way the pendulum of public acceptance swings. Examples are the Site 2 Montgomery County Regional Composting Facility (Section 3.2.11) and Kern County, CA (Section 3.2.13). Most of the following case studies are about programs that lie near the middle of the continuum of public acceptance.

The selected case studies also provide representative examples of most of the significant public acceptance issues and public outreach strategies that were identified in the literature review (Tables 3-1 and 3-1).

Each case study was assigned to the project team member who had the most knowledge and contacts with the particular biosolids recycling program. The case studies were researched using:

- The literature review and bibliography for initial resources and references;
- Biosolids program contacts who provided additional leads to other stakeholders;
- Additional documents provided by contacts: media clippings, process documents, meeting minutes, and position statements.
- Phone interviews with a variety of stakeholders involved in the biosolids recycling program, including biosolids managers, concerned citizens, government officials, biosolids trade organizations, agricultural advisors, etc.

Finally, in developing the case studies, the authors tried to touch on all of the major public acceptance concerns, concepts, and strategies that they knew of. They had found that, while every biosolids recycling program is different (depending on personnel involved, local political and social climate, size, location, and myriad other factors), there are common themes and experiences when it comes to the public knowledge, perception, and participation around biosolids recycling programs. It is the authors' hope that these case studies provide insight into the diverse, yet common, experiences of biosolids managers around the continent.

NOTE: The case studies focus on social concerns: the knowledge, understanding, perception, and behavior of biosolids managers, the public, and other stakeholders. **The case studies were written to highlight particular public perception, participation, and acceptance issues; they should not be cited or relied on for technical or historical details.** In addition, it is important to note that the case studies focus on events and particular projects that occurred in the past and **these experiences are not necessarily representative of the overall experiences or current operations of the particular facility, agency, company, or biosolids management program.**

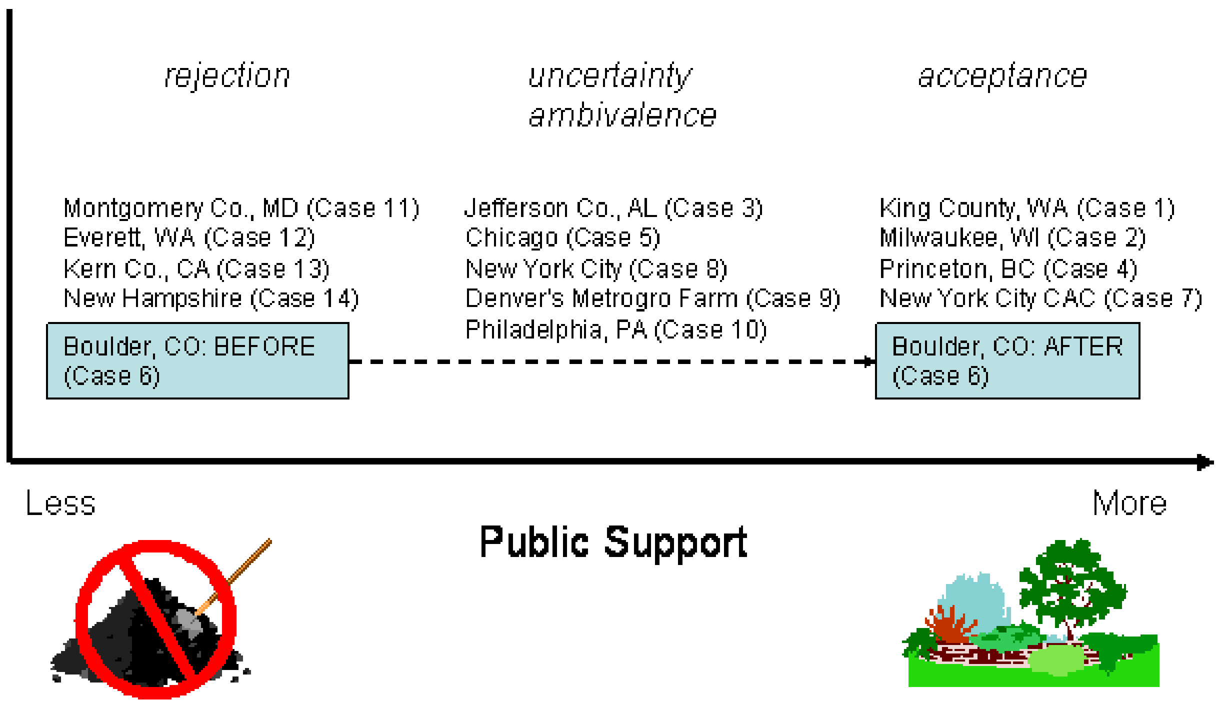
Table 3-1. Public Acceptance Issues Identified in the Biosolids Case Studies.

Public Acceptance Issues	1. King Co., WA	2. Milwaukee, WI	3. Jefferson Co., AL	4. Princeton, BC	5. Fulton Co., IL	6. Boulder, CO	7. New York City CAC	8. NYC and Rural Communities	9. Denver, CO	10. Philadelphia, PA	11. Montgomery Co., MD	12. Everett, WA	13. Kern Co., CA	14. New Hampshire
Social/Political														
Trust	•		•	•		•	•	•	•			•		•
Equity and Fairness	•		•	•	•	•		•	•	•	•	•	•	
Communications	•	•	•	•				•	•	•		•		•
Information (Sources and Timing)	•			•			•		•			•	•	•
Public Participation	•			•	•	•	•	•	•		•	•	•	•
Changing Demographics	•		•			•			•	•	•			•
Politics									•		•		•	•
Oversight and Enforcement	•							•	•				•	•
Scientific/Public Health														
Trace Metals and Chemicals	•	•						•	•	•		•	•	•
Pathogens								•		•	•	•	•	•
Odors and Other Air Quality				•	•		•			•				•
Water Quality			•	•					•	•		•		•
Soil and Food Quality										•			•	
Transportation/Trucking			•	•				•	•				•	•
Economic Viability			•		•		•	•	•		•	•	•	•
Emerging Issues and Uncertainty													•	•

Table 3-2. Public Acceptance Strategies Utilized in Biosolids Case Studies.

Public Acceptance Strategy	1. King Co., WA	2. Milwaukee, WI	3. Jefferson Co., AL	4. Princeton, BC	5. Fulton Co., IL	6. Boulder, CO	7. New York City CAC	8. NYC and Rural Communities	9. Denver, CO	10. Philadelphia, PA	11. Montgomery Co., MD	12. Everett, WA	13. Kern Co., CA	14. New Hampshire
Minimal Public Relations (Not Recommended)									●		●			●
Best Management Practices, Technical Oversight, and Local Research	●				●			●	●					●
Purchase Land to Manage Biosolids					●	●			●					
Use Remote and Isolated Areas			●					●	●		●			
Clean, Orderly, and Pleasing Appearance	●													
Establish Proactive Information Networks (e.g., neighborhood networks, complaint hotlines)	●				●									●
Public Meetings and Hearings	●		●			●			●	●		●		●
Foster Communication with Opinion Leaders ("gatekeepers")	●			●	●	●	●	●	●	●				●
Support Research and Demonstrations	●				●			●	●	●				●
Begin Slowly with Test Programs	●			●		●					●			
Provide Public Information (e.g., brochures, vedeos, websites, and tours)	●	●	●	●		●	●	●	●					
Work with the Media to Provide Information	●		●	●	●	●						●		●
Conduct Public Opinion/Marketing Surveys	●	●							●					
Political and Legal Efforts	●		●			●	●	●		●	●	●	●	●
Identify Multiple Strategies for Biosolids Recycling	●								●					
Market Biosolids Products	●	●		●					●					
Demonstrate Local Environmental Benefits	●	●	●	●				●		●				

Figure 3-2. Public Acceptance of Biosolids: The Continuum of Case Study Experiences.
(Groupings are subjective, but illustrate the relative levels of public support experienced by the biosolids recycling programs.)



3.2 The Case Studies

3.2.1 King County, WA: The Importance of Third-Party Support

3.2.1.1 Background

King County (or Seattle Metro at the time) ceased ocean disposal of sewage solids in the early 1970s. The county began to use its biosolids in soil reclamation projects and began a research program with the University of Washington to explore the use of biosolids as a forest fertilizer. In the early 1980s, the county contracted with a local landscape materials firm to produce GroCo compost, which became popular with landscape contractors. Forest applications evolved from large-scale demonstrations to full operations on private timberland. Throughout the decade, forest applications, compost production, and large-scale soil reclamation at an out-of-county strip mine dominated the recycling program. In the late 1980s, however, the program was rocked by two major developments: 1) the loss of its largest reuse site when the strip mine was sold to a new owner who no longer wanted biosolids, and 2) fierce opposition from citizen groups to proposed application of biosolids to county forestlands.

The biosolids management program regrouped and quickly began to focus on new opportunities. Thanks to years of successful pretreatment, the concentrations of metals in the county's biosolids had decreased by 60-80%, leading to a revised council policy allowing the use of biosolids in agriculture. Over the next several years, with the help of third-party allies and spokespersons, a strong agriculture program was developed and the forestry program rebuilt.

3.2.1.2 Public Acceptance Issues

Agriculture Program. In 1987, Metro/King County joined with other biosolids management agencies to form the Northwest Biosolids Management Association (NBMA). Membership grew to include universities, consultants, vendors, and regulators. The NBMA became the forum for King County to network with farmers and other agencies experienced with biosolids use in agriculture. The public had many questions: What's in biosolids? Where does it come from? Is it safe? These are the same questions asked by citizens elsewhere. The major issues and how they were resolved, as well as factors contributing to the program's success, are outlined below.

- **Urban vs. rural**: The Cascade Mountains form both a topographic and a cultural divide between primarily rural, agricultural eastern Washington and the more urbanized west. Residents were sensitive to "importation" from the west because of unrelated attempts to site a landfill in eastern Washington. They were also sensitive to issues of toxicity because of the presence of the Hanford Nuclear Reservation and its associated health concerns. The fact that biosolids were being used in King County—in forestry and composting—helped dispel a concern that urbanites were "dumping" on the rural areas.

- **Wind erosion**: The fine-textured soils in eastern Washington are prone to wind erosion; dust storms can shut down highways. People wondered if biosolids would contribute to the problem or if the fugitive dust would carry contaminants into neighborhoods and onto crops. Demonstration projects soon dispelled these fears as farmers could see that a field with biosolids would not "blow," while adjacent fields had dust clouds.

- **Local studies and research**: Regardless of the amount of biosolids research done elsewhere (e.g., on crop growth and metal uptake), each community wanted assurance that sites near them would have the same response to biosolids. Thus the county incorporated research and demonstration into new projects. This research investment also provided opportunities for open house style meetings with field tours showing comparisons of crops grown with biosolids and fertilizer. This approach helped greatly to demystify biosolids—people learned what biosolids looked and smelled like and saw application equipment in action. Many discovered that an agronomic application rate was a mere sprinkling of biosolids, not the "dumping" they had perhaps feared. In addition to having data on the lack of metal uptake in crops, the plant response to biosolids was positive and well documented.

- **Public outreach**: County biosolids staff worked long hours with farmers, county extension agents, private contractors, and farming communities to provide information about biosolids. Key to their success, however, was the pro-biosolids message that was being delivered by their allies: university researchers, who installed biosolids demonstration and research plots on farms; the local extension agent, who made numerous presentations and promoted biosolids use on his weekly radio program; and a respected third-generation farmer and official of the state wheat-growers association, who enthusiastically shared his experiences with biosolids.
- **Management practices and local oversight**: Early in the agriculture program, a subcontractor/farmer applied biosolids to an area identified as a buffer, a dry draw where water could flow in a storm event. Neighbors complained to the county, and the biosolids were removed. Several important changes were made to the biosolids management program following that incident: staff was added to provide field oversight to contractors/farmers; local sponsors were required for each project; a set of 'Performance Standards' was developed and added to contracts; and a third party audit system was implemented. The performance guidelines outline the responsibilities of all parties to ensure that projects follow current best management practices and to ensure quality operations and consistency among projects. The annual audits include a review of field practices and an assessment of monitoring techniques and data validation, as well as a review of compliance with regulatory requirements. These checks and balances have become an important element in maintaining public acceptance.

The agriculture program is now in its eleventh year of operations and has achieved a high degree of public acceptance. Seventy percent of King County's biosolids are recycled at two large projects: the Boulder Park and Green Valley Projects. Boulder Park dryland grains project encompasses more than 100 landowners and over 50,000 acres of dryland farms in north central Washington. The Green Valley project in Yakima County includes a consortium of farmers called Natural Selection Farms. Rangeland and irrigated crops, including hops, orchards, vineyards, and pasture, cover more than 40,000 acres with a capacity to recycle 50,000 wet tons of biosolids annually. Natural Selection Farms works closely with King County staff and local regulators to ensure a well-managed, high-quality project and has been recognized as a leader in biosolids recycling and environmental stewardship.

Forestry Program. In the mid-1990s, the forestry program was revitalized when a respected conservation organization, the Mountains to Sound Greenway Trust, recognized how biosolids could be used to enhance many of the benefits of the forests outside Seattle. The Greenway Trust was interested in biosolids for its fertilizing qualities and because King County had $12 million in cash and forestland which it would deed to the state, expanding state forests and bringing multiple environmental benefits such as wildlife habitat and water quality protection. This was the key to support from local environmentalists.

- **Public-private partnership**: To carry out this biosolids and land acquisition program, the Greenway Trust formed a 50-year public/private partnership whose members included a nonprofit conservation organization (The Mountains to Sound Greenway Trust), the King County Wastewater Treatment Division, the state agency that owned timberlands, a national timber company (Weyerhaeuser), and the University of Washington College of Forest Resources. The Greenway Trust led the campaign to generate public support for biosolids application in the forests of King County, successfully emphasizing the message that recycling biosolids was a safe and sensible solution that increased public forestland ownership, improved water quality, and increased wildlife habitat. The most visible results of that effort were more than 30 positive local newspaper articles and editorials in support of the biosolids recycling program, 15 environmental and recreational groups signed a petition of support, and a public opinion survey showing that the number of persons who approved biosolids application in the forests increased from 50-75%. Public support was sufficient to allow biosolids applications to visible portions of the state's most popular forest during the summer hiking and biking season.
- **Engaging opinion leaders**: The Greenway Trust worked one-on-one with various "gatekeepers"—leaders of public opinion—to ensure that they understood and supported biosolids recycling and could convey that information to others. These gatekeepers included scientists, public health officials, recreational and conservation groups, environmentalists, regulators and the media. Two leading environmentalists in the region volunteered to serve as spokespersons on behalf of the project after their own investigation of the issues convinced them that the use of biosolids and land acquisition for biosolids led to larger environmental benefits.
- **Product marketing**: GroCo, Inc. is responsible for permitting, monitoring, distribution and marketing of GroCo compost, a 3:1 mixture of sawdust and King County biosolids. GroCo compost has been on the market since 1981 and has a loyal following with commercial landscapers in the wholesale market. The general public can also purchase GroCo for residential use. Biosolids program staff work with other public jurisdictions to encourage the use of GroCo in their projects. In the past few years, GroCo, Inc. has donated its compost to a number of schools and community groups for special projects. These have included demonstration gardens at several schools; soil improvement and wildlife habitat enhancement at an urban park; landscaping of several public facilities; and planting of native trees and shrubs along river banks and highway rights of way.

  As part of the biosolids forestry program, the Mountains to Sound Greenway Trust uses GroCo for its summer compost re-greening program. Youth volunteers from the World Conservation Corps and from urban areas of Seattle use GroCo to reclaim old logging roads and revegetate the scars on steep hillsides of the Interstate-90 corridor east of Seattle. GroCo compost continues to serve as the public's introduction to biosolids. Free samples are handed out at flower and garden shows and at community gatherings. It is the form of biosolids that people can touch, smell, and understand; they can use it at home and see the results for themselves.

3.2.1.3 Conclusion

The biosolids management program of King County, WA, has met a series of challenges on the path to public acceptance, but those experiences have shaped and strengthened the program. To improve the program's relationship with the public, the county changed its outreach strategy, developing public-private partnerships and networking through a regional biosolids organization. The most effective change was working with external spokespersons, such as environmentalists and farmers.

Today, King County recycles its biosolids in five major land application projects, with partners from private industry, farmers, environmental organizations, state universities, and state government. Although the program has stable markets for biosolids and has enjoyed support from the public and the news media, ongoing public debate about biosolids is a reminder that significant public acceptance issues can be lurking just around the corner. King County is one of the demonstration agencies of the Environmental Management System being developed by the National Biosolids Partnership (see Chapter 1.0); this presents an opportunity to enhance internal communication and documentation and continue to improve biosolids recycling activities and public acceptance.

3.2.2 Milwaukee, WI: A Long-Term Marketing Success

3.2.2.1 Background

In 1926, Milwaukee's sewerage agency began to market Milorganite®, a new, heat-dried, pelletized organic fertilizer that was shown to release nutrients slowly to plants. It proved an excellent turf grass fertilizer. By the late 1990s, the Milwaukee Metropolitan Sewerage District (MMSD) was selling about 55,000 tons of Milorganite each year, about 70% in bags and about 30 percent in bulk. This included 700,000 50-pound bags sold to golf course managers and 900,000 40-pound bags for general use. A 1997 state audit found that the Milorganite fertilizer sales program results in overall sewage sludge management costs that are at least 40 percent lower than the cost of landfilling.

The history of Milorganite is well-documented (Milwaukee Metropolitan Sewerage District, 1995; Water Environment Federation, 2000a): the early laboratory and field testing work done by O. J. Noer on turf grass nutrient needs and soil fertility, the early traveling (by train) sales and demonstration efforts, and the quick growth in sales, eventually outstripping demand by the mid-1930s. Seventy-five years later, Milorganite remains a fertilizer product of choice. Three generations of golf course managers have come to swear by it. "Its integration into the consumer marketplace has been so successful that many homeowners are unaware of the product's origins," extolls the product website (Milwaukee Metropolitan Sewerage District, 1995).

Other biosolids management programs around the country have followed Milorganite 's lead, creating products for the competitive fertilizer and soil amendment marketplace, including Boston's Massachusetts Water Resources Authority and its contractor, New England Fertilizer; New York and the New York Fertilizer Company; Houston; and Tampa. Annual U.S. production of heat dried pellets is now estimated to be 275,000 dry tons (Wiseman, 2001).

3.2.2.2 Public Acceptance Issues

What sets Milorganite apart from most of its counterparts is the fact that "public acceptance" of the biosolids recycling product is not even an issue. Why is this? How is it that this product, the name of which stands for "Milwaukee Organic Nitrogen," boldly displays "organic" on its label, while, at the same time, in the mid-1990s, Boston's biosolids pellet fertilizer Bay State Organic was forced to become Bay State Fertilizer due to public pressure from organic farmers?

Product marketing: According to Mike Archer, current sales and marketing director for Milorganite, the success of the product is a result of ongoing marketing efforts and adapting to the market. Other staff at the sewerage district closely monitor the product's quality and conduct testing. That leaves Archer with the time he needs to focus on marketing. "What counts for me are questions like how does Home Depot's consolidation of all purchasing affect us?"

Milorganite's literature, and the way people talk about the product, clearly indicate a widespread understanding of Milorganite as a product, not as a waste that needs disposal. The marketing effort focuses on Milorganite as a fertilizer, as well as the environmental and economic benefits that have resulted from its production:

> The process [of making Milorganite]… is built on recycling, from utilizing waste heat through reconstitution of previously unusable material…If the Milwaukee Metropolitan Sewerage District (MMSD) had chosen in 1926 to dispose of biosolids in landfill instead, which is the next most viable economic option, over 9 billion pounds of dried product would have been thrown away, instead of beneficially reused. Environmentally, that has saved over 200,000,000 cubic feet of landfill space. Almost secondarily, the revenue generated from the sales of Milorganite over the years has saved Milwaukee taxpayers close to $300 million.

The competitive marketplace and Milorganite's market savvy mean that MMSD's relationships with regulators is also different than other biosolids managers. Milorganite has a deserved reputation for strongly defending its marketing and sales rights. It has defeated proposals that would require warnings on its product label about trace constituents, such as molybdenum.

Finally, Milorganite's attention to the product and marketplace are also apparent in its customer service. There are many biosolids programs that work at customer service. As with any good sales and marketing program, Milorganite conducts formal customer surveys every few years, as well as continually soliciting informal feedback. And they offer contracted toll-free customer service. As Archer notes, "sometimes people call and ask a question and the answer is on the bag, but they just really need someone to read directions to them; it's human nature."

3.2.2.3 Conclusion

Milorganite®, a bagged, pelletized, heat-dried biosolids fertilizer product, has been marketed since 1926. Its success has come from its performance as a pleasing, easily-managed, effective commercial product—it stimulates plant growth and customers are happy with it. This level of customer satisfaction has come about because of Milwaukee's recognition, decades ago, that they create a *product* that must meet the demands of the consumer. Thus, Milorganite has a consumer-oriented organizational ethos that understands and responds to its customers, requiring proactive communication, listening, and constant attention to quality and improvement.

That same perspective—determining what needs to be done to make the customer comfortable with the product—is applicable to any type of biosolids recycling program. It is a significant step to understanding the process of building public support for a biosolids product.

3.2.3 Jefferson County, AL: Biosolids Mine Reclamation

3.2.3.1 Background

In and around Birmingham, AL, 2,700 miles of sewer pipes collect wastewater, servicing much of the population of Jefferson County. Altogether, seven treatment plants accept a daily average flow of approximately 200 million gallons. The treatment of this wastewater generates 15,000 dry tons of sewage sludge each year. Each of the County's wastewater treatment plants processes its own sewage sludge, either by aerobic digestion or anaerobic digestion (one of the larger plants—Village Creek—is starting a new thermophilic digestion system).

In the 1970s, Jefferson County treated sewage sludge with a flash dryer, put it into bags, and sold some in local hardware stores. However, this program became too expensive, mostly due to increasing energy costs for operating the dryer. During the 1980s, most of the County's sewage sludge was disposed of in landfills.

In the early 1990s, the County began to work with United Land, a company involved with coal mining, steel, and other industry landowners. A strip-mined site in Beltona, AL was identified as a good candidate for reclamation with biosolids: it was remote from neighbors, yet accessible from the wastewater treatment facilities producing biosolids, and it was a wasteland, devoid of topsoil. For the next ten years, Jefferson County's biosolids division hauled treated and tested, Class B biosolids from the County's wastewater treatment facilities to Beltona, creating new topsoil that supports the growth of grass hay. The County receives a portion of the hay crop–about 15,000 bales each year–and uses it in construction projects, as well as for donations to non-profit organizations, church fairs, and other civic events.

3.2.3.2 Public Acceptance Issues

The Beltona project has earned high praise from Jefferson County Commissioners because of its economic and conservation benefits. In 2000, Jefferson County received a U.S. EPA honorary mention for its Beltona biosolids land reclamation program. However, public awareness of the project is low.

- **Local benefits**: In the words of Paul McCaleb, Administrative Assistant to the Jefferson County Commissioners, the project has “taken a strip mine that was essentially useless…applied biosolids, and planted grasses conducive for hay. The site is now green. And the hay is used for events throughout the county for charitable groups and also has come in handy for road sites, erosion purposes, reinforcing silt screens. The feedback we are getting from the public is good. So are the cooperative partnerships we have had to bring this about—with the property owner as well as other entities that have benefited from the hay." According to David Dennart, current Jefferson County biosolids manager, turkey, deer and other wildlife are evident in the green fields that have replaced the former strip mine.

- **Remote location**: It also helped to have a remote site that was easily accessible without creating increased nuisance from noticeable truck traffic. The Beltona site, says McCaleb, "is two miles off an interstate; and the biosolids trucks only have to drive by five or six homes on a relatively busy road: people don't even pay attention to them."

- **Communication and outreach**: The biosolids program staff have produced an education video about the Beltona project, but general public awareness of the project is believed to be minimal. Stakeholders in the Beltona project recall only one significant complaint from neighbors over the past 10 years: in 1995 an invasion of flies was initially blamed on the biosolids, but later traced to grease holding pits on a neighboring property. Area soil conservation staff and Auburn University's agriculture program have occasionally used the site for tours, and, according to Dennart, a few environmental groups have seen the site and recognize the conservation benefits.

- **Opposition to a new site**. In 2000, Dennart and the Jefferson County biosolids program began an attempt to repeat the Beltona success. The same landowner has available a mine tailings site in need of reclamation in the nearby town of Adger. But at a public meeting about the proposed project, there were a few people who objected strongly: Adger is in a more rural area and they did not want Jefferson County's city sludge dumped in the country near them. They were worried about the possibility that their children might get into the biosolids or groundwater might be contaminated. Jefferson County biosolids staff responded to the Adger residents' concerns by hosting a tour of the Beltona site at which 30 people showed up and, according to Dennart, "were accepting of it." They detailed plans for test wells and stormwater discharge monitoring at the Adger site. Nonetheless, the future of the Adger project remains uncertain. Says McCaleb: “We're hopeful we can still work something out on the Adger site. We're working with newspapers and TV to get some positive coverage. We're hoping to start on a small scale and a short time period to allow people to see how good this kind of reclamation project can be."

3.2.3.3 Conclusion

Jefferson County's experience highlights how successful biosolids recycling programs are finding it challenging to build on past successes. Around the country, wastewater treatment agencies have developed stable Class B land application projects and, in some cases, Class A programs that are relatively cost-efficient. They have not had the resources to do large, concerted public relations campaigns, but have done some effective outreach, as needed. Now they are finding that starting new land application projects requires going back to the beginning in terms of local public outreach and participation.

In 2001, with concerns about biosolids being openly and abundantly expressed on the Internet and in other media sources, past successes are no longer predictors of future public acceptance. Even in Jefferson County, AL, an identified leader in biosolids recycling in the southeastern U.S., biosolids managers are finding that more public outreach, education, and participation is required to ensure the long-term viability of biosolids recycling.

3.2.4 Princeton, BC: Reclamation of the Granby Tailings Site

3.2.4.1 Background

The Greater Vancouver Regional District (GVRD) is a regional government partnership of 21 municipalities and one electoral area that make up the metropolitan area of Greater Vancouver in southwestern British Columbia (BC), Canada. The role of the GVRD is to deliver essential services that are regional, rather than local, to the area’s two million people—half the population of the Province.

Since a 1990 GVRD Board directive to recycle biosolids, the Biosolids Recycling Program has been challenged to find opportunities for the beneficial use of the organic matter being generated by the District’s wastewater treatment plants (WWTPs). GVRD operates five WWTPs that treated over 430 billion litres (114,000 gallons, approximately 312 million gallons per day) of sewage during 2000. During 2000, the WWTPs produced 67,881 wet tonnes (74,805 wet tons) of biosolids. To date, the Program has recycled more than 750,000 tonnes (826,500 tons) of biosolids under its Nutrifor trademark in various land application projects in mine reclamation, ranch fertilization, gravel pit reclamation, landscaping, and silviculture enhancement.

GVRD's Nutrifor™ biosolids were used to reclaim a large mine-tailings area (the Granby Tailings) in Princeton, BC. This project's effectiveness earned it an honorary citation from the mine reclamation community. The project began in 1992-93 when the Town of Princeton council endorsed small-scale demonstration areas as part of the GVRD's process to obtain approval for a larger project.

After the successful demonstration of the value of biosolids in the pilot projects, the Princeton Town Council and the Economic Development Commission cosponsored a full-scale project to landscape the entire Granby Tailings area using Nutrifor. The project created a fertile top soil for landscaping the site which was seeded with mixed grasses to control wind erosion and dust problems and planted with trees and shrubs to stabilize slopes and provide wind breaks and wildlife corridors.

3.2.4.2 Public Acceptance Issues

The Program is now seeking local opportunities to recycle biosolids in municipal and retail distribution sectors. Breaking into these new markets will require biosolids products that are user-friendly and the development of partnerships with municipal members as well as with the private sector. Key to the success of this direction will be a public education and communication plan that will utilize the media to convey a "rise in the value" of biosolids, both actual and perceived, to build wider public acceptance of biosolids recycling.

- **Communications**: The Biosolids Recycling Program always tried to be proactive, open, and responsive to issues and concerns brought forward by the public and stakeholders. The print and broadcast media were used to advertise open houses, site tours, and information centers where project plans were outlined and further details could be obtained (Braman, 1998; Burbridge, 1998). Project communications in the area utilized the trademarked Nutrifor name to create product recognition with the local press and public. The Nutrifor program wanted to have the public focus on what Nutrifor and biosolids could do and the benefits derived from the project, rather than have focus on "more stuff from the big city being dumped in our backyard."
- **Third party input and support**: Regulators from the Ministry of Environment, Lands, and Parks and the Ministry of Energy and Mines were contacted early in discussions about where to undertake a mine reclamation project. This led to selection of the Granby Tailings site over another site under consideration that would not have had the same degree of success. Support for the project was also received from the Similco Mines (owners of the original mine site) management and staff, community leaders from the Regional District of Okanagan-Similkameen board of directors, and the Town of Princeton council. The benefits seen in the original demonstration areas convinced these leaders that the project was worth backing.
- **Media influence:** The success of the Granby Tailing reclamation project was aided in large part by local news media, which publicized the project scope and provided opportunities for the public to voice concerns and ask questions. The local newspaper, *The Similkameen Spotlight*, was a critical influence on local knowledge and understanding of the Granby tailings Nutrifor biosolids reclamation project (*Similkameen Spotlight*, 1992, 1997, 1998a,b, 2000). Letters to the editor were one of the prime vehicles for the concerned public to voice

concerns over biosolids from outside the area being recycled in Princeton, along with concerns about odors, truck traffic, GVRD's reputation, possible environmental impairment, and concerns about areas prone to flooding (Anderson, 1992; Bosomworth, 1992; Bunn, 1995; Lawson, 1998; Norman, 1995).

The GVRD also used letters to the editor to provide positive messages about the program (Currie, 2000; Johnson, 1997). For example, after the GVRD received a citation from the provincial mine reclamation community for “outstanding reclamation achievement” for the Granby tailings project, the Nutrifor Biosolids Recycling Program extended its thanks to the Princeton community for their support of the project and asked the community to share in the accolades.

One of the most significant media articles about the project was published after the project was completed. In the Spring 2000 issue of *Your Health*, the semi-annual publication of the British Columbia Lung Association, an article noted that the biosolids application had significantly reduced the amount of dust blowing around town.

3.2.4.3 Conclusion

The Granby Tailings project in Princeton, BC was successful because of its focus on communicating local benefits, strong support from regulators and community leaders, and effective use of demonstration projects. Project staff were proactive, open, and responsive in dealing with stakeholders, and sought to involve as many of the parties who would or could be positively or negatively impacted by the project. Project managers emphasized the local benefits of biosolids recycling and the use of Nutrifor to reclaim the Granby mine tailings site. The project started with a small demonstration, to show the potential benefits of the project, and grew to become a project noted by the British Columbia Lung Association for significantly reducing the amount of airborne dust and improving air quality in the area.

3.2.5 Fulton Co., IL: The Prairie Plan for Chicago Biosolids

3.2.5.1 Background

Chicago, like other large cities, has developed many different sewage sludge management practices over the years. Cleveland (1976) describes Chicago's 1970s biosolids operations, including heat-dried biosolids fertilizer production and distribution of air-dried biosolids in the Chicago area. Chicago biosolids are used on area golf courses, sod farms, and parks. In 1994, a majority of the city’s biosolids were used to construct a golf course on a former landfill site (Metropolitan Water Reclamation District of Greater Chicago, 1995). Chicago has also landfilled and incinerated biosolids.

One Chicago biosolids project stands out as one of the longest-lasting biosolids land application programs in the country: the "Prairie Plan" biosolids land application program involving reclamation of mine-spoiled lands in Fulton County, 180 miles south down the Illinois River from Chicago. The Metropolitan Water Reclamation District of Greater Chicago (MWRDGC–formerly Metropolitan Sanitary District of Greater Chicago) purchased 15,528 acres of mine-spoiled land in Fulton County between 1970 and 1975. Deliveries of up to 4500 wet tons of biosolids per day began in 1971. Initially, barges transported liquid (6% solids) biosolids to an off-loading and pumping station that fed a 10.8 mile pipe leading to the land reclamation site. In the early 1970s, land application was done by aerial spraying. Later systems included liquid injection, application of semi-solid biosolids cake and, more recently, application of air-dried biosolids (50% solids) barged downriver and trucked to the fields. Today, agricultural crops, fertilized with biosolids, are grown on the reclaimed land.

2.2.5.2 Public Acceptance Issues

The Fulton County site has received Chicago biosolids more or less annually for 30 years. It was one of the first large biosolids land application programs, and was watched with keen interest by many other cities (Adkins, 1975). Public acceptance issues and strategies employed by the program to engender local support include the following:

- **Local government involvement**: From the beginning, Fulton County leaders supported the Prairie Plan. In fact, they had invited MWRDGC to propose a reclamation operation and all 27 board members approved it. In order to provide good communication and information exchange, a local steering committee was established in Fulton County and included elected officials, county agencies, the highway department, representatives from the state university and local colleges, and local citizens. In communicating about the project, MWRDGC and the County leaders emphasized that the land being reclaimed had, for decades, been subject to no taxes because it was unproductive. By 1979, the Prairie Plan program was paying over $200,000 in taxes, providing jobs, and helping stimulate the local economy.

- **Organized opposition**: Despite the efforts of the local steering committee and MWRDGC staff, it was not long after the first deliveries of biosolids that opposition to the project flared up and Fulton County Citizens for Better Health and Environment was created. The editor and owner of the local newspaper, *The Daily Ledger,* was the first contributor to the opposition citizen group (CH2M Hill, 1982). In 1974-75, the group filed a $1 million lawsuit against the Prairie Plan operation, and the Illinois EPA cited the program for air quality violations caused by the aerial spraying of biosolids. Aerial spraying ceased, reducing the visibility of the project.

- **Management practices**: In response to citizen opposition, project leaders realized that day-to-day best management was critical to reduce impacts, including odors, as much as possible. Aerial spraying, and the resulting odors and appearance of the landscape, caused immense harm to the image of the operation and public acceptance. The end to aerial spraying and other improvements to management practices led to a reduction in the number of complaints.

- **Local research and monitoring**: The project has included extensive research and monitoring, especially through MWRDGC Research and Development division (R&D). R&D has published annual reports on the environmental impacts of the biosolids recycling program. The reports show how the quality of the biosolids has improved considerably over time. They show the results of years of monitored groundwater quality, runoff water quality, area surface water quality, and air quality (Metropolitan Water Reclamation District of Greater Chicago, 1999a-d). (Additional information about the history, technical operations, and research findings at the Fulton County land reclamation site is available in Adkins, 1975; CH2M Hill, 1982; and Stukenburg et al.,1993).

- **Public outreach**: Looking back on the project's first decade (the 1970s), project leaders recognized the shortcomings of their public outreach program and recommended additional education efforts, including better understanding of potential opposition and potential local supporters. Initially, the local steering committee had met monthly and provided an avenue for public participation in the project. In addition, MWRDGC established a local presence, with staff living near the land reclamation site. The staff wrote weekly educational columns in the local newspaper. They worked with local contractors and businesses, trying to become part of the local economy. Now, however, the committee meets less often and few neighbors or citizens ever attend. County leaders, health department officials, and others with a direct interest in the project are still kept informed, but there are no longer ads or columns in the local newspapers. Illinois EPA's Lyle Ray notes that the Prairie Plan project "has ripened to the point that the issues have passed: viruses, aerosols, metals…What tempers local critics is to look at those fields and see them growing crops where there were once strip mines, rocks, poor percolation rates; the current site looks like any other agricultural area." However, at least one reclamation engineer with the project is uneasy about the potential for public concern to re-emerge if odors or other off-site impacts occur.

3.2.5.3 Conclusion

After early opposition from citizens, the Fulton County Prairie Plan, which recycles Chicago sewage sludge on a reclaimed mining site, continues to operate "under the radar." Those who know about the project and accept it grudgingly do so because of its clear benefits—taxes, jobs. But, despite the local research and monitoring, the decades of experience, and environmental benefits to the land, the program does not seem to be something locals are proud of. Its continued success cannot be attributed to local citizen support or demand. Rather, the Prairie Plan seems to continue to be driven by committed staff working to meet the needs of Chicago, which has to have someplace to put sewage sludge.

3.2.6 Boulder, CO: Building Public Consensus for Biosolids

3.2.6.1 Background

The City of Boulder conducted an award-winning, Class B biosolids land application program throughout the 1980s. The City saw the need to purchase land for long-term application and decided to buy part of the large tract of wheat acreage that they were already using in the neighboring community of Niwot, located within Boulder County. The first available parcel of this tract was purchased in 1991, with little or no interest from the public.

In 1994, more parcels of this land became available for the city to purchase. A public meeting was held to address the existing Class B land application program, and city representatives were overwhelmed when it was interrupted within minutes by enraged local citizens, some of whom had recently moved to the Niwot community. The citizens mobilized and demanded that the city stop land application in the entire area. When the city attempted to hold another public meeting on the issue, the meeting was attended by an even larger group of angry citizens. There was no question that the biosolids issue had "come to a head," and "that battle lines were drawn."

3.2.6.2 Public Acceptance Issues

- **Organized opposition**: Some community activists started a group called Neighbors Opposed to Biosolids (NoBS), a group with 2,300 members, intending to end all biosolids application near the area in which they lived. Succumbing to public pressure, the city "voluntarily halted land application [of biosolids] within the county and moved the land application program 60 miles away to a more agriculturally based county" (Oerke et al., 1998).

- **Media coverage**: The city was highly criticized, and understandably so, for its handling of this difficult issue. The media swarmed with headlines reading "The Neighbors Don't Want Boulder's Sludge," "Sludge: Boulder's Dirty Problem," and "Sludge Safety Questioned." In fact, Drew Clark, then State House Representative to the neighboring Boulder County communities of Niwot, Gunbarrel Hill, and Heatherwood, wrote in an editorial to the local paper, "[i]f biosolids are so good, keep them for yourselves and spread them on Boulder [City] open space" (Clark, 1994). The media teemed with misinformation and often reported on the "spectacular rather than the science" (Bebler, 2001). At that time, little public education was done by the City to help emphasize positive aspects and foster the acceptance of biosolids land application. One might have said that by this point, it was probably too little, too late. An acceptable compromise had to be achieved between the city and its neighboring citizens of Boulder County if biosolids were to be beneficially used in the future.

- **Building public consensus**: The city commissioned the formation of a Study Review Group (SRG) that was given the task of finding an acceptable method of biosolids management to present to the Boulder City Council. This group consisted of representatives from all sides of the biosolids issue, including local government, neighborhood associations, academic researchers, and environmental representatives. Two steps by the city were critical to building trust and helping the SRG reach consensus. First was the city's decision to hire an independent engineering consulting firm (RTW) to assist the SRG with technical evaluation of the biosolids management options and to "ensure thorough understanding of technical issues" (Oerke et al., 1998). Second, and perhaps more significant, was the provision of a facilitator to keep the SRG process open and honest. Although the facilitator was a city employee, he was perceived by the participants as being just and fair in administering the meetings, keeping the group structured and on track.

- **Letting the process work**: Even though the SRG participatory process seemed lengthy at times, this time was needed to build trust among the participants and to work through ideas and concerns and complex technical issues. All meetings were held in a public forum where interested citizens could listen to the discussions. The meetings were scheduled for two or three hours and usually held to the agenda time limits. The meetings also allowed presentation time for process vendors to introduce and promote their various biosolids management technologies to the group. Throughout the process, a total of eight to nine months, the members spent an average of five hours per week working on biosolids issues. Although the SRG was to recommend an interim plan for biosolids management, the City Council retained the power for final approval. Some members worried that their efforts would be all for naught if the city council overlooked their recommendations.

- **Biosolids management plan**: The end result of the many months of hard work by the SRG was the recommendation of an interim biosolids management plan that included both Class A and Class B alternatives. Ten to twenty percent of the city's biosolids would be composted at a private facility as a pilot program, while the remaining 80-90% of biosolids would continue to be land applied at the site 60 miles from the WWTP in a more agriculturally based county. This final interim plan recommendation, including all the monetary and non-monetary selection criteria set forth by the group and incorporated by the consultant, was truly representative of the group's overall consensus. The process had succeeded in producing an agreed-upon management program for the city's biosolids. Members of NoBS, the citizen activist for the project was also received from the Similco Mines (owners of the original mine site) management and staff, community leaders from the Regional District of Okanagan-Similkameen board of directors, and the Town of Princeton council. The benefits seen in the original demonstration areas convinced these leaders that the project was worth backing. group that had opposed the city's biosolids program, deferred to their representative on the SRG and supported the final SRG recommendations.

For the most part, the final resolution of the SRG and subsequent decision of the city council has quelled the dissension over biosolids use in the region. The city had accomplished its prescribed goal, that is, to continue beneficially using biosolids with overall citizen consensus. This consensus would not have been achieved without the SRG process. In 2001, the city of Boulder is in the process of deciding on a long-term direction for biosolids management. Several composting options are being considered, but all include Class A processing of 100% of the biosolids, rather than land application of any Class B biosolids.

3.2.6.3 Conclusion

When Boulder's biosolids land application program met strong local resistance in 1994, the staff convened a "Study Review Group" of diverse stakeholders that was given the task of finding an acceptable method of biosolids management. The group was provided independent technical consultation and a neutral facilitator. They met regularly for months, learning about various options, and eventually agreed on an interim plan that was presented to the city council for approval. The interim plan included a combination of Class A and Class B biosolids recycling, with the proportion of Class A composting to be increased once a pilot compost operation was completed. The outcome and the process were considered fair and productive by all involved, and controversy around the topic subsided after the interim plan was approved and began to be implemented. In the end, the city was able to adhere to its policy goal of recycling 100% of the sewage sludge it produced.

3.2.7 New York City's Citizen Advisory Committee: A Formal Public ParticipationStrategy

3.2.7.1 Background

With the passage of the Ocean Dumping Ban Act in 1988, the New York City Department of Environmental Protection (NYCDEP), the U.S. EPA, and the New York State Department of Environmental Conservation (NYSDEC), negotiated a consent decree to eliminate disposal of sewage sludge in the ocean. The consent decree contained a number of deadlines to implement immediate, intermediate, and long-range sludge (disposal/utilization) activities. The decree also included stiff fines if any deadline was not achieved. The first (immediate) phase consisted of siting, designing, constructing, and operating a total of eight dewatering facilities to dewater sludge produced at the 14 wastewater treatment plants in New York City. The second (intermediate) phase of the plan called for the NYCDEP to negotiate sludge processing contracts with private entrepreneurs to handle the dewatered sludge in a land-based system. The third (long-range) phase of the proposed plan was to depend on a series of in-City processing facilities that would produce biosolids products (compost, heat-dried pellets, and alkaline-stabilized products) that would be used in New York City. This long-range plan was later modified to utilize private contractors to process and beneficially utilize the biosolids.

3.2.7.2 Public Acceptance Issues

CACs are a common forum used by government agencies and other organizations to gain public participation in decision-making. Evaluations of CACs as a form of public participation have appear over the past two decades (e.g., Rosenbaum, 1983; Renn et al., 1991, 1995; Cohen, 1995). These evaluations stress that the effectiveness of CACs is improved by agreed-upon ground rules, wide and equitable representation, transparency of the process, early involvement in the decision-making process, opportunities for full learning of technical details by all CAC participants, and full sharing of information.

The NYCDEP had a long history of citizen involvement in its various programs, using CACs as a vehicle for providing information and gaining feedback on initiatives from a broad cross-section of New York City residents. Because of the history of working with CACs on other programs, the tight time frame for implementation of the land-based plans, and the complexity of implementing projects in the city, the NYCDEP established a Sludge Management CAC in March 1989. A Pretreatment CAC was also formed. The CAC met monthly during the development and initial implementation of the Sludge Management Plan. The CAC initially determined that the NYCDEP should pursue a policy of 100% beneficial reuse of the sewage sludge produced by the city. The CAC recognized that in order to reach that goal, the NYCDEP had to clean up the sludge, and the CAC spent a good deal of time examining this issue.

Several factors contributed to the success of the CAC in providing public input to the NYC process:

- **Diverse membership**: The original Sludge Management CAC was composed of 42 members. These members represented a number of environmental groups such as the Natural Resources Defense Council (NRDC), the Environmental Defense Fund (EDF), the New York Alliance for Clean Air, and others. Also represented on the original CAC were representatives of community boards, Borough (equivalent to County) Boards, and other political representatives; industrial and business representatives; and interested citizens. The environmental groups (e.g., NRDC, EDF) wanted to close down hospital incinerators (which fed into the sewer system), thereby addressing both air quality and biosolids issues. The industrial representatives were concerned about the impact of biosolids management on sewer discharge costs. The community Boards were primarily concerned with facility siting and local impact issues (New York City DEP, 1998-2000; Hazen & Sawyer, 1995). The CAC gained much of its strength and credibility from the diversity of its membership.
- **Technical support**: The NYCDEP provided the CAC with a $300,000 budget to develop a Request for Proposals and hire its own technical consultant. During the development phase of the Biosolids Management Plan, the CAC reviewed and commented on all technical documents related to the plan, including siting, transportation, technology, product marketing, generic environmental impact statements, uniform land use review procedure (ULURP), contracts, permits, and other issues.
- **Independence**: Both the NYCDEP and the CAC recognized that for the CAC to maintain credibility as an independent group, they would need to develop their own agendas for meetings, have access to all documents produced as early on in the process as possible, have access to NYCDEP and contractor personnel as needed, and, most importantly, be able to present opposing viewpoints as necessary. On some occasions, the CAC defended the actions of the NYCDEP. When it opposed the actions of the NYCDEP, the CAC raised the issues to the appropriate parties. When necessary, the CAC wrote letters to prominent public officials, including NYC Mayor Dinkins, the Administrator of the U.S. EPA, and a member of the New York City Council. These letters carried extra weight because they were not from the NYCDEP but from a group of informed and concerned New York City residents.

- **Agency cooperation**: The CAC was sufficiently comfortable with its role in the process that it felt free to address any concerns with either the process or the direction of the NYCDEP-developed plan with the NYCDEP commissioner or appropriate deputy commissioner. Issues raised included timing of release of documents, opposition to certain program elements, or requests for additional information. Each of these requests was addressed in detail so that the CAC knew their concerns had been noted and considered. This give and take allowed the CAC to support the final decisions, even when they were not entirely in accordance with the decision.

With the implementation of the long-range Biosolids Management Plan, the need for an independent sludge-only CAC ended. At this time, the sludge and pre-treatment CACs were merged, and a CAC for pollution prevention was formed. This CAC, comprised of about 45 people, meets six times per year and, like its predecessor, maintains its independence by setting its own agenda, calling in outside experts, and taking field trips as required to understand key issues. In 2000, the CAC prepared a letter supporting in-City use of biosolids produced under certain conditions.

3.2.7.3 Conclusion

New York City established a diverse Citizen's Advisory Committee (CAC) for sewage sludge management in 1989 that included representatives of environmental groups, community and borough board members, business representatives, city staff, and more. Committee members brought different interests and agendas to the process, but all recognized their responsibility for developing an agreed-upon Biosolids Management Plan. The city provided the CAC independence and technical support. The CAC commented on, and revised, the Plan, which eventually was approved and implemented. Thereafter, when issues arose, the CAC responded, defending the biosolids management program. A revised CAC still meets six times a year to review new information and make additional recommendations.

The experience of the NYCDEP is somewhat unique in that its CAC was formed at the outset of the biosolids management program, before positions on how to utilize biosolids had a chance to harden. This approach to utilization of a CAC contrasts with the Boulder, CO case study (Section 3.2.6), where the Study Review Group was formed after a problem had occurred. In that instance, positions had hardened, and the participants were more entrenched in their positions.

3.2.8 New York City and Rural Communities: Developing Trust Between an Urban Producer and Rural Users of Biosolids

3.2.8.1 Background: The Rural/Urban Tension

One of the more vexing problems facing society is that wastes that can be treated and become resources—such as biosolids—are produced in urban environments while the true value is best derived by utilizing the products in rural areas. Depending on the degree of understanding on the parts of both urban and rural stakeholders, frequently distrust and conflict occur when the resources are moved from cities to agricultural areas. This case study looks at how the New York City Department of Environmental Protection (NYC DEP) addressed the public education and participation issues leading to acceptance of its biosolids by Sierra Blanca, TX and Prowers

County, CO. A number of other cities, including Philadelphia, Chicago, Boston, and Denver, also have faced and addressed similar issues.

3.2.8.1 Background

From the onset of the Ocean Dumping Ban Act, which ended the practice of ocean disposal of sewage sludge, the NYC DEP advocated the concept of beneficial use of the organic matter and nutrients in the material. The NYC DEP recognized the difficulty of beneficial use of the product in New York State, due to climatic and soils issues. The NYC DEP also recognized the difficulties inherent in transporting NYC biosolids to rural agricultural areas, in part because of skepticism about biosolids quality.

To overcome these hurdles, the NYC DEP undertook several initiatives prior to the letting of any contracts. First, they organized a rigorous laboratory monitoring program to characterize the biosolids from each wastewater treatment plant. Second, they worked with the industrial pretreatment program to identify any industrial sources that could be cleaned up. Third, they worked with their Citizen Advisory Committee to garner support for the concept of beneficial use (see preceding case study). Fourth, they initiated discussions with the drinking water program of the NYC DEP to reduce the corrosiveness of the water, thereby reducing the leaching of copper and lead from the water conveyance and plumbing systems. Finally, the NYC DEP initiated a Request for Proposals (RFP) to identify private vendors who could implement a beneficial use option for the biosolids. The RFP requested detailed information on regulatory issues such as local regulations and permit requirements, as well as a public participation plan.

Because the NYC DEP was aware of the potential difficulties inherent in getting their biosolids accepted, they insisted that DEP staff be visible and involved in all local public meetings and other outreach efforts so that there would be no question that the agency stood behind the program. In response to the RFP, the NYC DEP selected vendors for land application at two sites: Sierra Blanca, TX and Prowers County in southeastern Colorado.

3.2.8.2 Public Acceptance Issues

Sierra Blanca, TX. The vendor, a private company called Merco Joint Venture, proposed to land-apply biosolids to a 90,000-acre ranch near the Town of Sierra Blanca in Hudspeth County, TX. Initially, 18,000 acres were to be utilized for land application of biosolids to revegetate arid and semi-arid rangeland. The project was initiated in 1992, after receipt of a state registration to operate. It was somewhat unique, in that the ranch was owned by the contractor, so that no other landowners were involved. The site was large enough that no off-site impacts were expected. For example, the closest application area was greater than three miles from the nearest off-site residence, and most applications took place about seven miles from the nearest neighbors. The biosolids arrived in individually sealed containers at a railroad spur on the Sierra Blanca Ranch, so all activities were carefully contained (Carlile and Gillane, 2001; Water Environment Federation and U.S. EPA, 1997).

- **Local opposition**: Despite this isolation, there was initial opposition to the site by local residents for several reasons. First, there was concern that the biosolids were toxic and would be harmful to the environment and area residents. Second, there was concern that Sierra Blanca was being selected as a dumping ground due to a concurrent, but unrelated, proposal to site a low-level radioactive waste storage facility nearby. Some saw the biosolids project as a classic case of urban versus rural interests, with potential environmental justice issues. Adding to the uneasiness were people's unfamiliarity with biosolids recycling, the fact that a private company with a profit motive was managing the program, and the sheer size of the operation (Addington email to NYC DEP, August 2001). The airing of Michael Moore's *TV Nation* television news story about the New York City "sludge train" brought national attention to the project. (Moore's hard-hitting style brought on a libel lawsuit by Merco that was decided in favor of Merco at the local level but was later found in favor of *TV Nation* by a federal appeals court.)

- **Local research and monitoring**: To address the concerns of regulators and local citizens over biosolids quality, Merco developed a rigorous biosolids monitoring protocol and a method to ensure that the biosolids containers remained sealed during their trip from New York City to Sierra Blanca. In addition, Merco funded nearly $3 million in research projects from 1992 to 1998. The research, carried out by researchers at Texas universities and consulting firms, looked at such issues as ecological effects of biosolids application on semi-arid and arid rangeland, occurrence of airborne particulates and pathogens during land application, evaluation of fecal coliform testing protocols for biosolids, watershed evaluation of surface runoff within biosolids application areas of the ranch, and fecal coliform regrowth during railcar transport and pathogen die-off after land application. Although the research focused on concerns raised by opponents, it is not clear that the research findings changed anyone’s mind, either for or against the use of biosolids.
- **Local benefits**: With time, many Sierra Blanca citizens gained confidence in the safety of the NYC-Merco biosolids program. In addition to the research, the contractor stressed the economic benefits of the project that accrued through hiring 43 local residents, paying a per-ton host community fee, and otherwise supporting local projects. When it came time for a renewal of Merco's contract in 1998, Sierra Blanca's mayor lobbied for the project because of the economic benefits it brought to town. Merco's biosolids management efforts at Sierra Blanca were noted with a U.S. EPA excellence award in 2000.

Despite what was viewed by many as a successful biosolids land application project, in mid-2001, New York City cancelled its current 15-year contract with Merco after its first three years. The reason given for the change was that the City did not have enough biosolids to meet the needs of its various biosolids management programs and, by contract, would have to pay Merco because of the shortage (Truini, 2001b). Thus, the biosolids marketplace drove the decision.

Prowers County, CO. The second, more traditional, land application program chosen by New York City was in Prowers County, in southeastern Colorado. The Prowers County project entails land application on multiple parcels of land owned by private farmers (Brobst, 1994; Scharp, 2000, 2001). Prowers County was chosen for the land application site because it was close to rail transportation, the crop grown (winter wheat) allowed for essentially year-round biosolids application, and the fields were large so that only a few fields need to be permitted each year. In addition, no biosolids land application had been practiced within 100 miles of the site prior to initiation of the project, so there were no existing biases regarding biosolids. The regulatory climate towards land application in Colorado was generally quite positive; both the State and the regional Environmental Protection Agency office had good experiences with and knowledge of land application. The Prowers County project was characterized by the following:

- **Engage opinion leaders**: The developer recognized that the most positive way to gain acceptance for the project was to develop an educational plan to address each segment of the program. The segments identified included regulatory compliance, elected officials, farmers, media, site location, management, and operations. The developers recognized that because they were outsiders, the best educational approach would be to educate a few key local people who were recognized as leaders and then have these local representatives do the majority of the rest of the educating. A key individual who had to be convinced of the beneficial properties of biosolids to the farmers of Prowers County was John Stulp, who is both a farmer and a County Commissioner; after talking with people around the country who had used biosolids, and reading articles about the pros/cons of biosolids use, Stulp ultimately “developed a real comfort level with the practice” (Stulp, 1995).

- **Local monitoring and research**: To help establish the program’s credibility, the developers agreed to do more monitoring than was required, rather than backing off due to cost constraints. A major concern of the public in Colorado was how to ensure that the contractor followed regulatory requirements. To address this point additional requirements were included in the land permit (but not required by any regulation), including additional sludge monitoring, a water quality monitoring plan, a special study on soil metal accumulation, and a container inspection and handling plan to ensure that nothing but actual biosolids could be slipped into shipments. They also funded a local, independent County inspector when it became apparent that the State of Colorado would not be able to inspect the site on a routine basis.
- **Information and outreach**: An ongoing information dissemination program has helped maintain the credibility of the developer 10 years into the project. The contractor’s public relations office made contact with statewide media, and the state and federal regulators made themselves available to answer questions for the media and local citizens. Stulp (1995) noted the importance of the widespread availability of information and local/regional experts to answer questions and address concerns. Well-moderated public information forums provided citizens with a wide variety of expertise and perspectives. Stulp (1995) stressed " Honesty, openness, and willingness to invest in communication and continuing education are principles that help relieve our concerns regarding the unknown. The success of this project…has occurred because the parties involved with it have adhered to these principles. Everyone, from the farmers, to the contractors, local leaders and citizens, and the regulatory agencies involved, is important to this success."
- **Local benefits**: According to Bob Brobst, U.S. EPA regional biosolids coordinator, perhaps the most critical component of the success of this program was that the host community has experienced direct financial benefits through decreased fertilizer costs and improved soils and crop yields. Evidence of local support for the program came when more than 50 county farmers wrote a letter to the Mayor of New York City requesting that additional biosolids be allocated to their program.

3.2.8.3 Conclusion

Part of New York City’s biosolids management plan has been to transport biosolids long distances for agricultural use in rural areas in western states. NYC biosolids managers recognized that overcoming concerns about contaminants in the city biosolids would be a significant obstacle. They took actions to overcome this: stepped-up pretreatment, reducing the corrosiveness of the city’s drinking water, strict monitoring of the biosolids, and garnering support from their Citizens Advisory Committee. In addition, city staff insisted that they be visible and involved in all communications and interactions with the communities where the biosolids were going to be recycled. For their part, the biosolids management companies that conducted the land application programs worked with local community members to develop practices that would help allay local concerns, such as a container inspection and handling plan to ensure that nothing but actual biosolids could be slipped into shipments. Extensive communications were conducted. Local farmers, ranchers, and officials were well-informed, so that some became proponents of the biosolids recycling programs. Another critical component of the success of the Prowers County program was that the host community received direct financial benefits through decreased fertilizer costs and improved soils and crop yields; the Sierra Blanca program, which did not involve harvesting crops, did not have the benefit of this additional economic incentive.

3.2.9 Denver, CO: Metrogro Farm Biosolids Land Application Program

3.2.9.1 Background

Over the past decade, the Denver Metro Wastewater Reclamation District (Metro) has faced significant public acceptance challenges to its biosolids beneficial use program. A summary of Metro's long-standing recycling program can be found in Stukenberg et al. (1993) and detailed accounts of Metro's experiences are provided in two recent conference papers by Pearlman et al. (2000, 2001), a survey of stakeholders), and in media coverage (e.g., Lloyd, 1998).

The Denver Metro District's 185 million-gallons-per-day treatment facility serves a population of 1.5 million and produces approximately 80 dry tons of biosolids per day. Metro began land application of treated sewage sludge in 1969. During the first 15 years of these operations, most of the biosolids were land applied to farms growing wheat and other dryland crops on the plains east of Denver. More than 150 privately owned farm sites were eventually permitted. Metro charged farmers $3 per acre for biosolids land application and estimated that the farmers gained between $30 and $60 per acre in benefits from the nutrients and tillage. In 1986, Metro began to compost a small percentage of its sewage sludge; the compost is sold in bags or bulk.

Over the past two decades, increased development in the "Front Range" region (along the eastern edge of the Rocky Mountains) reduced the availability of appropriate rural land application sites within reasonable transport distances from Denver. By the early 1990s, some of Metro's land application sites were more than 120 miles from the wastewater treatment facility. In order to gain greater control over the location of utilization sites, Metro began to acquire land eight miles east of the small plains town of Deer Trail, eventually purchasing adjoining tracts totaling 52,000 acres.

3.2.9.2 Public Acceptance Issues

Some at Metro assumed that, because it owned the land, and because the land was remote and had few close neighbors, "interference and objections from neighbors would be minimal" (Pearlman et al., 2001). This assumption was incorrect. Even when the public wastewater agency took control of every step of the biosolids production and use process—from pretreatment to land ownership and farming—there were still factors beyond its control that influenced the viability of the biosolids recycling program.

- **Management practices:** In reflecting on the past decade of Metro's biosolids program experience, Pearlman et al. (2001) note that an early mistake was to discount advice about best agricultural management practices made by local Soil Conservation District (SCD) personnel. Metro staff had failed to understand the importance of the land stewardship ethic in the Deer Trail agricultural community and the elected SCD. Farm management mistakes on the Metrogro Farm slowly increased local skepticism about the big city of Denver's motives and abilities. Impacts of the large number of trucks hauling biosolids on county roads, and other factors, began to be local concerns. Hostility toward Metro began to be evident at local meetings in Deer Trail.

- **Biosolids quality**: The peak of controversy came in 1997-1998, around regional public concerns about the potential impacts on biosolids quality resulting from the Metro wastewater treatment system receiving treated groundwater from the Lowry Landfill Superfund site. A dispute existed regarding whether or not this groundwater had high levels of radioactivity. Cleanup of the Lowry site was already an emotionally charged issue. The apparent uncertainties about that difficult cleanup problem spilled over into the Metro biosolids program.
- **Local opposition**: Concerned citizens spoke out strongly. The story caught the national media's attention: Cable News Network aired a *Moneyline* special report, "Denver Sludge is Stinky Biz" (Cable News Network, 1997), and the *Christian Science Monitor* printed a lengthy piece (Lloyd, 1998)—both of which increased public concerns about the Lowry groundwater entering Metro sewers. Growing distrust within the local community, and soil conservation district concerns about Metro's farming practices, led to a cease-and-desist order passed by the Elbert County Commission on June 26, 1997. In addition, a "Stop the Sludge" campaign gained the endorsement of numerous small environmental and union groups energized by the Lowry groundwater issue.
- **Public outreach:** Although Metro’s initial reaction to the public outcry was negative, ultimately the program chose public education and outreach over legal action against the Elbert County order. Metro worked to provide additional information about the biosolids program and to regain public acceptance by discussing local concerns, providing tours, and "building bridges." They implemented some of the recommendations of the Soil Conservation District, including erosion control and road maintenance, and involved local citizens in planning efforts to improve Metro's biosolids program.
- **Local monitoring**: Also in response to public environmental concerns, Metro funded an extensive independent monitoring program run by the U.S. Geological Survey (U.S. Geological Survey, 2000). Citizens were involved in selection of the USGS as the monitoring agency, as well as in selecting locations of monitoring wells. The costs were high—the monitoring program alone will cost Metro $1.4 million over six years (in addition to $700,000 from USGS). However, Metro’s new efforts led to reversal of the Elbert County cease-and-desist order, and a reduction in the number and intensity of complaints (even when, in July of 2000, about 30,000 gallons per day of treated groundwater from the Lowry landfill began to flow into Metro sewers).

In retrospect, Metro biosolids program managers have come to recognize the importance of designing biosolids land application programs to fit into the fabric of the communities in which they operate. These conclusions corroborated the findings of the Metro-sponsored report by Hunt and Oerke (1994) that public acceptance of biosolids in northeastern Colorado is affected by a whole host of political and social factors. According to Pearlman et al. (2001), the current degree of public support for Metro's large land application program can be attributed to measures implemented in response to concerns of the community near the Deer Trail Metrogro Farm land application site, including improved communications and implementation of an independent monitoring program. In 2000, a survey of Deer Trail area stakeholders, conducted by an independent consultant paid for by Metro, showed that the community has become somewhat more accepting of the biosolids recycling program as they have watched it evolve and noted some of the positive effects, while also witnessing the independent monitoring that has found no significant negative impacts (USGS, 2000). However, Pam Whelden, a former SCD officer and longstanding local concerned citizen, believes that local citizens must remain involved in overseeing the Metrogro farm operations, in order to ensure reasonable solutions to new developments.

3.2.9.3 Conclusion

Understanding and addressing the needs of the local community was a central element in making Denver's Metrogro Farm in Deer Trail, CO, a viable site for ongoing land application of Class B Denver biosolids. When Metro bought a huge tract of land for their biosolids recycling program, they expected to have little local public resistance. But neighbors and civic leaders became concerned about their farming methods. When an order to stop land application of biosolids came from the County Supervisors, Metro decided not to bring legal action, but, rather, to try to better understand and address the concerns. Over several years of dialogue, many tours of the site, and the development of an extensive independent monitoring program by the U.S. Geological Survey, relations between Metro and the local community of Deer Trail have improved. Lessons learned include:

1. Actions speak louder than words: successful biosolids programs live up to public commitments and adhere to best management practices;
2. Listening is more important than talking: project critics are often right and can provide valuable feedback; and
3. There is no easy, canned solution to gaining public support.

3.2.10 Philadelphia Biosolids Mine Reclamation Program

3.2.10.1 Background

Pennsylvania has used biosolids for reclamation of mine lands since the 1970s, and the City of Philadelphia at that time targeted mine restoration as a worthwhile application for its biosolids. In the twenty years since initiating the program, Philadelphia biosolids have been applied to 2,100 acres of scarred mine land, enriching the soil, reducing erosion and helping neutralize the low pH waters characteristic of coal mine runoff. The city estimates that more than 100,000 wet tons of material has been land applied, encouraging revegetation with native species which shelter an increasingly diverse wildlife community. Even with an active reclamation program, only 1.5% of disturbed lands in Eastern Pennsylvania have been treated with biosolids, and residual mining activity scars an additional 12,000 acres per year.

The application of biosolids to mined lands has been encouraged by changes in federal mining laws and the release of bonds to coal companies after 1977. Bond releases are tied to completion of land reclamation in a three-stage process, including rough grading of the site, establishment of vegetative cover, and site monitoring over a five-year period. Application of biosolids can support reclamation objectives by enhancing growth of vegetation, which improves the ability of soils to hold water, reduces erosion, and provides habitat for wildlife. Sporting birds, then deer and elk, return to the area, a boon to hunters.

Philadelphia biosolids have earned a reputation for high quality. The city's Biosolids Mine Reclamation Program has tested its material for metals and fecal coliform levels from the start; they have tested for groundwater contamination at sites. They have not tested for airborne pathogens or measured the intensity of odors (a growing public concern). Philadelphia has an active pretreatment program for effluents from the industrial sector, and the quality of its biosolids compares favorably with others in the region for metal content and pathogens. In one instance in the late 1980s, a load of material was found to be contaminated with demolition debris. The program investigated that incident and has suffered no similar incidents since that time.

3.2.10.2 Public Acceptance Issues

The application of biosolids to mine reclamation sites was less controversial in the early years of the program. In the early 1980s, local government was generally trusted by the public. There was a strong sense of mutual respect between federal, state, and local levels of government. Although large corporations were less trusted, the public appeared to believe in government's ability to impose reasonable restrictions on corporate polluters whose toxic effluents might otherwise work their way into wastewater systems. Opponents to biosolids application were disorganized, lacked resources and credibility, and were ineffective. Over time, however, this situation began to change.

- **Public participation**: The Pennsylvania Department of Environmental Protection (DEP) permitting process for mine reclamation with biosolids has provided little direct public input into the decision making process. DEP issues a modification of the land owner's mining permit, which involves public notification to nearby land owners and, in most cases, a public meeting to examine any technical issues that may have been missed. The DEP regards these meetings primarily as informational. However, since the mid-1990s, such meetings have become increasingly contentious, as biosolids opponents express their opposition in a more varied and vocal manner. Although opponents have not been able to consistently block the DEP-issued permits, they have sponsored local ordinances intended to make land application economically infeasible.
- **Local ordinances**: In Pennsylvania, recent local ordinances for biosolids have taken several forms, the most common of which requires the contractor to pay a tipping fee; tipping typically fees range from one to three dollars per wet ton of material, and are intended to recover local costs associated with truck use of township roads, time spent by local inspectors at the sites, and any independent testing done by the township. However, in response to public opposition to the biosolids program, some towns have adopted ordinances requiring tipping fees of $40-60/ton. In at least one instance, such an ordinance has been challenged and struck down, but the expense of litigating restrictive ordinances serves to deter the contractor from working in those townships. Other ordinances have imposed high local permit or inspection fees, exhaustive hydrogeologic studies, or other site work upon biosolids contractors.
- **Organized opposition**: During the past five years, opponents have become much more sophisticated in their approaches, using the Internet to quickly disseminate information that has an authoritative appearance and can galvanize opponents to attend and speak out at public meetings. Several larger regional organizations, including PENnet and a local chapter of the Sierra Club, have adopted positions in opposition to biosolids. An affiliated group of

biosolids opponents have passionately taken up the issue, claiming that biosolids contain high concentrations of metals, carcinogenic/mutagenic compounds, or deadly pathogens. They point to the case of an 11-year old named Tony Behun, who they claim died in 1994 of an infection he contracted from riding a four-wheeler in a field on which biosolids had been applied. This claim was published in two national news journals (*Time Magazine*, September 20, 1999; *USA Today*, October 7, 1999), stimulating an investigation by DEP and the Pennsylvania Department of Health. The study found no clear evidence linking the boy's illness with biosolids, but some uncertainty remains. Opponents also cite the views of experts in the field, notably EPA "whistleblowers" Hugh Kaufman and David Lewis, and research by Schiffman and others that suggests the possibility of health effects from odors and air emissions.

- **Communication and outreach**: Philadelphia's biosolids recycling contractor has several individuals who work on the local level to cultivate relationships with members of the site community. The contractor has been successful in addressing local concerns and having projects move forward when sufficient time and resources are devoted to outreach. For example, the contractor developed strong relationships with many Township Supervisors, who saw a public benefit to remediating blighted mine land. Watershed organizations, County Conservation Districts, and the State Agricultural Extension have either invited biosolids into their regions or offered credible testimony in support of the practice of mine reclamation with biosolids. Regulators at DEP also appear to respect the technical competence of the Philadelphia contractor and value the work they do at the community level. In response to anti-biosolids positions taken by some state legislators, contractors and wastewater treatment programs also have had to focus additional attention on providing information to the Legislature.

- **Urban vs. rural**: From the few interviews conducted, it appears that those who have moved from urban areas to rural communities are more likely to oppose biosolids recycling, and more likely to become fearful and aggressive in their opposition, than rural natives. Residents who have lived alongside mines for years seem complacent about the existence of mining sites and feel less urgency about mine restoration. Long-time rural residents also are more familiar with farming, earth-moving, and other practices similar to the use of biosolids for mine reclamation–which may make them more accepting. A subtext of the urban/rural distrust of biosolids may also relate to racial distrust. In a few statements by opponents to biosolids use, there are suggestions that the primarily white conservative rural population may be uneasy regarding urban residents of other race, ethnicity, and/or social standing who are involved in the generation of urban biosolids. There is some concern among rural whites, spoken only in private conversation, that Philadelphia biosolids will contain pathogens (hepatitis, HIV), or other contaminants (drugs, needles) that they believe are mostly associated with urban populations. The vague uneasiness created by this perception, when encouraged by negative statements about biosolids, can add to fear.

3.2.10.3 Conclusion

Philadelphia biosolids have been used for more than 30 years to restore barren lands scarred by past mining. This use has included extensive study by university researchers. Yet considerable public concern has developed throughout the state, and opponents have become sophisticated and effective. Concerned citizens have organized around the issue. They point to the origins of biosolids and the uncertainties involved in recycling them, and they have convinced some larger regional organizations and state legislators to oppose biosolids recycling.

Opponents have used the Internet as a means of communicating quickly and cheaply, and have pointed to two local deaths and the comments of EPA “whistleblowers” to support their concerns about biosolids recycling. As a result, maintenance of the Philadelphia mine reclamation program has become far more complex than it once was. Contractors must now pay constant close attention to local and regional social and political factors, more open and regular communications with more different stakeholders, addressing questions and concerns, and understanding the interests of concerned citizens.

3.2.11 Montgomery Co., MD: The Washington Suburban Sanitary Commission Regional Composting Facility

3.2.11.1 Background

The Blue Plains wastewater treatment plant serves Washington, D.C. and parts of Prince Georges and Montgomery Counties in Maryland and one county in Virginia. In the early 1970s, Blue Plains produced both digested biosolids and undigested sewage sludge. The principal mode of disposal was land application. As a result of poor land management practices, public opposition forced the Washington D.C. Council of Governments (COG) to seek alternative methods of sludge disposal. In 1978, a local federal appeals court required that each of these four political entities dispose of their pro-rata share of the sewage sludge collected at the Blue Plains wastewater treatment facility. The COG decided that the aerated static pile method, developed by USDA’s Beltsville research facility, was an appropriate method to convert the sludge into a beneficial use product.

As part of the sludge disposal solution, a temporary composting site in a remote corner of Montgomery County in Dickerson was established. This site was to exist for approximately five years while a permanent facility was built. The site for a permanent facility was chosen in Montgomery County on the border of Prince Georges County and nine-tenths of a mile from the edge of Calverton. Calverton was a Maryland bedroom community of some 1,600 detached, mid-range-valued homes. Citizens of Calverton opposed the project, but although they delayed the project for years, they were not able to prevent its construction.

In 1982, the Montgomery County Regional Composting Facility (often referred to as Site 2) began receiving sludge from Washington, D.C. This was the first large-scale, partially enclosed, sewage sludge composting facility in the United States. Owned and operated by the Washington Suburban Sanitary Commission (WSSC) on a 116-acre parcel of land, the facility was "designed to process up to 400 wet tons of sewage sludge per day, although it operated at half-capacity until odor issues were resolved" (Water Environment Federation, 2000a). It cost approximately $58 million, $28 million of which was provided by federal and state grants.

3.2.11.2 Public Acceptance Issues

- **Odors and health concerns**: In the early 1980s, state-of-the-art sludge composting technology was in its infancy, and several design aspects of the site were poor. Although it was one of the first compost facilities in the country to draw air down through the static compost piles, allowing the capture and treatment of malodorous air, initially, the odor control system was inadequate and the facility developed odors. Citizen opposition to the facility mounted. In response to the odor problems, WSSC reduced the volume of sewage sludge being processed at the facility and invested additional money in odor control by installing chemical scrubbers. The final odor control upgrade was completed in 1992 and allowed the facility to increase its capacity to close to the original design of 400 wet tons per day. However, by this time, any efforts at Site 2 to mitigate odors were not accepted by the citizens of Calverton. Furthermore, the issue of *Aspergillus fumigatus*, a ubiquitous fungus found at composting facilities, increased the concern of the citizens. Considerable research was conducted at Site 2 to evaluate public and worker health effects from bioaerosols. The data invariably showed that there were no health concerns (Lees and Tockman, 1987; Chesapeake Occupational Health Services, 1991; General Physics Corp. Environmental Services Division, 1991).

- **Product marketing**: Despite its problems, many communities viewed the Site 2 facility as a model for converting waste to a resource. The product produced was marketed as ComPro and was in great demand, due to its nutrient, organic matter, and lime content. A unique non-profit organization, spun off from the Maryland Department of Natural Resources, marketed the compost, including a bagged product (introduced in 1995) that sold in the region's garden and hardware stores. "Millions of people have appreciated the landscaping benefits of the Compro product without even realizing it. Compro is used on some of the most high-profile lawns and gardens in the country; including the White House, Mount Vernon, the Governor's Mansion in Annapolis, Maryland, and the celebrated Orioles Park at Camden Yards in Baltimore. When Tiger Woods and the rest of the 1997 U.S. Open Tour strode the fairways at Congressional Country Club in Potomac, MD, they were walking on grass fed with Compro" (Water Environment Federation, 2000a).

- **Shut down of the facility**: Site 2 was shut down in 1999. After more than 15 years of intractable dispute, citizens had finally established enough political power within Montgomery County government and the state. In addition, the Site 2 facility clearly provided limited benefits at great costs, and it was only processing a small percentage of the sewage sludge being managed by the County. Direct land application had become the preferred mode of biosolids management. In addition, the land on which the facility was located had become valuable commercial real estate. One final hurdle had to be overcome: the large debt owed on the facility. Through its hard-won political power, opponents to Site 2 were able to obtain forgiveness on state loans.

In the end, the same citizen concerns that had arisen years before led to the Site 2 closure. In testimony given in November 1996 before the Montgomery County Council, Professor Donaldson, speaking for the Calverton Citizens Association, endorsed "in the strongest possible terms" closure of the site because of ongoing, severe odor problems (Calverton Citizens Association, 1996). Despite opposition to the Site 2 composting facility, and general support for land application of biosolids, one Montgomery County Council member raised some concerns; Nancy Decek, who represents upper Montgomery County, worries that if, in the future, land application is terminated or reduced, the sludge would be disposed of by burning in the incinerator which is in her district and unwanted by her residents. Montgomery County and Calverton citizens had come up against the difficult choice of how to manage sewage sludge.

In looking back on the 15-year battle over Site 2, Professor Donaldson states: "In retrospect, it is possible that the composting experiment in the national capital area could have been a resounding success if we, the concerned citizens, the county government, and the WSSC worked together to find a mutually satisfactory solution. In hindsight, it is possible that there really was such a solution along the lines of a far less costly site located in the decidedly rural, western or northern portion of Montgomery County. Such a site could possibly have even been tied to Blue Plains by rail transportation, which would have even reduced transportation costs relative to those of Site 2."

3.2.11.3 Conclusions

The siting of WSSC composting facility in the small bedroom community of Calverton, MD outside of Washington, D.C., was fraught from the start with controversy and legal battles. In 1982, the site finally began receiving and composting sewage sludge from Washington. Odors were an immediate problem. Over the next 10 years, a variety of expensive odor control measures were added, amidst mounting local public anger and pressure. In 1999, local opposition had created enough political power to force closure of the facility. Several lessons can be learned from this case:

1. Proper siting of any facility is extremely important; the temporary Dickerson site would have been a much better site since it was in a remote, rural area with rail transportation and would have resulted in a less costly facility.
2. Communities change, and a site that was once good may no longer be.
3. A new technology and/or facility should be scaled up in phases in order to evaluate and deal with potential problems.
4. Citizens should be engaged in the development process as early as possible.
5. Involving the public in planning and decision-making can often result in better, more efficient, and cost-effective decisions.

The experiences gained at Site 2, the nation's first large-scale municipal sewage sludge composting facility, have assisted in establishing better management practices elsewhere. The current state-of-the-art in composting has resulted in extremely strict control of odors and the involvement of citizens in decision making (for example, see Farrell, 2001, regarding the new Marlborough, MA biosolids and municipal solid waste co-composting facility).

3.2.12 Everett, WA: Attempts to Site a Long-Term Biosolids Land Application Project on the Tulalip Indian Reservation

3.2.12.1 Background

The City of Everett, WA entered into a partnership with Seattle Metro (now King County DNR) to site a regional biosolids recycling facility. A large tract of forested land (925 acres) was identified on the Tulalip Indian Reservation near Port Susan. The Tulalip reservation, like many reservations, is not entirely owned by native peoples. Over the last one hundred years or so, much of the reservation has been sold to various entities including Union Oil of California (UNOCAL). In the 1980s, the tribe began to rethink the wisdom of selling off the reservation a piece at a time and instituted a policy of retaining the remaining reservation lands in tribal hands and regaining lands within the reservation boundary whenever possible.

For the purposes of siting the proposed biosolids recycling project, an option to purchase the land from the UNOCAL Corporation was secured. The City of Everett and Seattle Metro (the city) recognized that the tribal government was a powerful ally in siting a facility within the reservation. The Tulalip tribal government had no specific laws or zoning codes dealing with the land application of biosolids (or, at that time, "sludge") but was influential with county, state, and federal officials. The city offered to give the Tulalip tribes 250 acres of waterfront property at the close of the sale from UNOCAL. In addition, the city promised to transfer title of the remainder of the property to the tribes at the end of 20 years (the estimated life of the property as a biosolids repository). In return, the tribes were to support the city in its efforts to obtain permits to recycle biosolids on the property. The parties came to an understanding, but no written agreement was ever drafted or signed.

Public outreach and education was recognized as a crucial element in successfully establishing a biosolids recycling facility. The city and the tribes collaborated in an outreach program to contact individual neighbors of the proposed project. A tribal and a city representative went door to door and spoke with individual citizens prior to a public announcement that the city had an option to buy the property for use as a sewage sludge recycling facility. Interested citizens were invited to attend informational meetings and to participate in selecting a consultant to do the project design. A very short period of time was allotted for this important outreach, however, and several neighborhoods were not contacted.

3.2.12.2 Public Acceptance Issues

When the news broke in April of 1990 that the City of Everett had an option to buy property on the reservation for the purpose of "dumping sludge," neighbors that had been unaware of the project were outraged. Before the city could organize its first public meeting, a group of concerned neighbors convened a meeting of their own. The guest of honor and featured speaker was Linda Zander, an infamous local opponent and self-proclaimed victim of sludge. Ms. Zanders' message was simple: sludge kills. Sludge, she said, contains pathogens, heavy metals, and a host of toxic organics that we have not dreamed of testing for. Sludge projects pose a threat to surface water and ground water. Aerosols from sludge containing viruses, bacteria, and parasites could impact neigbors' health. And, sludge stinks.

Early May saw the first of a string of letters to the editor of the local paper objecting to the project. The May 23rd City Council meeting was dominated by a large contingent of concerned neighbors of the proposed project. The council was regaled with fears that water quality would be jeopardized by heavy metals and pathogens. Citizens requested information on several aspects of the project, including the effects of sludge on humans and wildlife, and the city was unprepared to respond. The Council was left with the impression that city staff did not know what it was doing. That impression was not entirely incorrect. Several council members became uneasy with the project. Support within city government was weakened. Nonetheless, the purchase of the property was completed at the end of May, 1990.

Over the next four years, the city worked to conduct technical and permitting analysis and public education efforts in a vain attempt to establish biosolids land application at the site. Public acceptance issues played a significant role in the failure of the project, as discussed below.

- **Organized opposition**: Neighbors of the proposed project formed an activist group called Residents Against Tulalip Sludge or RATS (later renamed Concerned about Tulalip Sludge or CATS). CATS organized a letter-writing campaign directed at the city and then at elected officials. Initially, letters were written to the city requesting information about biosolids and about the project. The city was inadequately staffed to respond to the information requests. As time wore on the public demeanor changed. Polite inquiries became terse. Letters to the editor openly questioned the motives of city staff and city officials, and citizens wrote to city council and county council members asking that the project be stopped. A frustrated citizenry began writing the governor, state legislators, and finally U.S. Congressman Swift and U.S. Senator Gorton.

- **Communications failures**: At the time that the project was proposed, city staff was not technically trained in biosolids manufacture and management; the primary city "expert" contact was a water quality scientist with virtually no experience with wastewater and no experience whatsoever with biosolids. This made staff reluctant to respond to the public's questions and concerns. Responses to the requests for information were, at first, timely, but then began to take weeks and months. To make matters worse, the city took an impersonal approach to providing information; documents were shipped to the city clerk and made available to the public for copying (at $0.25 per sheet). In an attempt to defuse concerns associated with the term "sewage sludge," city biosolids leaders began to refer to sewage sludge as organic nutrients (ON). (In this regard, they were a little a head of their time: no one else in the city, let alone the region or the country, was using alternative terminology.) Opponents seized on this unsanctioned name change and accused the city of obfuscating the issue and trying to confuse and mislead the public about the project. Nearly a year passed after the announcement of the pending land purchase before the city provided technical information about the project.

- **Environmental review**: Under the Washington State Environmental Protection Act (SEPA), the environmental review and site permitting process begins with the preparation of an environmental checklist. The outcome of the environmental checklist is a determination of whether or not additional environmental review is necessary. In the event that a "determination of significant adverse environmental impact" (DS) is issued, either an Environmental Assessment (EA) or an Environmental Impact Statement (EIS) is required. However, seeking to assure citizens that the city was conducting a thorough review of the project, the Mayor committed the city to producing an EIS even before the planning process had determined whether or not such a review was warranted.

  After struggling for several months, the planning department decided to issue a DS without the benefit of a checklist. Thus, the first official document relating to this biosolids recycling project was a declaration that the project was likely to harm the environment. City council members and several influential political leaders in the county began to openly question the wisdom of applying sewage sludge to the Tulalip property. Political opponents of the mayor exploited the issue to gain political advantage. As time passed, the lack of activity by the City created additional distrust; citizens began openly wondering what the city was plotting behind closed doors. CATS hired a high-profile environmental attorney to track the project as city staff struggled with the regulatory process.

- **Tribal opposition**: The media coverage produced by the controversy over the project began to generate interest in the property. Maps of the property were printed in the local paper. Several companies recognized that the property might have substantial value for uses other than sewage sludge recycling. Substantial sand and gravel deposits were thought to be on the property. Developers began to appreciate the shoreline access and panoramic views. Speculators, developers, and mining companies made unsolicited offers on the property. It became apparent to city officials that the property was worth substantially more than they had paid for it. The original plan of returning it to the Indians now seemed foolish, maybe even irresponsible. The city informed the tribes that the original agreement in principal resulting in a transfer of title of the land to the Indians in return for support of the project was no longer on the table. The tribes were outraged. In late fall of 1991, the tribal members voted to oppose the project until further technical details were supplied. The media covered the tribal meeting and trumpeted the anti-sludge vote. Opposition from the tribes resulted in the emergence of a new issue. Now the city was perceived as the white man dumping his smelly burden on Native Americans.

- **Public education**: In March and April of 1992, a series of sludge workshops were held near the project site to provide technical information to the public on sewage sludge recycling and the use of biosolids for fertilization. The workshops covered biosolids quality, forest fertilization with biosolids, agricultural fertilization with biosolids, geohydrology and groundwater, and land application permitting. Experts from outside the city were brought in to explain the science behind biosolids recycling. The technical workshops were reasonably well received by a skeptical public, but a two-hour workshop could not totally change public perceptions formed during 12 months of negative statements by opponents and concerned neighbors. Then, a second workshop was held to educate the public on the permitting process for sewage sludge land application. The fact that the proposed site was within the reservation boundary, but not owned by the tribe, had caused some confusion as to which agency or agencies had jurisdiction over the project. At the workshop, participating federal, state, local, and tribal representatives were unable to clarify who had jurisdiction for the proposed project, and opposition to the project was galvanized.

The city toiled for some time, but never released a final scoping document. In 1994, the first geohydrology studies were begun. However, a new mayor took office early in 1994 and concluded that the property was far more valuable as a potential gravel mine, a high-end development, or both. The sewage sludge project ended, and marketing of the property began. Ironically, in 2001, the property was sold to the Tulalip tribes.

3.2.12.3 Conclusion

From an engineering perspective, the Tulalip property was an excellent choice for a biosolids recycling facility. The soils, topography, and geology were ideal for forest application of biosolids. It was a large tract of land in proportion to the tonnage of biosolids that was to be recycled. The site was relatively remote, yet accessible by a major county road. The site involved an opportunity to partner with a powerful and influential local presence—the Tulalip tribes. And yet, the project failed.

Biosolids managers from the City of Everett have reflected on their failure to successfully develop a forestry biosolids land application program on the Tulalip Indian Reservation. Although the city staff notified and involved local community members early in the development process, they failed to involve some key community leaders. And, more importantly, they were not well trained and were unable to answer questions and concerns in a timely manner. In addition, some social and political factors were overlooked; for example, the agreement worked out between the city and the tribe turned out to be politically and socially unacceptable to many people in the area. Finally, city staff did a poor job of gauging the mayor's and city council's commitment to the project; when the public outcry grew, the policital support for the project waned.

The Tulalip experience was painful and expensive (at least to the mayor, as he lost an election), but the city biosolids management program has gone on to develop several high-profile, successful biosolids recycling projects.

3.2.13 Kern Co., CA: An Ordinance Banning Class B Biosolids

3.2.13.1 Background

Kern County, CA is the fourth most prosperous agricultural county in America. The crops grown include direct food-chain crops such as carrots, non-food-chain crops such as cotton, and indirect food-chain forage crops for the growing countywide dairy industry. In addition to the abundant agricultural land, Kern County enjoys the advantage of being relatively near the populated areas of Los Angeles and Orange County. Because of the large potential market for nutrients in Kern County, and because of increased costs of biosolids handling, Los Angeles and Orange County contractors started hauling biosolids to Kern County in the early to mid-1990s. Initially, there was no opposition to the practice, and the volume of biosolids utilized in the County increased to the extent that Kern County was handling almost one-third of the biosolids produced in California. This was twice as much as was land applied in the next most utilized county.

Then, in the mid-1990s, a series of incidents occurred that caused Kern County acceptance of biosolids to change markedly. The most visible incident occurred in the dry eastern part of Kern County, when a major storm sent large volumes of biosolids from one field to a neighbor's field. Unfortunately, the neighbor did not want the biosolids, and apparently no effort was made to remove the biosolids and restore the land. This incident caused the farmer to start complaining about the activities of his neighbor, where he said that the neighbor just dumped the biosolids and did not make any attempt to grow crops. From this incident and other complaints about odor and trucking, opposition to the practice of beneficial use grew almost exponentially.

3.2.13.2 Public Acceptance Issues

The Kern County case study involves a number of interesting issues that, when taken together, led to the banning of Class B biosolids, effective in January 2003. These issues center on rural resentment versus perceived urban arrogance.

- **Public education**: Unlike in Colorado, where because of an intensive educational campaign, rural farmers welcome biosolids from New York City, no such educational campaign was undertaken by the City of Los Angeles and Orange County contractors. This is exemplified by the comments of a Kern County farmer, Ed Palls, who stated, "We don't want to be L.A.'s toilet." It is crucial to inform and involve the public about land application and carefully monitor the practice, especially when an urban utility wants to utilize the resources of a rural area.

- **Proving zero risk**: A second issue in Kern County's decision to ban Class B biosolids arose from the inability of biosolids proponents to prove that there was absolutely no risk associated with land application of biosolids. In the absence of such "proof," the County took the precautionary approach of banning the practice. This concept of needing to prove a negative is advocated by the Cornell Waste Management Institute (CWMI) in "A Case for Caution" (Harrison et al., 1999).

- **Organized opposition**: The most significant opposition to biosolids application in the County came from an economically important local industry, the carrot growers. The growers were concerned about public fears that utilization of Class B biosolids would somehow taint the carrots, even if Class B biosolids were not used in the carrot fields. The carrot growers were concerned that this perception could ultimately lead to a boycott of their product by the public.

- **Use of low-bid contractors**: The fourth issue that led to the ban was the use of low-bid contractors who took shortcuts to reduce costs, which led to environmental concerns. Kern County represents a case where there was a diverse group of land appliers operating in the County under a variety of contracts. These operators had, in some cases, limited supervision. The opposition, on the other hand, was united and politically entrenched in the County.

3.2.13.3 An Ordinance Banning Class B Biosolids

In November 1996, in response to growing public opposition, the County of Kern Board of Supervisors (Board) got involved in the biosolids issue, and referred the issue to the Resource Management Agency (RMA) Agricultural Commissioner’s Office and County Counsel for recommendations. The RMA director, David Price III, appointed a Biosolids Ordinance Advisory Committee (BOAC). The BOAC was comprised of two sewage agencies, a biosolids composter, two biosolids-using farmers, a number of farmers opposed to biosolids utilization, the local farm bureau representative, two representatives of regional water quality boards, a Sierra Club representative, and David Price III.

The BOAC technical subcommittee was comprised solely of representatives of Kern County departments and the local air pollution districts, with no representatives from the biosolids industry. The subcommittee developed an interim urgency biosolids ordinance, which was adopted during the summer of 1998. This interim ordinance had an expiration date of January 11, 2000 and was subsequently replaced by a permanent ordinance, which was adopted on October 19, 1999 and became effective on January 1, 2000.

The ordinance was developed to ensure protection of public health and safety and to provide a mechanism to ensure local control and enforcement of nuisance issues. The ordinance was developed over a two-year period with a series of meetings, public hearings, and workshops allowing for public participation and input. During the implementation process, a road closure due to damage of a local road by biosolids-carrying trucks caused this issue to be included in the ordinance and led to a significant fee of $2.25 per ton of biosolids carried on local roads. An additional monitoring fee of $1.12 per ton is included as well.

The ordinance allowed for continued application of Class B biosolids at existing sites until January 1, 2003. This date was chosen to allow amortization of sunk costs; therefore, Kern County cannot be accused of illegally taking lands. No new land can be permitted for land application after enactment of the ordinance. The ordinance requires monitoring of 40 CFR Part 503 metals, nutrients, and PCB/dioxins; provides site restrictions and setback requirements; requires certain recordkeeping; and requires an impact fee of $3.37 per ton of biosolids land applied in Kern County.

The rationale for the ordinance is telling as to the mindset of the BOAC technical subcommittee. The rationale quoted the CWMI study “There is no such thing as 'safe’... the question really is 'is the risk acceptable?'” The subcommittee felt that in light of the current scientific debate over risks associated with land application of sewage sludge (biosolids), they would be remiss if they did not ban Class B biosolids. It is interesting to note that the subcommittee did not have the same concerns about manure, which contains, in some cases, significant pathogens, and/or Class A products, which can contain metals.

The ordinance underwent a series of court challenges aimed at the legality of the process. By 2003, however, Orange County had developed improved rapport with Kern County through development and implementation of an environmental management system, although more issues remain to be addressed over time.

3.2.13.4 Conclusion

In late 1999, Kern County, an agricultural county in south-central California, adopted an ordinance banning land application of Class B biosolids. The ban threatened major biosolids recycling programs of Los Angeles and Orange County. Issues that led to the ban included:

- The lack of any education and outreach campaign, which resulted in entrenched, unchangeable opposition on the part of Kern County residents;
- Apparent scientific uncertainty regarding the safety of biosolids recycling, and the impossibility of proving zero risk;
- The opposition of local carrot growers, concerned that negative public perception of biosolids would spill over into concerns about the safety of their produce;
- Use of low-bid contractors who took shortcuts to reduce costs, which led to local environmental concerns; and
- Lack of monitoring of contractors and practices.

The biosolids program contractors failed to recognize significant political and social motivations in Kern County and how to deal with them. Since the conflicts of 1998 and 1999, it has taken several years to begin to reestablish some trust amongst stakeholders.

3.2.14 New Hampshire: Failure and Rebound of Biosolids Recycling

3.2.14.1 Background

By the early 1990s, the northern New England states of Maine, New Hampshire, and Vermont all had ongoing biosolids land application programs, including evolving state regulatory oversight. In New Hampshire, biosolids land application had been piloted at Somersworth in the mid-1970s, and composting was tested at Durham with assistance from University of New Hampshire researchers. Similar biosolids recycling developments had occurred in Maine and Vermont.

But New Hampshire took a different approach from its neighbors in 1993-1995. When the U.S. EPA promulgated the 40 CFR Part 503 Rule, New Hampshire chose not to regulate sewage sludge at the state level. Planned revisions to the state's sewage sludge management rules were set aside and the state's regulatory personnel were involved only to the extent of providing technical assistance and education. The rationale was that, according to the best current research and the U.S. EPA, treated sewage sludge being recycled to land posed minimal risks. New Hampshire's frugal budget and preference for as few regulations as possible could not support a state program that appeared to be redundant of the federal rules. Enforcement and oversight were left to the one part-time staff person at U.S. EPA Region 1 in Boston, MA (Beecher, 1996).

3.2.14.2 Public Acceptance Issues

The state’s decision not to play an active role in sludge regulation set the stage for strong, negative public reaction to sludge disposal in New Hampshire. Public acceptance issues included concerns over management practices at biosolids application sites, possible adverse health effects from biosolids exposure, and poor communication to the public about the program.

- **Management practices**: The lack of state regulations meant that New Hampshire was a cheaper place for biosolids disposal than states requiring state permits. Thus, private companies managing sewage sludge for municipalities as far away as New Jersey came to New Hampshire to find land application sites. In addition, the federal regulations did not include management practices—such as setbacks and odor control—designed to avoid nuisances and other local impacts. The industry in New Hampshire, and the region, involved many competitive private firms and numerous wastewater treatment facilities trying to find the most cost-efficient ways to manage sewage sludge. The relatively young biosolids management marketplace created incentives for cutting corners and trying new processes. While some well-established land application companies continued to manage biosolids in New Hampshire with the best management practices used in other states, other managers did not do as good a job. Only minimal oversight and enforcement of sewage sludge use or disposal was provided by the regional office of the U.S. EPA. Complaints and questions about odors, messy trucks, and other nuisances and local impacts began to pour into the state's Department of Environmental Services (DES). Even when emergency rules, and then final rules, were adopted by DES in late 1995 and early 1996, respectively, the local anger continued.

- **Health concerns**: The death of an apparently healthy Greenland man, Shane Conner, in the fall of 1995, brought the sewage sludge management issue to a climax in New Hampshire. Conner, a 26-year old man who lived near a hay field where biosolids were applied, suffered unusual symptoms, then died. The family and some vocal opponents to biosolids recycling blamed his death on the biosolids, even though the state medical examiner and the Greenland Board of Selectmen found no evidence to support such a claim. A lawsuit, brought by the family against the land application company, the biosolids generator, the landowner, the farmer, and the state of New Hampshire was eventually settled. The man's family received an undisclosed sum of money and signed a statement that there was no scientific evidence linking biosolids to the unfortunate events (New England Biosolids and Residuals Association, 2001). In a separate incident, a farmer in a western New Hampshire town told a legislative committee that he thought "sludge" had led to the death of his cows; DES staff and other officials disagreed with his assessment.

- **Organized opposition**: Initially, New Hampshire citizens were mostly unaware of wastewater treatment and sewage sludge management. This began to change quickly, however, with newspaper headlines such as: "Folks Get Wind of Sewage in Bristol," "Auburn Sludge Operation Shut Down," and "Few Rules Apply to Sludge Spreading." Public meetings, intended to provide accurate information to local residents, turned into angry public debacles. Opponents, outraged by the apparent inadequacies of management practices and oversight and enforcement, took their concerns to every potential forum of public discourse. In addition to encouraging towns to ban biosolids, they took the issue to the media, the DES regulatory process, the courts, the legislature, and the election process. They routinely wrote letters to the editor and developed press events. They weighed in heavily in the regulation development process. The New Hampshire chapter of Sierra Club sued the state. During the legislative sessions of 1999 - 2001, the legislature had an extensive education about biosolids recycling as it considered more than twenty bills on the subject. And state election campaigns for the House and Senate and the 1996 and 2000 Governor's races included discussion of biosolids management.

- ♦ **Local ordinances**: Local towns, pressured by concerned citizens, encouraged by vocal opponents, and with limited technical resources and time, began to take the conservative approach of just saying 'no' to sewage sludge management in their towns. Local bans and moratoria on Class B land application, and, in some cases regarding all sewage sludge products, proliferated. Today, 38 (or 17%) of the state's municipalities have ordinances in place banning or severely restricting at least some biosolids products (mostly Class B).
- ♦ **Communications**: Biosolids managers, both wastewater treatment facility operators and those working for private management companies, as well as state DES staff, were behind from the start. With limited staff and time, biosolids regulators and managers could not meet public demands for information. They had too few established communication outlets, too few informational materials, and too few knowledgeable spokespeople who could readily answer questions with sound technical information. Thus, as questions increased and remained unanswered, the public's skepticism grew.
- ♦ **Seeking consensus**: Two formal efforts were made by the state DES to develop a more constructive dialogue. First, a "Granite State Residuals Task Force" was established with members representing all perspectives, but the group lacked a clear mandate and objective, and proved ineffective. DES then established a "Sludge Management Advisory Committee" (SMAC), with many of the same participants. SMAC adopted a more formal process of joint fact-finding and education, including informative sessions led by university and cooperative extension experts. SMAC's 18 months of work ended in May of 2001 with an indefinite postponement of further meetings. Although it provided no formal consensus recommendations to the DES, the SMAC process did yield somewhat improved mutual understanding and developed a stronger, and more scientifically sound, information base for all participants.

Jim Graham is a reporter and editor for the *Concord Monitor,* one of New Hampshire's leading newspapers and the major paper published in the state's capital city. As an experienced environmental and political issues reporter, he has been covering the entire recent sewage sludge/biosolids debate. Graham feels strongly that the biosolids issue is not going away. "People are more aware of the debate, but there is still concern about odors, potential well contamination, and more." He believes each New Hampshire community in which a land application program is proposed will still have a tough debate. "It will be an issue for the local people no matter what other communities or states have done. ... It won't ever fade away. Hopefully, the level of debate will be more sophisticated—beyond just odor problems; beyond the simplistic 'this is bad nasty stuff that is flushed down the toilets and we don't want to see it again.' We need to focus on the true potential of biosolids recycling. After all, siting landfills is almost impossible."

3.2.14.3 Conclusion

When the federal Part 503 sludge regulations were adopted in 1993, New Hampshire chose not to regulate biosolids any further, beyond the federal rules. Because Part 503 has few requirements for managing biosolids to avoid public nuisance, New Hampshire quickly experienced conflict between some biosolids managers who failed to avoid the generation of malodors and other nuisances and communities in which land application programs were occurring. By 1995, conflicts were occurring around the state. Biosolids recycling became a political issue, even in the 1996 and 2000 gubernatorial campaigns.

At first, biosolids managers did not have adequate information or support to address the growing list of public concerns. Opponents convinced more than 30 towns to impose significant restrictions or outright bans on biosolids recycling. But biosolids managers, wastewater operators, and state regulatory officials began to work harder at addressing the conflict through meetings and advisory groups. Although it was a difficult and frustrating public debate for all involved, increased mutual understanding developed. Once new state rules were adopted in 1999, fewer complaints ensued and the conflicts diminished.

Today, New Hampshire biosolids managers better understand the perspective of concerned environmentalists–concerns about the long-term impacts of trace metals and chemicals applied to the land in biosolids products, the potential impacts on public health of trace pathogens (especially in Class B biosolids), and concerns about the amount of testing, oversight, and enforcement being done to ensure that existing regulations are being followed. For their part, many critics of New Hampshire's biosolids recycling programs have come to a better understanding of the limited options for cost-effective sewage sludge management and the challenges faced by water quality professionals working with wastewater and biosolids on a day-to-day basis. The mutual respect that has developed amongst some people on various sides of the issue may lead to more productive and mutually satisfying progress on sewage sludge management issues in the future.

Although it was a difficult process, the benefits coming from New Hampshire's conflicts are clear. The state regulatory structure is improved and includes requirements for up-to-date best management practices and monitoring. Complaints have diminished dramatically. The media is now experienced with the issue, and coverage has become more informed and thoughtful. State legislators have spent many hours learning about sewage sludge management. And biosolids managers have developed an understanding of the need for attention to legitimate public interests.

In 2003, the biosolids recycling situation in New Hampshire is more stable. Long-standing Class B land application programs continue on dairy and other farm lands and at gravel pit reclamation sites. Biosolids composting continues in several municipalities. And, despite the controversy, one of the larger cities, Nashua, made a commitment to land application of Class B biosolids, commemorating a new egg-shaped anaerobic digester complex in May 2001.

3.3 Case Study Acknowledgments

The primary author of each case study is listed below, along with sources other than those found in the annotated bibliography. However, additions and edits to the case studies have been made by the Project Team, with input from additional sources. Therefore, any errors are the ultimate responsibility of the Project Team and Principal Investigator, Ned Beecher. The case studies were written to highlight particular public perception, participation, and acceptance issues; they should not be cited or relied on for technical or historical details.

Table 3-3: Case Study Acknowledgements.

	Case Study	Primary author(s)
3.2.1	King County, WA: The Importance of Third-Party Support	Roberta King and Peggy Leonard, *NBMA and the King County Department of Natural Resources*
3.2.2	Milwaukee, WI: A Long-Term Marketing Success	Ned Beecher, *NEBRA*
3.2.3	Jefferson Co., AL: Biosolids Mine Reclamation	Ned Beecher, *NEBRA*
3.2.4	Princeton, BC: Reclamation of the Granby Tailings Site	Ken Lee, *NBMA and Greater Vancouver Regional District*
3.2.5	Fulton Co., IL: The Prairie Plan for Chicago Biosolids	Ned Beecher, *NEBRA*
3.2.6	Boulder, CO: Building Public Consensus for Biosolids	Jennifer Filtz, *E & A Environmental Consultants*
3.2.7	New York City's Citizen Advisory Committee: A Formal Public Participation Strategy	Joel Alpert, *Compost And Technology Solutions, Inc.*
3.2.8	New York City and Rural Communities: Developing Trust Between an Urban Producer and Rural Users of Biosolids	Joel Alpert, *Compost And Technology Solutions, Inc.*
3.2.9	Denver, CO: Metrogro Farm Biosolids Land Application Program	Ned Beecher, *NEBRA*
3.2.10	The Philadelphia Biosolids Mine Reclamation Program	Barry Connell, *Center for Environmental Communications*
3.2.11	Montgomery Co., MD: The Washington Suburban Sanitary Commission Regional Composting Facility	Eliot Epstein, E & A Environmental Consultants and Ned Beecher, NEBRA
3.2.12	Everett, WA: Attempts to Site a Long-Term Biosolids Land Application Project on the Tulalip Indian Reservation	Dan Thompson, NBMA and City of Everett, WA
3.2.13	Kern Co., CA: An Ordinance Banning Class B Biosolids	Joel Alpert, Compost And Technology Solutions, Inc.
3.2.14	New Hampshire: Failure and Rebound of Biosolids Recycling	Ned Beecher, NEBRA

And thank you to the following for initial recommendations on the literature review and case studies: Maurice Barker, Janet Bauchman, Pradip Bhowal, Chris Bowman, Kyle Dorsey, Lauren Fondahl, Cathy Jamieson, Eric Meintzma, Frank Murphy, Mark Schmitz, and Todd Thompson.

CHAPTER 4.0

THE 2002 BIOSOLIDS PUBLIC KNOWLEDGE AND PERCEPTION SURVEY

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4.1 Background

The nation's dependence on effective wastewater treatment requires an increasing capacity for the management of sewage sludge and biosolids. The amount of municipal sewage sludge generated annually continues to rise. The U.S. EPA (U.S. EPA Office of Solid Waste and Emergency Response, 1999) estimates that more than seven (7) million dry tons of sewage sludge are generated each year, compared with four and one half (4.5) million dry tons in 1972, and that U.S. municipalities will produce more than eight (8) million dry tons annually by the year 2010.

Approximately 60% of the sewage sludge produced today is applied to land as biosolids fertilizers or soil amendments, an increase from 33% in 1988. This trend, in conjunction with the increasing amount of biosolids produced, means that more land application sites are being proposed to meet a growing demand.

Many of these sites are surrounded by neighbors whose perceptions of biosolids are largely unknown. The purpose of the 2002 Biosolids Knowledge and Perception Survey, therefore, was to find out:

- what these potential neighbors know about biosolids,
- how they perceive biosolids recycling as a public policy,
- how they perceive biosolids in the context of their lives, and
- what kinds of information influence their decisions about biosolids management.

The survey questionnaire and a summary of the collected raw data appear in Appendices B and C.

4.2 Methods

4.2.1 Survey Domains

The survey was designed to test a series of hypotheses about the influence of lifestyle choices, life experiences, and demographic characteristics on the public's comfort or unease with biosolids recycling (Table 4-1). The selection of survey domains (topics for survey questions) and development of the survey itself were guided by the information obtained through the literature review, case studies, and discussion with project reviewers and other key stakeholders.

The survey was designed to obtain information in the following domains:

- information on what people know about wastewater treatment and biosolids management;
- initial impressions of the wastewater treatment process and the use of its byproducts;
- specific knowledge of biosolids;
- how respondents react to the language that describes solids from wastewater treatment;
- how respondents obtain information about technical/environmental issues;
- what factors increase or decrease the level of concern about biosolids recycling;
- what types of information influence people's opinions regarding biosolids recycling;
- which sources of information are most trustworthy; and
- how respondents rank the risk of biosolids recycling in comparison to other activities in their daily lives.

Additional questions were developed to identify characteristics of the respondents so that experiences and traits could be correlated with responses to questions about wastewater treatment and biosolids recycling. Specifically, questions were included to gather information on the following lifestyle and demographic characteristics:

- Lifestyle choices and experiences: whether or not a person
  - lives in a rural, suburban, or urban area;
  - has lived in a farming or ranching community;
  - does any farming or gardening;
  - uses fertilizers (and what kind of fertilizer?);
  - chooses organic foods; and/or
  - considers himself/herself an environmentalist.
- Demographic or social characteristics:
  - age;
  - gender;
  - race or ethnicity;
  - level of income;
  - whether or not children live in the household;
  - level of educational attainment;
  - ways in which they obtain news or information;
  - working in or having received education in a scientific field; and
  - region of the country in which they live.

Some of the characteristics being tested in this way are based on assumptions made by people involved in biosolids recycling; for example, it is widely assumed that people with direct experience with farming are more likely to understand and accept the use of biosolids, an assumption that was tested by the survey.

Finally, some questions were developed from two smaller previous national surveys of public opinion, that reported by Powell-Tate (1993) and that of Frederick Schneiders Research (1998).

Table 4-1. Hypotheses Tested by the 2002 Biosolids Public Knowledge and Perception Survey.

Hypothesis 1.	Few people are knowledgeable about wastewater treatment or biosolids recycling.
Hypothesis 2.	Certain lifestyle choices and experiences influence a person's knowledge, perception, and opinion regarding biosolids recycling.
Hypothesis 3.	Demographic or social characteristics influence a person's knowledge, perception, or opinion regarding biosolids recycling.
Hypothesis 4.	Most people have some negative reaction to the concept of using treated sewage sludge / biosolids as a fertilizer or soil amendment, although they are accepting of using animal manures.
Hypothesis 5.	Personal proximity to biosolids affects the way in which they are perceived.
Hypothesis 6.	The messages that introduce people to a new or innovative technology, such as biosolids recycling, influence the formation of their opinions on the subject.
Hypothesis 7.	Certain factors about biosolids recycling programs (including the source and cost of biosolids) heighten concerns.
Hypothesis 8.	Some positive and negative messages about biosolids are more convincing than others.
Hypothesis 9.	Certain types of individuals and institutions are considered more trustworthy and credible than others as a source of information about environmental issues such as biosolids.
Hypothesis 10.	Perceived risk of biosolids recycling is often high in comparison to other known and perceived risks.

4.2.2 Survey Language and Interpretation

The specific language of the survey was developed through a consultative process between the Center for Environmental Communications and Ned Beecher at New England Biosolids and Residuals Association, with the assistance of the Survey Center of the University of New Hampshire. This instrument was subsequently reviewed and commented upon by Elaine Vaughan of the University of California at Irvine and Douglas McKenzie-Mohr of St. Thomas University (New Brunswick), who have conducted extensive research into public perception and participation in environmental programs. The input of the Biosolids Stakeholder Review Panel also guided development of the domains, leading to final survey language.

The final survey questionnaire is included in Appendix B. Most of the questions in the survey were open-ended, i.e. the respondent was not provided with a list of possible answers from which to choose. If possible answers were provided by the interviewer, it is clearly indicated in the text of the question. Text in a question that is printed in **ALL CAPITALS BOLD** is an instruction to the interviewer. For example, in Question 7, the "IF YES, ASK" is an instruction to the interviewer:

Q7. "Do you ever seek out and purchase and eat foods that are specifically labeled as being organically grown?" IF YES, ASK: "Would you say you do that occasionally … frequently … or all the time?"

The verbatim questions and interviewer instructions are included in order to provide the reader with as much information about the interview process as possible.

The beginning of the survey included questions to expose respondents to the survey format and to statistically balance the sample for gender, home ownership, and regional distribution. At the end of the survey were a number of additional questions intended to obtain demographic information about the respondents such as age, race, level of education, income level, and number of residents per household, as well as some questions used to statistically balance the survey against additional sampling error.

The language used in the survey questions introduced several potential sources of bias:

- **Issues raised in survey questions**: Some questions in the survey (e.g., those that mention factors that may increase or decrease the level of concern over biosolids) may have influenced respondent views about biosolids recycling as the survey progressed. However, the survey was designed to minimize bias around key questions (questions that appeared early in the survey) as much as possible, and sampling methods took this factor into account.
- **Choice of terminology**: In describing relevant materials and processes, the survey used simple and universal terms, not all of which were as precise as language used by scientists or industry professionals. For example, the term "sewage" was used rather than "wastewater" and "publicly-owned treatment works" (POTWs) were called "sewage treatment plants" because the survey developers believed that these terms are more clearly understood by members of the public. The goal of simplifying the language was to balance precision against understanding of the questions by a broad cross-section of the public. In addition, some terms (such as "human waste," "human manure," and "sewage sludge") elicit strong reactions because of their focus on the origin of the material, whereas the term "biosolids" is generally free from associations (Powell-Tate, 1993). The current survey used terms that directly confront the origin of biosolids; this approach was taken because it appeared, from the literature and case studies, that people are more likely to accept biosolids recycling when they are fully aware of what biosolids are, how they are made, and how they can be beneficial. Assessing how people get to that level of understanding and perception was one goal of the survey.

4.2.3 Administration of the Survey

The Center for Environmental Communications (CEC) was the primary project team member responsible for the survey. CEC identified four independent organizations that were available to conduct the survey. On the basis of interviews with each of the four, and a review of their credentials and cost proposals, the Survey Center of the University of New Hampshire (UNH) was selected as the best qualified to meet the project needs.

The UNH Survey Center is an independent, non-partisan academic survey research organization and a division of the UNH Institute for Policy and Social Science Research. The Survey Center conducts telephone, mail, e-mail, Internet, and self-administered surveys, as well as focus groups and other qualitative research for university researchers, government agencies, public non-profit organizations, private businesses, and media clients. Its senior staff have more than 40 years experience in designing and conducting custom research on a broad range of political, social, health care, and other public policy issues.

In addition to providing the facilities and staff to select the sample and conduct the survey, UNH Survey Center staff, most significantly Dr. Andrew Smith, played an important role in the development of the survey instrument and assisted in the analysis of the resulting data.

4.2.4 How the Sample Was Selected

A sample of households in the United States was selected by a procedure known as random digit dialing (RDD). First, with the aid of the computer, an area code is selected at random (e.g., 603). Next, one of the three-digit telephone exchanges that are currently used in the area (e.g., 772) is randomly selected. The computer then randomly selects one of the "working blocks"—the first two of the last four numbers in a telephone number (e.g., 64)—and attaches it to the randomly selected exchange. Finally, the computer program generates a two-digit random number between 00 and 99 (e.g., 57) which is attached to the previously selected prefix (772), and the previously selected working block (64) resulting in a complete telephone number—i.e., 603-772-6457. This procedure is repeated until a sufficient quantity of telephone numbers has been generated to conduct the survey. The objective of RDD is to ensure that each household with a telephone in an area has an equally likely chance of being selected into the sample.

The random sample used in the 2002 Biosolids Public Knowledge and Perception Survey was purchased from Marketing Systems Group, Fort Washington, PA. Marketing Systems Group screens each selected telephone number to eliminate non-working numbers, disconnected numbers, and business numbers to improve the efficiency of the sample; this reduces the amount of time interviewers spend calling non-usable numbers.

Each of the randomly generated telephone numbers is called by an interviewer from a centrally supervised facility at the UNH Survey Center. If the number called is found to be non-residential, it is discarded and another random number is called. (Approximately 50% of the numbers are discarded because they are found to be businesses, institutions, or not assigned.) If it is a residential number, the interviewer randomly selects a member of the household by asking to speak with the adult currently living in the household who has had the most recent birthday. This selection process ensures that every adult (18 years of age or older) in the household has an equally likely chance of being included in the survey. No substitutions are allowed. If, for example, the randomly selected adult is not at home when the household is first contacted, the interviewer cannot substitute by selecting someone else who just happens to be there at the time. Instead, he or she must make an appointment to call back when the randomly selected adult is at home. In this way, respondent selection bias is minimized.

Once a designated respondent was reached, several questions were asked to further screen them for inclusion in the survey. First, any respondent who said they were only a seasonal resident was excluded. Second, any respondent who does not currently own his/her home, or who rents an apartment, was excluded. The final sample consisted of home owners and renters who rent entire houses—people assumed to be likely to know and care about fertilizers and how their sewage is disposed of.

The selection of individuals who own or rent homes introduced a demographic bias that is worthy of discussion. First, excluding renters reduced the number of respondents who live in urban communities to 20% of the sample. This compares to the 1990 U.S. Census Bureau data that indicates that 75% of the population lives in urbanized areas or places outside of urban centers where there are more than 2500 residents (U.S. Bureau of the Census, 2002, http://factfinder.census.gov). Because such a high majority of respondents to the biosolids survey live in suburban or rural communities, they are more likely than the general public to have experience with farms and gardens, an intentional bias that served the purposes of the survey.

Limiting the sample to those who own or rent houses introduced other potential biases. For example, it reduced the racial distribution of respondents. The sample was disproportionately white—88% (compared to the 2000 U.S. Bureau of the Census estimate that the U.S. population is between 69-75% white). The small percentage of minority representation in the biosolids survey made it virtually impossible to compare perceptions between races. It was not possible, therefore, to examine "environmental justice" issues through this survey.

Another distortion caused by the choice of homeowners and house renters as the sampled population was that respondents were somewhat older than the national mean, as fewer young adults own their own homes or rent single-family homes. The sample was also weighted toward those with higher incomes; more than 50% of respondents to this biosolids survey had incomes over $45,000, compared to the national median household income of $37,005 (year 2000 estimate, U.S. Bureau of the Census). Finally, levels of educational attainment were also different from the U.S. average; 42% of the biosolids survey respondents have completed college, whereas the national rate is closer to 13% (1990 Bureau of the Census estimate).

4.2.5 Who Was Surveyed and When

The UNH Survey Center placed calls to contact 7,246 respondents nationwide. Respondents to the biosolids survey were interviewed between February 14 and March 13, 2002. The telephone interviews were conducted between 10:00 a.m. and 9:30 p.m. local time. Table 4-2 shows the outcome of these contacts; completion rates were well within the expected values for telephone surveys of this type.

Table 4-2. Response Rates for the 2002 Biosolids Public Knowledge and Perception Survey.

OUTCOME	NUMBER	PERCENTAGE
Completed Interviews	1069	15.0
Refusals	1285	17.7
Failure to Interview (e.g., no answer, busy, answering machine, broken appointment, respondent away)	2542	35.1
Failure (disconnect, changed number, business number, computer/facsimile)	1616	22.3
No Eligible Respondent	714	9.9
TOTALS	7246	100%

4.2.6 Survey Data Compilation

The UNH Survey Center interviewers who conducted the survey recorded responses on prepared forms. For open-ended questions, they wrote down verbatim answers. After the telephone survey interviews were completed, all verbatim responses were coded in order to facilitate computer analysis of response data. Data analysis was conducted by the UNH Survey Center and CEC using the computer software *Statistical Package for the Social Sciences (SPSS).*

4.2.6.1 Sampling Error

The Biosolids Public Knowledge and Perception Survey, like all surveys, is subject to sampling error due to the fact that all appropriate U.S. homeowners and house renters were not interviewed. For those questions asked of 1000 or so respondents, the error is ± 3.1%. For those questions where fewer than 1000 persons responded, the sampling error can be calculated as follows:

$$\text{Sampling error} = \pm (1.96)\, [P(1-P)/N]^{1/2}$$

where P is the percentage of responses in the answer category being evaluated and N is the total number of persons answering the particular question.

4.2.6.2 Weighting of the Data

To avoid biasing the sample in favor of households that can be reached through more than one telephone number, each case was weighted inversely to its probability of being included in the sample. In addition, the data were weighted to correct for sampling biases due to size of household (i.e., number of adults living in the household). The data also were weighted to correct for potential sampling biases on the sex of the respondent using 2000 U.S. Census figures.

Finally, the data were weighted to reflect the region of the country where the respondent lives, so that regions of the country are proportionally represented. When data were analyzed at the U.S. level, CENSUSWT was applied for all analyses. When data were analyzed within regions, REGIONWT was applied.

4.3 Results

Results of the nationwide 2002 Biosolids Public Knowledge and Perception Survey are presented under the following topical subheadings:

- Key Traits of Survey Respondents (Questions 2–8)
- Knowledge of Sewage Treatment and Biosolids (Questions 9–12)
- Testing Opinion of Biosolids Recycling (Questions 1 –17)
- What Affects People's Level of Concern? (Questions 18–20)
- Testing Arguments In Favor or Opposed to Biosolids Recycling (Questions 21–34)
- Identifying Trusted Sources of Information (Questions 35–37 and 40)
- Perception of Risk (Questions 38–39).

For many of the survey questions and responses, the discussion includes information about how the responses to that particular question correlate with responses to other questions. Correlations were determined by statistical software, and are used to analyze the data with respect to the survey hypotheses (Table 4-1); for example, "Is there a tendency for those people who have lived in a farming or ranching community to know more about biosolids?" Any significant correlations that were found are included in the discussions of the results, following, and in the subsequent conclusions. Significant correlations are reported either as comparisons of percentages (e.g., 48% of rural respondents had heard of the term "biosolids" versus 36% of urban respondents) or in the narrative that accompanies each question. If no significant correlation was found, none is reported.

A summary of raw response frequencies is given in Appendix C, and the full raw data set, including interviewer notes of individual responses, is available in electronic format from NEBRA.

4.3.1 Key Traits of Survey Respondents

Survey questions Q2-Q8 focus on determining respondents' traits and their involvement with agricultural and environmental matters. Biosolids managers and the project team believed that some of these traits would correlate with higher levels of knowledge and higher levels of acceptance of biosolids recycling.

4.3.1.1 Lifestyle and Awareness of Biosolids (Q2-Q4)

The surveyed population is more rural (79%) than the general U.S. population (75%) (U.S. Bureau of the Census, 2002); this difference was caused by surveying only homeowners or house renters. The assumption on the part of the survey team was that homeowners and house renters are more likely to understand and respond to a survey about wastewater and biosolids issues than apartment dwellers. Residents in multi-family units or apartment buildings are, therefore, underrepresented in the survey.

The results show that respondents who live in rural areas are more likely than suburban or urban dwellers to say they have heard of the term "biosolids:"

CORRELATION (Q2 & Q11)		
48% of rural respondents…	**40%** of suburban respondents…	**36%** of urban respondents…
…had heard of the term "biosolids"		

44% of respondents state they live, or have lived, on a farm, ranch, or in a farming or ranching community. Respondents who live on agricultural land or within agricultural communities are 15% more likely than generalized rural dwellers to have heard of biosolids than those who do not. Their definitions of biosolids are also somewhat more accurate than definitions from individuals who do not live on or near agricultural land. The majority of respondents, however, regardless of the type of community in which they live, had never heard of biosolids.

There is also a correlation between individuals who live or have lived in agricultural communities and their acceptance of a neighbor's application of biosolids to their property, with acceptance being higher by those who have lived on farms or ranches:

CORRELATION (Q3 & Q14A)	
48% who have LIVED ON FARMS, RANCHES…	**41%** who have NOT LIVED ON FARMS, RANCHES…
…"think it's great" or "probably ok" to have a neighbor apply biosolids to their property	
CORRELATION (Q4 & Q14A)	
45% of FARMERS & GARDENERS…	**41%** of NON-FARMERS OR GARDENERS…
…"think it's great" or "probably ok" to have a neighbor apply biosolids to their property	

56% of respondents state they farm and/or garden. There is some correlation between those who do farming or gardening and their knowledge of biosolids, but it is weaker than the correlation with respondents who state that they live on agricultural land or in agricultural communities. The weaker correlation may be attributed to dilution of the sample with individuals who work in home gardens.

There is also a limited correlation between individuals who farm or garden and their acceptance of a neighbor's application of biosolids to their property. It appears that a person's attachment to agriculture (Q2, Q3) and active involvement in farming or gardening (Q4) somewhat predispose individuals to know more about and accept biosolids recycling. This predisposition is not, however, very pronounced.

4.3.1.2 Use of Fertilizers on Lawn, Garden, or Farm (Q5-Q6)

36% of respondents use chemical fertilizer on lawn, garden, or farm, whereas only 1% use biosolids. In asking about fertilizer use, interviewers did not suggest any answers; those respondents who mentioned biosolids- or sludge-based products did so without prompting.

Nearly half of the respondents state that they base their selection of fertilizer on convenience and cost. Efficacy ("works best") accounts for a fairly large proportion of the remainder, which may also be interpreted as a statement in favor of convenience. Family health and environmental impact drive preferences for particular types of fertilizer in less than one household in five; this result is consistent with national surveys (Roper, 2001; Gallup, 1999) showing that approximately one in five Americans base their purchasing decisions, to a significant extent, on environmental protection and health.

There is some correlation between those buying organic products and the use of "environmental protection" as a rationale for fertilizer purchases, but because of the low numbers in this pairing, the correlation is relatively weak. The practice of using animal manures is well accepted, with 71% of respondents "likely" or "somewhat likely" to use fertilizer made from animal manures. This acceptance was found even among respondents who live in urban communities. In fact, the likelihood of using fertilizer made from animal manures was similar for rural, suburban or urban respondents (i.e., within the margin of error):

<table>
<tr><th colspan="6">CORRELATION (Q6A & Q7)</th></tr>
<tr><td colspan="3">78% who PURCHASE ORGANIC…</td><td colspan="3">45% who DON'T PURCHASE ORGANIC…</td></tr>
<tr><td colspan="6">… use environmental protection as rationale for their purchase of fertilizer</td></tr>
<tr><th colspan="6">CORRELATION (Q6B & Q2)</th></tr>
<tr><td colspan="2">75% of RURAL respondents…</td><td colspan="2">68% of SUBURBAN respondents…</td><td colspan="2">67% of URBAN respondents…</td></tr>
<tr><td colspan="6">…are very likely or likely to use animal manures</td></tr>
</table>

The response to use of "human manures" as fertilizer was strikingly different. Although question Q5 showed that few people (16%) actually use animal manures, the practice is accepted by 71% of respondents. When asked if they would extend this practice to the use of human manures, their responses were the opposite, with nearly six in ten stating that they were not at all likely to use them. Only 20% of respondents state they would be very likely or somewhat likely to use a fertilizer from human manures and sewage. 76% state they were not too likely or not at all likely to use such fertilizer. More significantly, among the respondents who are unlikely to use fertilizer from human manures, 57% are "not at all likely" to use them.

People understand and support the use of animal manures. The description of animal and human manures in Q5 and Q6 was the same; i.e., "manures…that had a barnyard odor and looked like moist soil." Yet, people recoil from the notion of using manures from human sources. In both questions, the materials were not described as composted or treated in any way, and there is good reason to be cautious about either, if they are not treated for pathogens. Some practitioners (Toffey, 2000d) believe that a visceral resistance impedes acceptance of recycling human wastes, an opinion that finds support in the survey data.

4.3.1.3 Preference for Organic Foods (Q7)

The survey included a question about respondents' preference for foods labeled as being organically grown as a means of identifying individuals who may be sensitive to the ways in which agricultural practices may influence food quality and personal health. This question was also of particular interest because of the controversy surrounding establishment of a national standard for organic foods that excluded biosolids as a possible organic soil amendment.

The survey found that 60% of respondents do not ever seek out and purchase foods organic foods. Other responses were occasionally (24%), frequently (11%), or all the time (4%).

The project team had hypothesized measurable opposition to land application of biosolids amongst self-identified consumers of organic foods. However, the survey found that the consumption of organic foods is not strongly correlated to perceptions of biosolids. First, there is a significant (p = 0.034), but not especially powerful, correlation between consumers of organic foods and their having heard of biosolids. Second, occasional consumers of organic foods are generally as likely to support (40%) a neighbor's application of biosolids to their property as they are to oppose (42%) the application of biosolids to their property. Moreover, 51% of respondents who consume organic foods "frequently" or "all the time" believe "it's great" or "probably okay" for a neighbor to apply "biosolids" to their property, which is higher than the percentage of respondents (43%) who do not consume organic foods.

Even when the attitudes of organic food consumers are examined in relation to a neighbor using "sewage sludge" on their property (Q14B), 40% of occasional consumers of organic foods are supportive of the practice. Among the respondents who consume organic foods "frequently" or "all the time," the percentage supporting the practice drops to 29%, which is similar to the percentage (30%) who do not consume organic foods.

4.3.1.4 Self-described Environmentalists (Q8)

A large majority (76%) of respondents agree strongly or somewhat that the term environmentalist applies to them. There is a strong positive correlation (p = 0.103) between self-described environmentalists and awareness of biosolids. This is stronger than the correlation between self-described consumers of organic foods and those who say they have heard of biosolids (p = 0.034). The number of self-described environmentalists who are able to correctly define "biosolids," however, is not dramatically different from the percent of the general population who correctly define biosolids, nor do they express opinions that differ in any important way.

The project team had hypothesized that this subgroup of respondents would know or care more about land application of biosolids or sewage sludges than the general public. The survey results do not support this hypothesis.

4.3.2 Knowledge of Sewage Treatment and Biosolids

Questions Q9 and Q10B test understanding of sewage treatment, while questions Q11 and Q12 introduce the term "biosolids" and establish a baseline understanding of how familiar the respondents are with the concept of biosolids recycling. Quoted verbatim responses are as important as the percentages of various responses—they indicate respondents' feelings regarding biosolids recycling.

4.3.2.1 Knowledge of Sewage Treatment (Q9-Q10)

In Q9, respondents are given a definition of sewage as "the mixture of waste and water than goes down toilets, sinks, and drains." When asked about the type of treatment their sewage received, responses were 52% public sewage treatment plant, 34% home or group septic system, and 13% do not know. These percentages are inconsistent with the national averages of homes that discharge to wastewater treatment facilities and homes that rely on onsite (mostly septic) systems; the U.S. EPA estimates that approximately 75% of households are served by wastewater treatment facilities and 25% by on-site systems. The difference between the surveyed population and the national average is likely created by the under-representation in the surveyed population of urban households, which would all be connected to sewage treatment plants. The way in which a householder's sewage is treated does not correlate in any important way with any of the other questions in the survey.

Although only 33% of respondents had ever visited a sewage treatment plant (Q10A), a significantly higher percentage of those respondents had heard of the term "biosolids:"

CORRELATION (Q10A & Q11)	
58% who HAD VISITED a sewage treatment plant…	**34%** who HAD NOT VISITED a sewage treatment plant…
… had heard of the term "biosolids."	

Having visited a sewage treatment plant informs people about wastewater treatment and biosolids management and makes them more likely to have heard of biosolids. The correlation between having visited a sewage treatment plant and having heard of biosolids was one of the strongest in the survey. Those who have visited a sewage treatment plant also are somewhat more accepting of a neighbor applying biosolids or sewage sludge to their property than the general public.

In response to a question (Q10B) about sewage treatment plants, an overwhelming majority (93%) believe that sewage treatment plants are necessary or a good idea. This question elicited the most unambiguous response of the survey. There is widespread support for sewage treatment that crosses boundaries of age, gender, region, personal habits, agricultural experience or understanding of sewage treatment processes.

4.3.2.2 Knowledge of Biosolids (Q11-Q12)

Although 42% of respondents have heard of "biosolids," this apparently high recognition of the term is somewhat deceiving. There are many ways to correlate people's understanding of the term "biosolids" with demographic characteristics, and some correlations are stronger than others. The general state of knowledge about the term, however, remains weak. Of the 449 individuals who, in question Q11, stated they had heard of the term "biosolids," 447 attempted to define the term in question Q12. Respondents' definitions are widely varied and, for the most part, imprecise (Table 4-3).

About 14% of the respondents are correct or close in their definition of "biosolids." However, a highly correct definition of biosolids should embrace its essential nature (solid or semi-solid material), origin (municipal wastewater or sewage treatment), and acknowledge the fact that it is treated. By this definition, 6% of those attempting a definition—or 3% of the entire group of respondents—can correctly define the term. One 1% specifically define biosolids as "sludge."

Table 4-3. Public Knowledge About Biosolids (n=1069).

HEARD OF BIOSOLIDS?	NO	YES	CAN DEFINE?		EXAMPLE COMMENTS
	58%	**42%**	**% of YES**	**% of all**	
Correct: (*treated* human waste/sewage, fertilizer)			6%	3%	"Biosolids are those treated solids that come back as fertilizer on the land." "Organic matter that is left after it has been processed by the sewer ponds."
Substantially correct: (human waste, sludge)			25%	11%	"Biosolids is human waste." "A residue from sewer treatment." "Any waste from a living organism, not necessarily human." "Byproducts of the waste treatment." "Sewage that breaks down."
Somewhat correct (biological waste, organic waste)			14%	6%	"Organic waste. Biological waste, actually." "Organic material."
Re-statement (biological solids, solids)			7%	3%	"Biodegradable solids." "Biological wastes." "Biosolids are solid waste."
Other or don't know			48%	19%	"Don't know – waste or something." "Cow pies to start fires." "I wouldn't know, I've just heard of it."

None of the four groups are much more likely than other respondents to use recycled biosolids on their own property. Among the respondents who provided an incorrect definition of biosolids or said "don't know" (48% of the 42% attempting a definition), a substantial number (40%) later stated (after learning the correct definition) that they are very likely or somewhat likely to apply recycled biosolids to their property.

CORRELATION (Q12 & Q16)			
Of the ENTIRE GROUP OF RESPONDENTS …	Of those who CORRECTLY OR CLOSELY DEFINE "BIOSOLIDS"…	Of those who are NOT SO ACCURATE DEFINING "BIOSOLIDS"…	Of those who RESTATE THE QUESTION AS THEIR DEFINITION…
…36%…	**…42%…**	**…35%…**	**40%**
…said they would be "very likely" or "somewhat likely" to use biosolids on their property.			

Some subgroups are more likely than others to offer a correct or substantially correct definition of the term “biosolids:”

CORRELATIONS (Q12 & personal traits)	
Respondents AGES 50-69 are…	…14% more likely …
Respondents EDUCATED BEYOND HIGH SCHOOL are…	…15% more likely …
Respondents who have LIVED ON A FARM OR RANCH are…	…15% more likely …
Respondents who have SCIENCE BACKGROUND OR EDUCATION are…	…14% more likely …
Respondents LIVING IN RURAL AREAS are…	…9% more likely …
Respondents who say they are ENVIRONMENTALISTS are…	…7% more likely …
… to have heard of the term “biosolids” in comparison to the entire group of respondents.	

4.3.3 Testing Opinions of Biosolids Recycling

Questions Q13 to Q15 test responses to the concept of biosolids recycling. Half of the survey respondents answered FORM A (Q14A and Q15A), in which the material was referred to as “recycled biosolids.” The other half answered FORM B (Q14B and Q15B), in which the material was referred to as “sewage sludge.” These questions are followed by Q16-Q17, which pose specific scenarios to uncover feelings about the use of biosolids close to the respondent’s home.

Up to this point in the survey, the respondents had not been given any clear indication of the focus of the survey and had not been asked to provide any significant opinions, and the questions were not challenging. Thus, responses to question Q13 are not affected by any significant bias introduced by the survey itself and should fairly represent opinions regarding biosolids. The subsequent questions begin to challenge respondents to think hard about the possible implications of biosolids recycling; in so doing, the questions themselves begin to introduce a bias that may increase respondents’ sense of concern about biosolids recycling.

4.3.3.1 Overall Reaction to Use of Biosolids as Fertilizer

In Q13, respondents were given a definition of biosolids, as “the solid matter removed from sewage that has been treated and tested so [it] can be recycled as a fertilizer.” 53% of the respondents state that recycling biosolids is a “good idea” or made some other positive comment, and another 10% offer positive comments with some conditions. The second most frequent group of responses were opposed to recycling biosolids: 16% of respondents oppose recycling of biosolids, some stating that the practice is “disgusting.” 6% state that they are skeptical or leery of the practice, or that they have some concerns about it (Table 3-4).

Table 4-4. Reaction to Definition of Biosolids (n=1062).

REACTION	PERCENT	EXAMPLE COMMENTS
POSITIVE	63%	
General positive reaction (good, positive, etc.)	53%	"A good idea." "A very solid idea–I would question the idea of using it on human foods for consumption, but good for parks." "As long as it's treated, it's ok." "I think it's a good idea, if it can be safely reused."
Positive, with conditions (i.e., not on gardens, lawns)	5%	
Positive, if it works	3%	
Other positive reaction	2%	
NEUTRAL	12%	
Indifferent, don't know, don't care	6%	"I would have to have more information on it." "I'm a little leery." "The way they do it here is fine, but other places do it differently and I don't like it." "Not too keen on using it in my yard."
Need more information	4%	
Open to the idea	2%	
NEGATIVE	25%	
General negative reaction (against it, disgusting, etc.)	16%	"I don't like the idea." "I think it's alright for animal waste, but not human." "Yuck! It turns me right off." "I'd be worried about spreading disease or viruses."
Skeptical, leery, etc.	5%	
Negative reaction - health concerns	2%	
Negative reaction - odor	1%	
Other negative reaction	1%	

4.3.3.2 Reaction to a Neighbor's Use of "Biosolids" or "Sewage Sludge" as Fertilizer

When asked for their attitude toward a hypothetical neighbor's use of biosolids as fertilizer**,** 44% of respondents think it's "great" or "probably OK," 35% would "ask them to stop" or "prefer them not to do it," and 19% said it is "none of my business. Some correlations between responses to this question and personal or regional traits of respondents are statistically significant:

CORRELATIONS (Q14A & personal traits)	
Those LIVING IN RURAL AREAS are…	…7% more likely …
Those who have LIVED ON A FARM OR IN A FARMING COMMUNITY are…	…4% more likely …
Respondents who have SCIENCE BACKGROUND OR EDUCATION are…	…4% more likely …
MEN are…	…4% more likely …
WOMEN are…	…6% less likely…
SUBURBAN respondents are…	…6% less likely …
URBAN respondents are…	…7% less likely …
… to "think it's great" or "it's probably okay" when asked about their neighbor using "BIOSOLIDS," in comparison to the entire group of respondents.	
CORRELATION (Q14A & Region of Residence)	
Region	*Ratio of support to opposition of neighbor's use of biosolids*
Rocky Mountain (AZ, CO, ID, MT, UT, NM, WY)	3.8 : 1
New England (CT, ME, MA, RI, NH, VT)	2.7 : 1
West (AL, NV, OR, WA, CA, HI)	2 : 1
Great Lakes (MN, OH, WI, MI, IN, IL)	1 : 1
Mid-Atlantic (DC, MD, NY, DE, NJ, WV, PA)	1 : 1

When the term "sewage sludge" is used instead of "recycled biosolids," people's perceptions of the suitability of these materials for application to their neighbor's property is altered. Of 526 respondents asked about "sewage sludge" use (Q14B), 32% "think it's great" or "it's probably OK," 53% would "ask them to stop" or "prefer them not to do it," and 18% said it is "none of my business." In each response category, the number of respondents who support spreading of "biosolids" declines by 10-12 percentage points when the material is called "sewage sludge."

The relative patterns of correlations observed in Q14A, above, are roughly repeated in Q14B, but to a lesser extent in some cases:

CORRELATIONS (Q14B & personal traits)	
Those LIVING IN RURAL AREAS are…	…1% more likely …
Those who have LIVED ON A FARM OR IN A FARMING COMMUNITY are…	…4% more likely …
MEN are…	…4% more likely …
WOMEN are…	…2% less likely…
… to "think it's great" or "it's probably okay" when asked about their neighbor using "SEWAGE SLUDGE," in comparison to the entire group of respondents.	

Relative differences between regions remain in place, but the amount of opposition grows across the board when the term "sewage sludge" is employed.

4.3.3.3 Preferred Sources of Information about "Biosolids" or "Sewage Sludge" (Q15)

A majority (55%) of respondents say that they would turn first to a friend or acquaintance if they had questions about a neighbor's use of biosolids (Table 4-5). The Internet, which contains a wide variety of information on biosolids and sewage sludge, is not widely chosen by respondents as an initial source of information. Second choices were local health department (16%), state health or environmental officials (13%), friends (12%), and the U.S. EPA (9%).

When the term "sewage sludge" replaced the term "biosolid," there is a significant shift (X^2= 28.815, p = 0.002) in the source people would turn to for information (Table 4-5). Although friends and neighbors still rank most highly, 29% select local, state, or federal officials when "sewage sludge" is involved. More importantly, when "sewage sludge" is involved, the second choice of 44% of respondents is government officials. Apparently, the level of concern and negative response to "sewage sludge" revealed in Q14B results in an increased reliance on government officials.

It is possible that questions Q15A and B were leading questions. That is, they may have led some respondents to a particular answer: If you had questions about your neighbor's use of biosolids, who would you ask first? Your neighbor, of course! Despite this possible question-induced bias, there appears to be a sizable proportion of the population that would turn to friends and neighbors for initial information. Local, state, or federal agencies of government that deal with health and environmental issues are the first choice of 20%. When asked whom they would ask next, the most frequent (39%) second choices were agencies of government, especially local health departments.

Table 4-5. First Choice for Information About "Biosolids" or "Sludge" (Q15A, B).

FIRST CHOICE SOURCE	"BIOSOLIDS" (n=527)	"SLUDGE" (n=522)
Friend, acquaintance	55%	49%
Local health department	11%	17%
State health officials	6%	6%
University researchers	4%	2%
U.S. EPA	3%	5%
Plant operators	3%	4%
Environmental organization	2%	0%
Other	9%	9%
Don't know	8%	8%

4.3.3.4 Likelihood of Using Biosolids (Q16)

The majority of respondents (57%) are *unlikely* to use recycled biosolids in their own yard, a significantly larger percentage than those who would be *likely* to use recycled biosolids:

10% very likely
26% somewhat likely
25% not too likely
32% not at all likely

When this question is correlated against other factors, some of the general trends observed in Q14 are noted again:

CORRELATIONS (Q16 & personal traits)	
Those LIVING IN RURAL AREAS are…	…5% more likely …
Those who have LIVED ON A FARM OR IN A FARMING COMMUNITY are…	…4% more likely …
MEN are…	…7% more likely …
… to use recycled biosolids on their own yard, garden or farm, in comparison to the entire group of respondents.	

Among the regions, residents of the Rocky Mountain and Western states are more likely to use biosolids than residents of other regions.

4.3.3.5 Perceived Risk of Biosolids to Children (Q17)

A majority (53%) of respondents were unlikely to allow their children to play on a yard treated with recycled biosolids, with smaller percentages saying they were somewhat likely (22%) or very likely (9%) to do so. The question (Q17) was designed to test the perception of risk attached to intimate contact with biosolids. Because children are generally regarded as the least able to protect themselves from risk, adults tend to be conservative about allowing children to contact materials they may consider potentially harmful.

Men (36%) are more likely than women (26%) to allow children to play in a yard in which biosolids had been applied, which is a result consistent with other studies of public response to changes in an environment. Women are less likely than men to take risks or allow children to be exposed to possible risks.

The likelihood (“likely” or “somewhat likely”) of allowing children to play in a yard in which biosolids had been applied is markedly higher (32%) among adults with education above the high school level than it is among adults whose educational attainment was at the high school level or below (11%). Respondents who work or have been educated in the sciences are 7% more likely to allow their children to play in a yard in which biosolids had been applied. This result comports with literature that indicates that engineers and scientists express a higher level of “comfort” concerning the control of environmental problems.

Other responses to this question are somewhat unusual. A smaller percentage (31%) of respondents state they are generally likely to allow their children to play in a yard with biosolids than apply them to their own yards (36%, from Q16). However, the percentage (53%) that indicate they would not allow their children to play in a yard with biosolids is lower than the percentage who would not apply (57%) biosolids to their own yard (although the differences are not large). Adults with children in their households do not respond much differently to this question than adults without children.

4.3.4 What Affects People’s Level of Concern?

4.3.4.1 Information Needs

When asked what specific information they would need to be more comfortable with recycled biosolids being used near their home, respondents’ verbatim responses fall into three basic groups: those who want to know more about health impacts (37%); those who want to know more about the processes that generated biosolids (33%); and those who have generalized questions about research findings and historical impacts (13%) (Table 4-6). There are no significant correlations between respondents’ needs for particular types of information and their personal traits.

Individuals wanting more information about health impacts offer responses like these:

> “I would like to know what it would do to our health in the coming years.”
> “All the medical information; if it’s good/bad or healthy/unhealthy.”
> “Bacterial issues.”
> “I’d like to know about the smell, safety factors, and infection factors.”

Those who wanted more information about the processes offer these:

> “A complete explanation of the process.”
> “Is it government tested?”
> “I’d need to know a lot more about how it is made.”

Respondents who stated they want more information about research or historical uses say such things as this:

> “I don’t know what it would be like. If it’s like all the other fertilizers, fine.”
> “Research done, and testing results.”
> “Need to know where it is used, and how it worked out.”

Table 4-6. Desired Information about Recycled Biosolids (n=1068).

TYPE OF INFORMATION	PERCENT
Testing, safety literature	23%
More information (in general)	14%
Health issues, hazards, risks	12%
Explanation of the process, how to use it	9%
What it is made of, content	6%
Bacteria, viruses, etc.	6%
How it is treated	4%
General disapproval	4%
Side effects	3%
Already use, already know about it, no problem	3%
Odor	2%
What chemicals are in it	2%
Other	2%
Don't know, don't want to know	10%
TOTAL	**100%**

4.3.4.2 Factors Influencing Level of Concern (Q19A-H)

Questions Q19A-H were designed to probe the influence of a number of factors on respondents' level of concern about having biosolids applied near their home (Table 4-7). Among the eight factors evaluated, the least impact on public concern was associated with knowing that the biosolids derived from local sewage or were provided free of charge. This suggests that local sewage treatment facilities are not much more trusted or distrusted than those from other communities. Also, biosolids managers have speculated that showing value of biosolids products by having them cost something should reduce public concerns; in this survey, nearly a quarter of respondents had increased concern if biosolids were free of charge.

In contrast, concern was significantly increased by knowing that biosolids are from a large city or contained industrial waste. The increase in concern over large city sewage is more pronounced (42%) among residents of rural communities than among suburban or urban residents. There has been discussion in the wastewater treatment industry regarding perception by suburban or rural residents of biosolids that emanate from urban sites. The survey found clear evidence of distrust of biosolids from urban settings, but did not test for the reasons behind this distrust. In one of the most unequivocal responses of the survey, three out of five respondents stated that the presence of industrial waste in biosolids would increase their concern about biosolids being applied near their home.

Knowing that biosolids applied near their home are independently reviewed and certified each year significantly decreases the levels of concern. Wastewater treatment programs have tried many different ways of communicating the relative risks associated with recycling biosolids. As with many environmental issues, having third party oversight appears to engender trust and to reduce levels of public concern about biosolids. Other factors that significantly reduce concern are supervision of the biosolids production process by a local citizens advisory committee, and being contacted by a neighbor or contractor prior to the use of biosolids.

Table 4-7. Factors Influencing Level of Concern with Biosolids Use.

Factor	Effect on Level of Concern (% of respondents)		
	No Difference	Increases Concern	Decreases Concern
Local sewage	62	18	13
Large city sewage	52	36	7
Includes limited amount of industrial waste	20	63	12
Available free of charge	65	22	8
Reviewed and certified by independent expert auditor	31	16	49
Supervised by a local CAC	34	18	43
Contacted by biosolids manager in advance of use	34	13	48
Scientists say negligible risk	25	33	36

If scientists say there is negligible risk associated with biosolids recycling, about one third of the surveyed population finds their concerns reduced. However, public ambivalence toward scientific testimony is reflected in the fact that nearly as many (33%) say they would be more concerned as say they would be less concerned (36%) (Table 4-7). Even among respondents who are either working in, or have some education in a scientific field, the perceptions are remarkably similar. Having scientists testify to the relative risk of an environmental practice is a time-honored practice that has some potential benefit, but there is ample evidence that traditional voices of authority no longer sway perceptions in the way they did fifty years ago. The savvy public is more aware that scientific opinion can be purchased or manipulated to suit the objectives of any particular enterprise.

4.3.4.3 Testing and Oversight (Q20)

Responsibility for testing and oversight of biosolids use was most frequently (44%) considered the responsibility of state or federal government officials, with the next most frequent responses being university researchers (23%) and local government officials (11%). Only a small percentage thought that landowners (7%) or sewage plant operators (&%) should have responsibility for oversight and testing of biosolids use.

This result if consistent with the responses to questions Q15A and Q15B, in which local, state, and federal officials were cited as reliable sources of information on recycled biosolids and sewage sludge. The responsibility for testing and overseeing biosolids is, in the minds of respondents, the clear responsibility of state and federal officials. This position is consistent among subsets of the sample; i.e. males/females, living in farming communities, level of education, and age.

95 respondents volunteered an “other” response to this question, from which some patterns developed. 54 suggested some combination of overseers to the use of biosolids. There was also a fairly frequent (18) expression of interest in the “independence” of those reviewing biosolids. Some of these comments include:

"All of them, together."
"A combination between the government and private sector."
"State people and local people together."
"Independent source without a monetary interest, and local people."
"A board made up of experts—a combination of all."

Although the sample of voluntary comments is relatively small, the theme of combining interested parties into a decision-making entity may be a worthy topic of inquiry for future surveys or focus group research.

4.3.5 Testing Arguments in Favor or Opposed to Biosolids Recycling

Two series of questions tested particular arguments that have been used in support of or in opposition to biosolids recycling. In these series of questions, to avoid prejudicing the respondents by placing provided answers in a particular order, the order of possible answers to each question (Q21 – Q26, Q28 – Q33) was rotated with each interview. The final questions (Q27 and Q34) in each of the two series of questions are forced-choice questions covering the same topic as the series of questions just before them. These final questions are intended to corroborate the responses to the previous series of questions.

4.3.5.1 Arguments in Favor of Biosolids Recycling (Q21-27)

When asked (Q21) which of five uses for biosolids is the best, responses were as follows:

31% produce gases than can be burned to generate electricity
25% improving soils damaged by mining, dredging, or construction
16% fertilizer for forests to grow trees
9% fertilizer for food crops
7% fertilizer for lawns and gardens

Correlating this question with other questions or demographic characteristics does not uncover any particularly noteworthy patterns.

Of the five arguments posed in favor of recycling biosolids, there is very strong agreement that disposing of a waste product and returning nutrients to the soil are very persuasive (Table 4-8). To a lesser extent, there is support for erosion/water quality benefits, but the percentage of survey participants (17%) expressing uncertainty about the strength of this rationale indicates that the relationship of erosion to water quality, or some other aspect of the question, was not well understood by respondents. Half of the respondents agree that an argument that biosolids use is beneficial and involves minimal risk is a strong argument, although the number who responded "don't know" is fairly high when compared to other questions in this series. More than six in 10 respondents agreed that saving money for sewage treatment plants and communities is a strong argument in favor of recycling biosolids. This is a strong response, in isolation from other sample answers.

Table 4-8. Reactions to the Strength of Various Arguments in Favor or Against Recycling of Biosolids.

ARGUMENT FOR OR AGAINST BIOSOLIDS RECYCLING	THIS IS A STRONG ARGUMENT…		
	AGREE (%)	DISAGREE (%)	NO OPINION (%)
Arguments in Favor			
Disposal of waste product	77	14	5
Nutrients, organic matter to soil	77	13	8
Prevents erosion, improves water quality	41	34	17
Beneficial, involves minimal risk	50	28	25
Saves money	62	17	15
Arguments Against			
Inadequate testing	54	16	23
Bad odor	51	23	21
Poor government oversight and enforcement	59	16	19
Harmful to health	44	28	23
Land and water contamination	50	27	18
Not enough is known	72	19	6

Responses to a forced-choice question (Q27) on the strongest argument for recycling biosolids yielded results consistent with those expressed previously (Table 4-8):

37% returns nutrients to soils
21% disposes of a waste product
13% saves money
11% beneficial and involves minimal risk
8% prevents erosion

In sum, the strongest argument in favor of recycling biosolids in 2002 is that it "returns nutrients to soils." The 1998 survey by Frederick Schneiders Research asked a similar question of a random sample of adults, finding 42% who agreed with this position. There are no significant regional differences in responses to this question. Nor are factors such as having lived in a farming community, level of education, science education, or gender significantly related to perceptions about the strongest arguments in favor of recycling biosolids.

4.3.5.2 Arguments Against Biosolids Recycling (Q28-Q34)

There is overwhelming agreement (72%) of respondents that a strong argument against recycling biosolids is that "not enough is known about biosolids." Strong support (54%) also was expressed for the argument of inadequate testing of biosolids. This finding may reflect general concerns about the adequacy of biosolids testing and the general lack of information about biosolids, as expressed earlier in the survey (Q13, Q18, and Q28).

Despite the fact that odor is an issue in the field, barely half of respondents stated that they considered bad odor a strong argument against recycling biosolids (Table 4-8). In Q6B and Q6C, there is no indication that the references to "barnyard odor" influences responses. Nor do many respondents identify odor as a serious issue in Q13 or Q18. Biosolids managers and the developers of the survey expected to find a much higher percentage indicating that biosolids having bad odors is a strong argument against recycling them. But, apparently, the savvy public is aware and accepting that odor alone is not a reason for halting a practice. Certainly there is ample evidence that concerned citizens and environmental groups have chosen not to focus on odor issues (Sierra Club, 2002a), but, rather, to focus on other issues.

A majority of respondents (59%) felt that poor government oversight and enforcement is a strong argument against recycling biosolids. However, given the small percentage of people surveyed who have any apparent experience with biosolids, this reaction may indicate that people generally expect strong oversight and enforcement in any environmental matter. There are no particularly remarkable correlations between this question and other factors to explain the strength of feeling evident in the responses.

Based on recent history, health arguments are considered one of the most powerful arguments against any new activity, particularly activities that can affect local environmental conditions. Because of this, one might expect this argument to score more highly than the other arguments posed—but it did not. There are no correlations with other factors to explain the responses to this question. Environmental contamination was considered a strong argument against biosolids recycling by a slightly higher percentage (50%) than health risks (44%).

The results of a forced-choice question about the strongest argument against recycling biosolids are not entirely consistent with the opinions expressed in the preceding series of questions (Q28-Q33):

44% "not enough is known"
14% "poor oversight and enforcement by government"
13% "adverse health impact"
10% "inadequate testing"
8% "land or water contamination"
6% "bad odors"
6% "don't know"

In both the series of questions and in the final corroborating question, the clear choice of respondents is the argument that "not enough is known." Based on their agreement with the individual arguments, "adverse health impacts" should have ranked last among the six choices. Instead it ranked third, an insignificant percentage point behind the second choice. Furthermore, this ranking is fairly consistent across demographic factors (gender, rural/urban, live in farming community, children in household, education in science field, ability to define biosolids, or region).

Although the forced-choice ranking cannot be clearly explained by the data obtained from Q28-Q33, it agrees with the expectations developed by the Project Team through the examination of the literature on risk perception. The purpose of asking the final corroborating question is, in part, to allow respondents to review and revise their answers to the individual questions, and many respondents seem to have adjusted their answers in this instance.

4.3.6 Identifying Trusted Sources of Information

Survey questions Q35-Q37 obtain responses on the trustworthiness of information sources, including ranking of these sources. The final question (Q40) asks respondents to identify a single type of person from whom they might obtain trustworthy information. When asked to choose among a list of possible sources of information on biosolids, respondents selected the following as "most trustworthy":

34% U.S. Environmental Protection Agency
21% university researchers
13% state health and environmental officials
10% non-profit environmental organizations
8% independent auditors
6% local health agencies
4% sewage plant operators
1% friends
1% the company delivering the biosolids

Choices of "second most trustworthy source of information:"

23% state health and environmental officials
18% university researchers
17% U.S. Environmental Protection Agency
11% local health departments
10% independent auditors
10% environmental organizations
5% plant operators
2% friends
2% the companies delivering biosolids.

There is a clear preference for agencies of government when respondents are asked to rank sources of trustworthy information. Federal agencies are clearly the first choice. University researchers and state governments are next, followed by local governments, environmental organizations, and independent auditors. Although studies have shown that government has declined in influence since the mid-1980s, the results of this survey appear to show a dramatic upswing in trust in government agencies.

Verbatim responses (Q36) about why sources were deemed most trustworthy reveal some of the reasoning behind the choices; respondents trust entities without economic or other vested interests in recycling biosolids and sources perceived as experienced and knowledgeable. Example verbatim responses include:

"The U.S. EPA is looking out for what's best for our environment."
"The U. S. EPA has the least economic interest."
"The state wants what's best for the citizens."
"The university is looking out for the better good, and to preserve the future for others."
"It's important that they be neutral and objective, and not side with anyone; not be in it for the money**."**

Similarly, sources felt to be least trustworthy are those with perceived conflicts of interest or lack of knowledge. Nearly one-third of respondents cited economic interest in biosolids recycling as a reason to distrust a source of information. A significant undercurrent of distrust in government, however, also is evident; approximately 10-15% of the responses cite distrust of government, or corruption of government, as the reason for their answer. Mismanagement and corporate greed are another related theme.

Among the responses are:

"I never trust anyone who has a self interest."
"Big companies are more concerned about themselves, just in it for the money."
"A lot of people are not qualified to give out information."
"They don't know what they're talking about."
"Anything to do with government, because they're always in somebody's pockets."
"Political people aren't trustworthy; they have their own agenda."

The final question in this series (Q40) was designed to find where people were likely to obtain information about environmental issues like biosolids recycling, with an attempt to uncover their preferences for personality types. The responses are consistent with other questions in the survey. Technical experts, government officials, and non-profit organizations are fairly well trusted. Non-vested interests are trusted. The following types of people are considered most trusted sources of accurate information about environmental issues, including biosolids recycling:

21% a water quality engineer
20% a scientist
17% a non-profit organization
17% a local health agent
9% a farmer
3% a school teacher
3% a neighbor
2% a news broadcaster
2% an elected official
1% a spokesperson for private company
1% a movie star

4.3.7 Perception of Risk

Questions 38 and 39 obtained information on the relative perception of risk posed by biosolids in comparison to well-studied common risks. Specifically, these questions help in understanding how significant a risk respondents believe biosolids to be on a relative scale in comparison to other familiar perceived risks. These questions appear late in the survey and may be significantly biased by the concepts and feelings introduced by previous questions.

Exposure to pesticides is a known and accepted risk, and some consumers are careful to limit their exposures. The true quantitative risk posed by pesticide residues, however, is uncertain, but generally considered to be relatively small. When asked to rank the risk from contact with applied biosolids relative to pesticide residues in food, responses were as follows:

64% biosolids pose a smaller risk than pesticide residues in food
13% biosolids poses a larger risk
12% same risk
12% don't know

There are few correlations between the responses to this question and other responses in the survey. Some, however, are worth noting:

- ♦ Among respondents who are correct or close to defining biosolids, 72% believe that biosolids pose a smaller threat than pesticide residues—familiarity seems to correlate with perception of lower risk.
- ♦ Among those who call themselves environmentalists, there is a somewhat higher percentage of individuals (20%) who consider biosolids a larger threat then pesticide residues in food.
- ♦ Among individuals who strongly oppose calling themselves environmentalists, there are a higher percentage (72%) who believe biosolids pose less threat than pesticide residues.
- ♦ A slightly higher percentage of respondents from the Rocky Mountain region state that biosolids pose less threat than exposure to pesticide residues.

When contact with biosolids is compared against another familiar risk, that of driving to work, responses were as follows:

64% biosolids pose a smaller risk than driving to work
20% biosolids pose a larger risk
7% same risk
10% don't know

The risks of driving are well known, as more than 52,000 Americans die each year in traffic accidents, and virtually every driver knows someone who has died or been injured behind the wheel. The same percentage (64%) of people believe that biosolids pose a smaller threat to their health in comparison to both pesticide residues and driving a car to work. 74% of those who accurately define biosolids in Q12 believe biosolids are a smaller threat than driving to work, as do 71% of those with some education in the sciences.

4.4 Conclusions

The research team assumed that homeowners or house renters have a higher than average level of knowledge and interest in agricultural practices and sewage management and are more likely than the average U.S. population to be potential users of biosolids products or neighbors to sites where biosolids are used. The sample selection process, therefore, limited survey respondents to randomly chosen members of households where the residents owned or rented their houses. This resulted in a population of respondents that, in comparison to the total U.S. population, had:

- ♦ above average income levels,
- ♦ above average education levels,
- ♦ below average representation of urban dwellers,

- below average representation of minorities, and
- was older than the national average.

Because of the attributes of the surveyed population, a random survey of the *total* U. S. population might result in somewhat different findings, such as a lower overall awareness and knowledge of sewage treatment and biosolids.

The survey was relatively long for a telephone survey, averaging 25 minutes. One benefit of the use of a longer survey is the ability to test for the accuracy and validity of responses. This is done by asking redundant or similar questions. The survey included several pairs or groups of similar questions placed in different parts of the survey. The answers to these similar or redundant questions, as well as the overall feeling of responses to other questions, are quite consistent, which suggests that respondents were truthful and consistent during the survey interviews.

The survey data reveal potentially useful trends that can help inform the development of biosolids recycling public outreach and participation programs. The major findings are summarized in the following sections, the order of which does not reflect a judgment regarding relative significance:

- Personal Knowledge and Opinion (Section 4.4.1)
- Information Needs (Section 4.4.2)
- Factors That Affect Opinions on Biosolids Use (Section 4.4.3)
- Arguments That Influence Public Perception (Section 4.4.4)

4.4.1 Personal Knowledge and Opinion

4.4.1.1 Knowledge of Biosolids is Limited

Respondents to the 2002 Biosolids Public Knowledge and Perception Survey were asked several questions (Q9 – Q12) designed to test their overall knowledge of wastewater treatment and biosolids. Although most knew something about how their own sewage is treated, and one third say they have visited a wastewater treatment facility, only 3% of respondents could very accurately define "biosolids," while another 11% were able to define "biosolids" fairly accurately. Some biosolids stakeholders have speculated that the general population is ignorant about wastewater treatment, as well as about biosolids. But this survey suggests that quite a few people know about wastewater treatment and that the gap in knowledge is mostly with details, including the relatively new term "biosolids."

Those more likely than others to report having heard of biosolids include:

- homeowners and house renters aged 50 to 69;
- people with higher levels of education;
- those with a background in science or who had science education;
- people living in rural areas;
- people who had visited sewage treatment plants;
- people who currently or who at one time lived in a farming or ranching community; and
- self-identified environmentalists.

The question about knowledge of the term "biosolids" was written and placed in the survey to allow direct comparison with a similar question asked in the Frederick Schneiders

Research (1998) survey. The finding in this 2002 survey is consistent with the finding of that prior survey, in which 85% of adults could not correctly define biosolids. Thus, between 1988 and 2002 there has been no significant change in the public's knowledge and understanding of the term "biosolids." The current survey findings are also generally consistent with findings of Powell Tate (1993), whose *Communications Plan on Biosolids* stated, "Our research survey found that even many of those who should know the term 'biosolids' because of their involvement with agriculture and environmental issues, were unfamiliar with the term."

On the other hand, this survey did reveal a small percentage of the population who can accurately define biosolids, and some who have used biosolids. If the survey results are extrapolated to the general U.S. population, the 3% of survey respondents who know what biosolids are represents approximately 5.5 million people. And those who were close in their definitions represents approximately twenty million people. Given that the term "biosolids" has been in use for only a decade, this represents a substantial level of assimilation into common usage.

The most important finding regarding knowledge of biosolids is that the public mind is a relatively blank slate. Most people know virtually nothing about biosolids, a finding that suggests that the public's perception of biosolids recycling may be significantly influenced by the first presentation they hear on the topic.

Biosolids managers may, by implication, increase the likelihood of a positive reception to biosolids recycling activities if they—or, better yet, one of the more trusted information sources—reach out to the affected public early in the process to provide information about biosolids and answer questions from the public. These survey results clearly support early communications with the public and early public involvement in any biosolids recycling program. (The alternative is to wait for the public to learn about biosolids on their own, and risk the likelihood that they will form opinions around negative experiences, e.g. bad odors, or information that stresses only the negative sides of biosolids recycling.)

4.4.1.2 Support for Wastewater Treatment is Very High

The responses to most questions in the 2002 Biosolids Public Knowledge and Perception Survey reflect a mixture of opinion or were qualified in some manner. In contrast, an overwhelming 93% of respondents stated that sewage treatment plants "are a necessary protector of our environment" or "are probably a good idea" (Q10B). It is clear that wastewater treatment agencies, public officials, environmental groups, and others have been successful in ensuring that the public understands the importance of wastewater treatment.

Biosolids management is a critical part of wastewater treatment; for example, wastewater treatment facilities report that residuals management can consume as much as one half of operating expenses. It may be advantageous for wastewater treatment programs to stress the fact that society cannot have wastewater treatment without sewage sludge and, in many cases, biosolids management.

The findings regarding public knowledge, understanding, and support of wastewater treatment indicate that wastewater agencies will benefit from creating additional opportunities for the public to see and hear about agency efforts. Agencies might open their gates more often, invite the public in more frequently, and provide more tours and other opportunities to see how wastewater treatment and biosolids production work. Such efforts would build on the strong support wastewater treatment enjoys.

4.4.1.3 People Support Biosolids Recycling in the Abstract, But are Uneasy About Being in Close Proximity to It

Many people react positively to a carefully-crafted initial definition of the term “biosolids” (Q13) but there is a notable level of uneasiness when they consider themselves or their families being close to biosolids (Q14 – Q17).

The initial reaction of survey respondents to the definition of biosolids was quite positive. Although the survey showed that there is little public knowledge of the term, almost two thirds of adult homeowners and house renters reacted in a positive fashion to a definition that was read to them under controlled circumstances (in the security of their own homes; a definition from a neutral party; and no competing definitions). At the same time, however, one quarter of the respondents provided clearly skeptical responses, some with considerable passion behind them. The skepticism expressed by some respondents to this survey is consistent with the skepticism observed in response to any new technology, a widely observed phenomenon.

The subset of respondents who responded in passionately negative terms are the individuals that biosolids managers dread as they introduce new audiences to biosolids recycling; the strength of these negative reactions can naturally trigger anxiety and skepticism in the minds of individuals who had previously not formed strong opinions about biosolids recycling.

When presented with scenarios in which they may come in close personal contact with biosolids, people are more cautious (Figure 4-1). 25% express a clearly negative reaction to the initial concept of biosolids recycling—even when it is explained in the most careful, neutral way. In three scenarios posed by the survey, respondents reacted with unease or outright opposition:

- When biosolids are described as “human manures,” three-quarters of the population would rather not use them as fertilizer, even though most would use animal manures as fertilizer.
- After being provided a neutral definition of “biosolids,” respondents were asked how likely they would be to use biosolids at their home. Approximately one-third of U.S. homeowners and house renters say they would be "very likely" or "somewhat likely" to use biosolids.
- Only one in 10 say they are very likely to let their child play on a field treated with biosolids, and another two in ten say they are somewhat likely. More than half say that they are not very likely or not at all likely to let their child play on a field treated with biosolids.

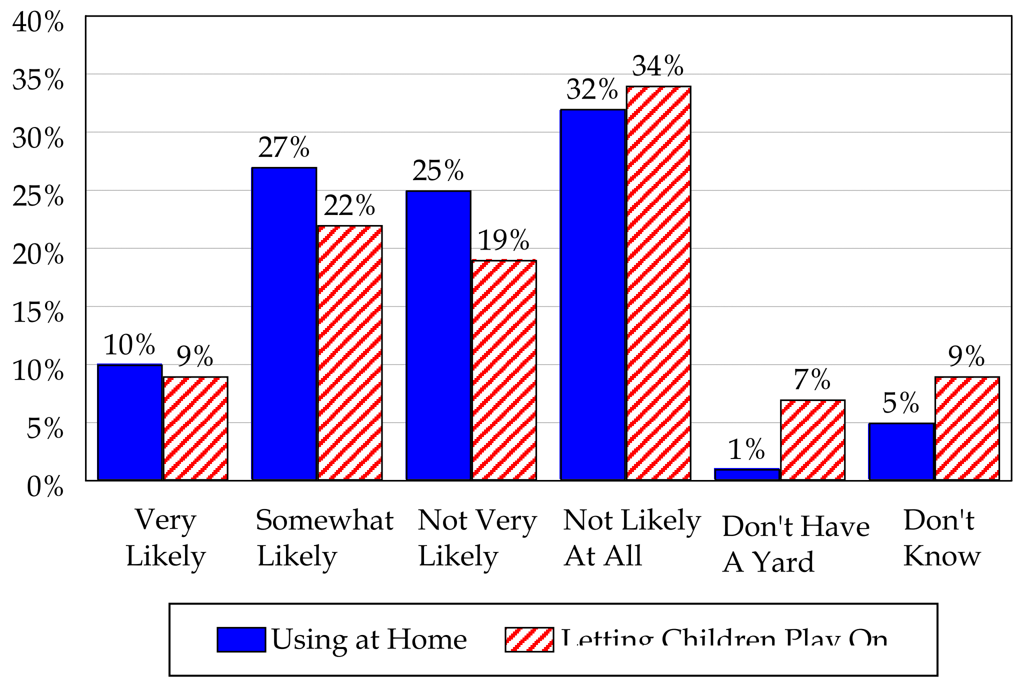


Figure 4-1. Reservations About Using Biosolids (n=1068).

This initial natural skepticism or uneasiness with biosolids recycling is a significant finding of this survey, and it is underscored by the quotes of respondents' comments throughout the survey, many of which express uncertainty about this unfamiliar practice.

It is likely that people's uncertainty and uneasiness are an underlying factor in the development of local public outrage: when neighbors to a biosolids recycling program feel uneasy and are forced to quickly decide on whether to "accept" biosolids or not (e.g., due to a pending permit decision), this uneasiness can grow into a strong negative reaction. Biosolids managers can address this uneasiness by providing adequate information and plenty of time for people to process the concept, gather more information, ask questions, and gain better understanding. Doing so will not convince everyone, but it will reduce the chances of inciting the outrage that comes from ignoring people's uneasiness and pressuring them to make decisions before their questions have been answered to their satisfaction.

4.4.1.4 The Choice of Words Makes a Significant Difference

As has been argued by people on both sides of debates about biosolids/treated sewage sludge recycling, the terms themselves color people's impressions. This survey split the respondents into two groups. Half the sample answered two questions (Q14A & Q15A) about "recycled biosolids," and the other half answered two identical questions (Q14B & Q15B) about "sewage sludge." The acceptance of a neighbor's use of biosolids dropped from 44% to 32% when the term "sewage sludge" was used in the question in place of the term "biosolids." Twice as many think "biosolids" use "is great" as think "sewage sludge" use "is great".

It is important to note that the use of the term "biosolids" is no insurance that the concept will be accepted: in either case, less than half accept their neighbor's use of biosolids or sewage sludge and there is a significant proportion of negative responses (uneasiness) in either case.

Nonetheless, it is clear that—at least initially—U. S. homeowners and house renters are significantly more likely to respond favorably to the use of "biosolids" by a neighbor than they are to the use of "sewage sludge," a result that appears to confirm the obvious recommendation of Powell -Tate (1993) that "…use of the term 'sewage sludge' instead of 'biosolids' may neutralize efforts to gain widespread acceptance of the term 'biosolids.'" The use of terms is particularly important when first introducing the concept to the public, as their initial impressions may predispose them to either accept or reject information that is offered, which, in turn, creates the context within which they will form an opinion.

However, the benefit of using the term "biosolids" is likely short-lived. While the language clearly makes a difference in the early stages of a person's development of knowledge and opinion, its importance may diminish as a person focuses more on the actual concepts and more detailed information.

Although this survey did not directly test the hypothesis, the authors recommend that . biosolids managers use clear, factual, up-front discussion of the process by which biosolids are generated, treated, and used. Such information should be provided soon after the overall concept of biosolids recycling is introduced. It is likely that a person's acceptance or support will be gained only after he or she has worked through this personal opinion-formation process—a process that requires information that the person perceives as complete, neutral, and objective.

4.4.2 Information Needs

4.4.2.1 People Seek More Information

Respondents identified many different kinds of information that they would seek, if they were interested in learning more about biosolids (Q18). The categories of information they would most frequently seek were:

- biosolids testing and safety;
- general information about health issues;
- hazards and risks; and
- the process of creating and using biosolids.

When asked to be more specific about health issues, respondents to this survey focused on general health hazards, risks, bacteria, viruses, and side effects. The type of questions they asked about how biosolids are processed focused on the original materials that go into biosolids, how they are treated, what chemicals are added, and what has historically been done with them. A third cluster of responses were focused on the availability of research findings on chemical composition, health research, research into alternative management techniques, and general questions about the overall amount of research that has been done on biosolids.

Responses to this and similar questions clearly show that the public knows what questions are potentially important when evaluating environmental issues such as biosolids recycling. This is an important finding. Some observers of debates about biosolids have suggested that the public is not well-informed about true environmental concerns. This does not appear to be accurate with regard to public reaction to the concept of biosolids recycling. Even though a minority of people know about sewage treatment, and even fewer know about biosolids, a large percentage can identify environmental and health issues that they think must be important with regard to biosolids. The questions they have about these issues—and the answers they receive—help them form opinions about biosolids recycling. Biosolids managers should anticipate these concerns and respond with appropriate information. As a rule, the public first needs to know how biosolids are generated and treated and then the health/safety impacts that may accompany any management process that is used.

The finding that respondents' have some uncertainty about biosolids and can quickly identify potential issues is similar to results from a focus group study conducted for the Greater Vancouver Regional District (Greater Vancouver, 2000). This prevalent uncertainty or hesitancy keeps people from fully and unconditionally embracing what they intellectually find to be a good idea. More study could be done to better understand the impacts of this common response on the formation of people's opinions and their subsequent behavior regarding biosolids recycling.

In general, responses to this survey's questions about information needs confirmed the hypothesis that there is a substantial gap between what the wastewater treatment industry knows and what the public knows about biosolids recycling. The gap is wide and it crosses demographic and geographic boundaries. Although some groups (those aged 50-69, individuals who live in agricultural communities, those with more education, and those with education in the sciences) are statistically more likely to know something about biosolids, the depth of their knowledge is thin and their numbers are not likely to constitute a majority of residents in any community.

4.4.2.2 People Turn First to Familiar Faces for Information About Biosolids Being Used Locally

According to this survey (Q15A & Q15B), friends and acquaintances are the first source of information that most people would turn to when seeking information about "biosolids" or "sewage sludge" being used in their neighborhood. Other initial sources of information would be local health departments and state health officials.

The survey measured small, but significant, differences regarding whom people would first approach for information on "biosolids" versus whom they would initially approach for information on "sewage sludge:" U.S. homeowners and house renters are somewhat more likely to ask a friend or acquaintance about a hypothesized neighbor's use of "biosolids" than they are about a hypothesized neighbor's use of "sewage sludge." In contrast, respondents to this survey are significantly more likely to ask their local health department about the use of "sewage sludge" than they are about the use of "biosolids."

4.4.2.3 People Trust Government Agencies and Academic Researchers

Survey respondents saw the federal government as the most trustworthy source of information on biosolids (Q20 & Q35) (Figure 4-2). University researchers and the state governments were seen as next most trustworthy. Local governments, environmental organizations, and independent auditors are groups also considered trustworthy. Wastewater plant operators, companies delivering biosolids, and friends are less trustworthy sources (even though friends are likely the first source of information!)

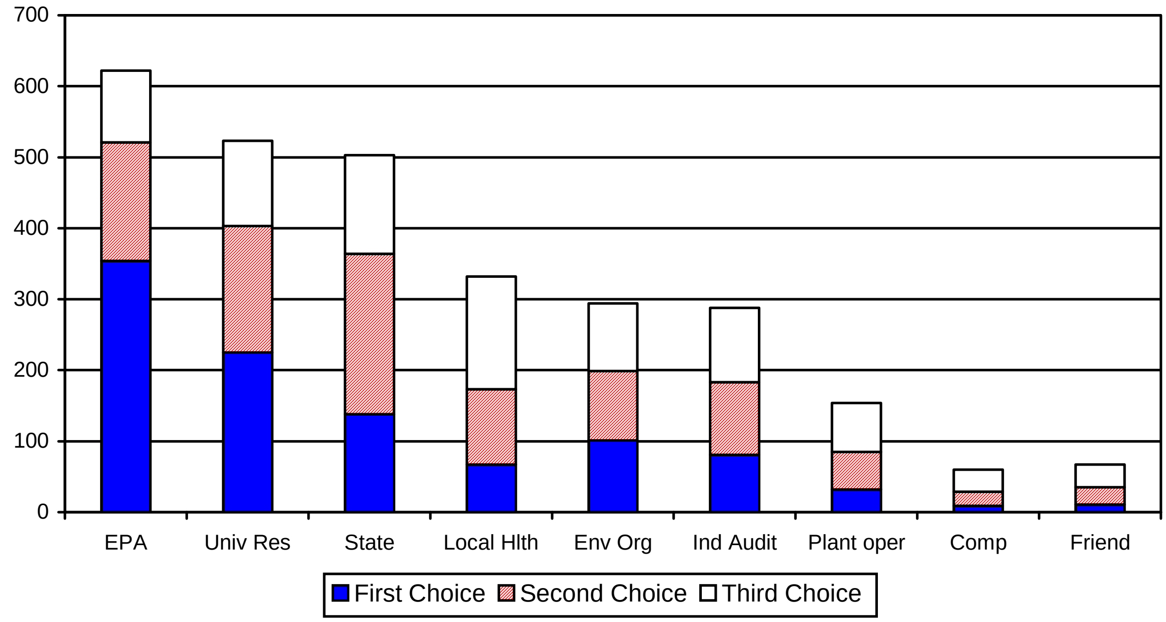


Figure 4-2. Trustworthy Sources of Information About Biosolids (n=1069).

When identifying individuals and organizations to speak on biosolids issues, the first choice of someone the public would find trustworthy would be an expert from the U.S. EPA or another federal agency. They are seen as most trustworthy, initially and cumulatively. A second tier of potential purveyors of information would be university researchers or state officials, and a third tier would be a local official, environmental organization, or independent auditor. It is clear that organizations with a perceived commercial interest in biosolids are not seen as trustworthy providers of information.

These findings may be important in implementing the recommendation of Powell-Tate (1993) that biosolids managers seek out "gatekeepers"; in other words, leaders who help shape opinions in their particular field of expertise. Clearly, it will benefit biosolids program managers to engage respected experts who are leaders in their fields, especially those who are from one of the trusted information sources—a federal agency, university, or state agency.

It is interesting to note the relatively low trust rating respondents gave independent auditors (see Q35). This result may be due to a lack of understanding of the term "independent auditor" as it appeared in this question—the concept of an independent audit is complex and can mean many different things to different people. This finding (Q35) must be contrasted with the finding of a question posed earlier in the survey (Q19E), which found that having an annual certification by "an independent expert auditor" dramatically reduces respondents' level of concern. Also supportive of the value of independent auditing is the response to the question asking why respondents trust whom they trust—many identified independence as a critical factor (see next section). The contrasting finding of question 35 is the most incompatible result identified in the survey data. It also stands in contrast to both the literature and case studies, which showed that independent auditors can play an important role in answering questions from the public and gaining their trust in biosolids recycling.

4.4.2.4 People Trust Government and Those Who are Knowledgeable and Objective

The reasons that respondents trust certain organizations cluster in three areas (Q36 & Q37): that the organization is a governmental organization, that the organization is the most knowledgeable about the topic, and that the organization is neutral and objective. It should come as no surprise that the neutrality and objectiveness of an individual or organization engenders feelings of trust within the general public. What is surprising, however, is the strong perception that agencies of government are trustworthy (Figure 4-3).

This finding is a turnaround. Government sources of information have had declining credibility with the public for more than a decade. Whether or not the finding of this survey is corroborated by future studies will determine if it is a complete reversal, or merely a transitory change in public perception, perhaps due to the tragic events of September 11, 2001, the response to which has been led by government agencies.

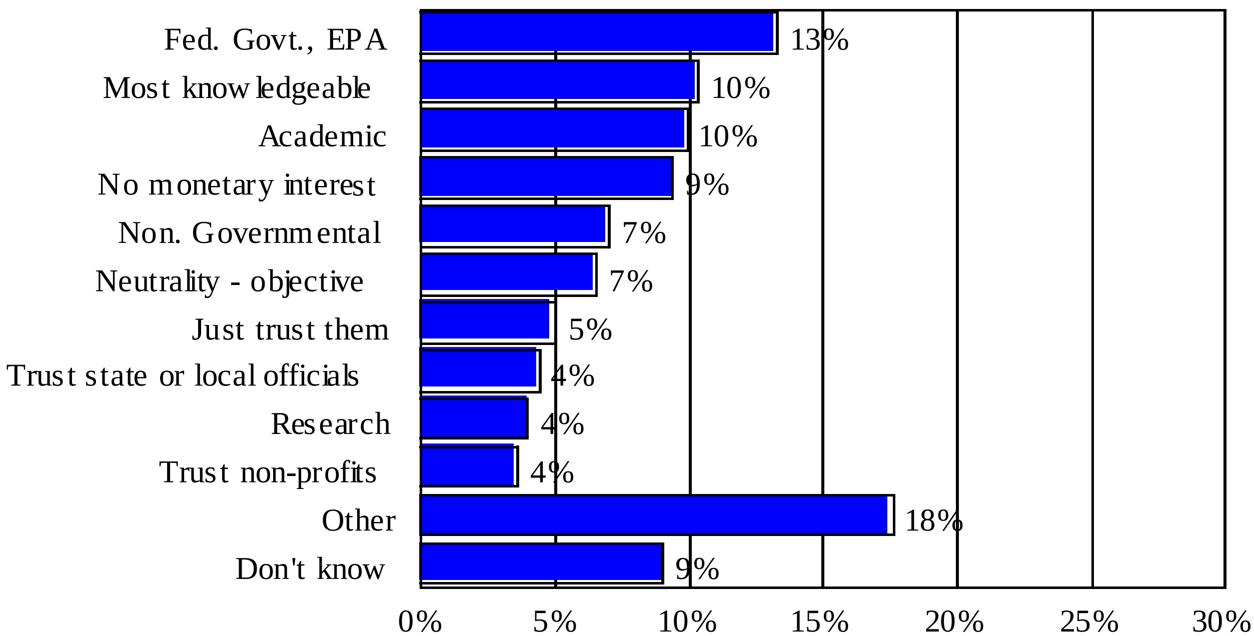


Figure 4-3. Reasons for Trusting a Source of Biosolids Information (n=1069).

The finding that people trust those who are most knowledgeable on a subject provides a clue as to why professional organizations such as the National Biosolids Partnership, the Water Environment Federation, the Association of Metropolitan Sewerage Agencies, and regional biosolids and byproducts associations have been successful in working with the public. These are organizations that bring considerable expertise to the topic of biosolids recycling and, therefore, garner the trust and respect of a significant proportion of the general population. In addition, regional associations have the ability to know details of local situations—an added level of expertise that national organizations usually cannot provide.

Those who have garnered the most trust amongst critics of land application are government officials (e.g., Dr. David Lewis, a microbiologist with the U.S. EPA) and academic institutions (e.g., Cornell Waste Management Institute). At the same time, trustworthiness of organizations hinges on their ability to remain objective. According to this survey, the most frequently cited reason for distrusting an organization is if the organization has some interest in biosolids recycling that would taint its presentation of information. This includes a financial, political of other form of self interest. Other reasons cited *less frequently* by respondents are that the person or organization

- lacks knowledge about the topic,
- is from the government,
- is not truthful, or
- is corrupt.

Some critics of biosolids recycling have criticized U.S. EPA, WEF, AMSA, and regional associations as being untrustworthy because they appear to have interests in promoting biosolids recycling that taint their objectivity. Results of this survey suggest that organizations will generate trust amongst the greatest percentage of the public if they focus strictly on learning more about biosolids recycling and developing objective information to share with all parties equally.

4.4.3 Factors That Affect Opinions on Biosolids Use

4.4.3.1 People Favor Constructive Uses of Biosolids

Lack of knowledge about biosolids doesn't appear to have limited respondents' imagination when it comes to expressing opinions on preferred uses for the material (Q21) (Figure 4-4). Generating electricity through the combustion of gases is the favored use of biosolids among the choices that were presented. Americans have frequently embraced new ideas after a period of initial skepticism, and using wastewater treatment byproducts to turn on the lights has a certain innovative appeal, especially given well-publicized concerns about sources of energy.

The survey found that there is somewhat less support for crop applications of biosolids. This finding has to raise some concern amongst biosolids managers, as agricultural land application is currently a favored use for biosolids. Managers of agricultural biosolids recycling programs may derive greater environmental benefits and enhance public support by utilizing—and touting their use of—digested biosolids from which energy has been extracted.

The cumulative total of responses to the question on best uses of biosolids (Q21) suggests a decided preference for the use of biosolids in a manner that keeps them away from human contact. This may be coincidental, and additional survey or focus group work would be necessary to test this validity of this apparent choice.

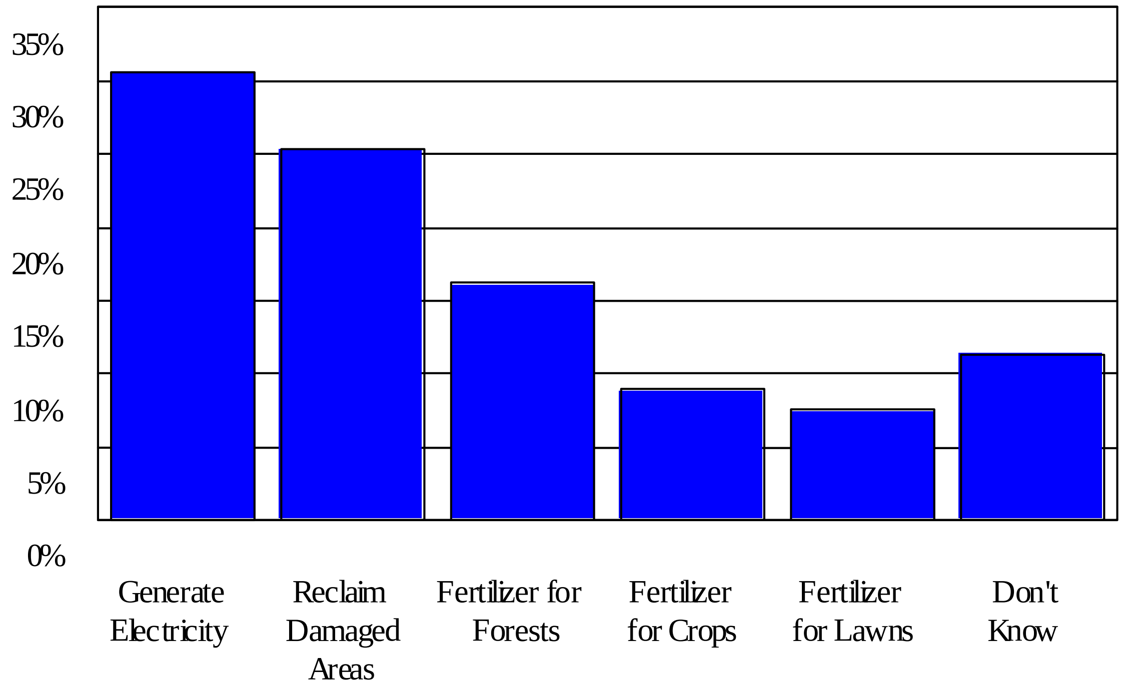


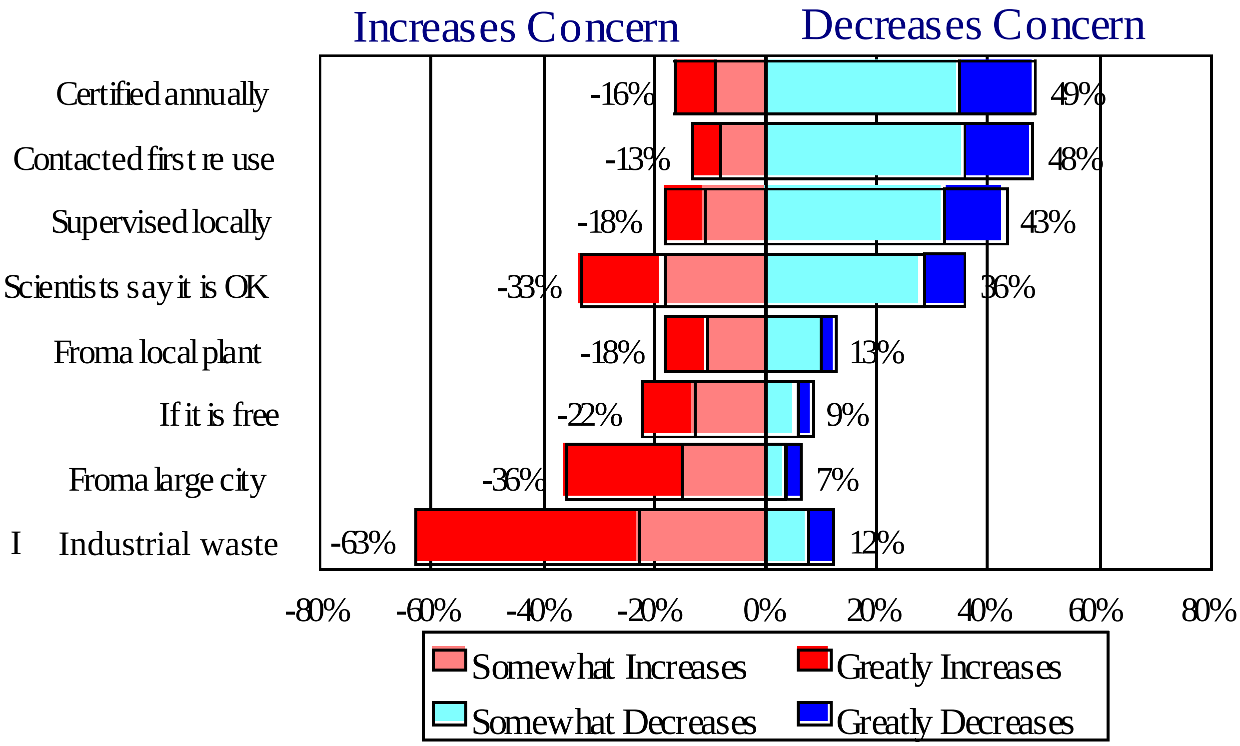
Figure 4-4. Best Use of Biosolids (n=1056).

4.4.3.1 Some Factors Increase Their Concern, Others Decrease Their Concern

Homeowners and house renters were asked to indicate whether several factors increase, decrease, or have no effect on their level of concern about using biosolids (Q19A – Q19H) (Figure 4-5). Factors that serve to decrease citizen concerns about the use of biosolids include knowing that it is certified annually, if they are contacted prior to it being used, and if its use is supervised locally. Factors that have mixed or no impacts on concerns about using biosolids are having scientists say it is OK to use, knowing that it comes from a local plant, or having it be provided free of charge.

Knowing that biosolids may have been produced from materials that contain some industrial waste dramatically increases concern among the respondents, and knowing that it comes from a large city also increases concern. These factors are clear deterrents to generating public acceptance for biosolids.

Figure **4-5. Factors That Increase or Decrease Concerns About Biosolids (n=1069).**



4.4.4 Arguments That Influence Public Perception

4.4.4.1 Returning Nutrients to the Soil and Waste Disposal are the Strongest Arguments for Using Biosolids

Of those tested in this survey (Q22 – Q27), the most persuasive arguments for using biosolids are that recycling biosolids returns nutrients and organic matter back into the soil and disposes of a waste product. *These are powerful arguments in the minds of eight out of 10 respondents.*

The argument that recycling biosolids saves money for sewage treatment plants and communities is seen as a moderately strong argument for the use of biosolids. Less persuasive arguments for the use of biosolids are that recycling biosolids is beneficial and involves minimal risk and that recycling biosolids prevents erosion and improves water quality.

After rating each individual argument, respondents were asked to rank the strongest argument for recycling biosolids against the others. Returning nutrients to the soil and disposing of a waste product were again cited as the strongest arguments for recycling biosolids; saving money for sewage treatment plants and communities gets moderate support. Stating that recycling biosolids is beneficial with few risks, or that it prevents erosion and improves water quality, are not considered as strong as other arguments for recycling biosolids.

These results are similar to those reported by the 1998 survey of Frederick Schneiders Research, in which respondents rated the strength of biosolids recycling messages. In that survey, the notion of returning nutrients to the soils as biosolids fertilizer was judged to be a strong message by 42% of respondents. Decreasing runoff and soil erosion was considered a strong argument by 36%, and describing scientific studies that call biosolids “safe and beneficial” is a strong argument for 35% of respondents. It appears, therefore, that the public most consistently responds to arguments that emphasize the recycling of nutrients to the soil.

Although Powell-Tate (1993) recommended that messages about biosolids avoid focusing on the waste origin of the material, the results of the current survey suggest that this approach be reconsidered. The public is savvy and distrusts any attempts to cover up the origin of biosolids. Open acknowledgement and discussion of how biosolids are produced, treated, and used will likely benefit from a positive public response to recycling of a necessary waste product. Most people can understand and recognize that 1) wastewater treatment is a necessary and good thing; 2) biosolids are generated from it and must be managed, and 3) a benefit of a well-run biosolids recycling program is that it disposes of this byproduct.

A marketing focus group analysis done for Greater Vancouver in 2000 (Greater Vancouver, 2000) included a major recommendation that, when marketing Greater Vancouver’s Nutrifor biosolids product, “The objective of any awareness campaign should be to define biosolids as an environmentally sound way to use sewage sludge…” The current survey corroborated this; one reason that people support biosolids recycling is that it disposes of a necessary by-product.

4.4.4.2 Lack of Information is the Strongest Argument Against Recycling Biosolids

Respondents were read several individual arguments that have been made against the use of biosolids and asked whether they agreed or disagreed that each is a strong argument against recycling biosolids (Q28 – Q34). According to 70% of respondents, the strongest argument against using biosolids was that “not enough is known about biosolids” (Figure 4-6).

The strong positive response to this argument may reflect the respondents’ own lack of knowledge about biosolids, but the strong response to these questions may be driven by something else as well. Earlier in the survey, respondents generally supported the concept of biosolids recycling (Q13), but they subsequently came up with questions and expressed uncertainty (e.g., Q18). The variety of questions and the depth of their uncertainty may have been reflected in the strength of their choice that “not enough is known about biosolids recycling.” Further, 78% of respondents who say they have not heard the term “biosolids” (in Q11) agree that “not enough is known” is a strong argument against biosolids recycling. This compares with only 65% of those who have heard of biosolids.

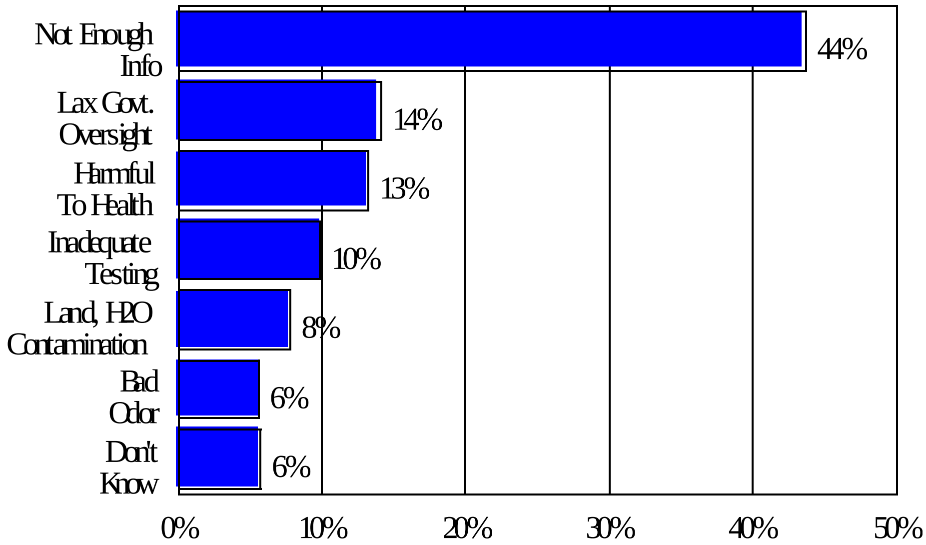


Figure 4-6. Arguments Against Recycling Biosolids (n=1049).

Those who felt they knew more did not as readily buy into the argument that “not enough is known”. This finding parallels the result of research showing that unknown risks tend to be seen as greater risks (Slovic, 1993). However, responses to questions (Q38 and Q39) about the relative risk presented by biosolids versus other commonly perceived risks (pesticide residues on foods and driving) strongly identified biosolids as low risk—less than that of driving and, somewhat surprisingly, less than pesticide residues in foods. Thus, even though their level of knowledge was low, respondents to this survey did not perceive biosolids as particularly risky—even after they had heard two series of positive and negative statements about biosolids recycling.

While the results regarding perception of risk are somewhat contradictory, the survey clearly indicates that the success of the wastewater treatment and biosolids management industry in gaining public acceptance of any biosolids management practice will depend to a large extent on increasing public knowledge of this subject.

Finally, there was some expectation on the part of some project participants that the argument about health concerns would have a stronger response than the survey found (just 13% chose this as the strongest argument against biosolids recycling). What lies behind such responses is difficult to guess; additional research would be needed to better understand such responses.

4.5 Topics for Future Research

The 2002 Biosolids Public Knowledge and Perception Survey is by far the largest (more than 1,000 surveyed) and most rigorous national survey of its type to date. In utilizing several questions and testing several hypotheses included in previous surveys (Powell-Tate, 1993; Frederick Schneiders Research, 1998), it built on past assessments of public knowledge and perception of biosolids management. At the same time, the current survey establishes some new baseline information that can be re-evaluated in future surveys of the same segment of the public (house owners and renters), most notably:

- the level of knowledge of the term “biosolids,”
- the level of initial uneasiness with the concept of biosolids recycling,
- the sources of uneasiness/concerns,
- the level of perceived risk associated with biosolids recycling,
- the most persuasive arguments for and against biosolids recycling,
- whom people turn to for information, and
- what sources of information people trust regarding this topic.

By following the methods, format, and some of the basic questioning of this survey, future surveys should be able to determine whether or not biosolids managers’ future public outreach and participation efforts have the intended effect of improving public knowledge, understanding, participation, and perceptions of biosolids management. However, a general survey of this sort is not recommended for at least five years. Why? Because this survey’s strongest finding was that people know very little about biosolids recycling; time is needed to develop more widespread knowledge. A survey would make the most sense after a concerted effort is made to increase public knowledge.

In the near term, it could be useful—perhaps in focus groups—to probe how people’s uncertainty about biosolids recycling evolves as they learn more about biosolids. It appears that, if pressured to form opinions, people’s uncertainty creates a level of discomfort that most often leads to formation of negative opinions about biosolids recycling. However, if enough time is provided for people to absorb information, ask questions, and integrate the concept with their world view, it is more likely, although not guaranteed, that a positive or accepting opinion of biosolids recycling may develop.

Other questions that arise from the results of this survey and await further testing include:

- Does the fact that most people support wastewater treatment have much influence on how they perceive and form opinions about biosolids management?
- How strong are the arguments in support of or against biosolids recycling? Do the arguments supportive of biosolids recycling actually have much effect in overcoming people’s initial uneasiness about biosolids? Do the arguments have more or less influence than other aspects of the communication and information exchange process, such as who the communicator is, or how information is presented?
- It might be useful to explore more deeply the rather tentative, “hypothetical” support for recycling biosolids in general that can so easily disappear in the face of negative press coverage and/or increased local opposition.
- Why is it that respondents did not identify bad odor as a more significant argument against biosolids recycling? Experience in real world situations has certainly demonstrated that odors are the single most common factor triggering concern.
- What are the key attributes of the communication process and who would be the best spokespeople and sources of information for biosolids recycling?
- What were respondents’ underlying assumptions as they answered the questions about arguments in favor of biosolids recycling and those opposed? Did they assume the

statements were statements of fact? They were asked to evaluate how strong they felt the arguments were. To what extent were their answers just reflecting their opinion of biosolids?

Finally, future surveys might be tempted to test other political, economic, or social norms to see if there is any correlation between them and respondents' knowledge and perceptions of biosolids recycling. This survey tested a few such norms, including self-identification as an "environmentalist," those who choose organic products, different age groups, and different regions. However, the survey found weak or no correlations of these norms with views of biosolids recycling. Why? Because the overarching finding of this survey was that very few people know anything about biosolids. Therefore, it is unlikely that any correlations will become highly significant until a much larger proportion of the population knows a lot more about biosolids recycling. Therefore, testing for correlations of this sort is not likely to be useful in the near future.

APPENDIX A

APPENDED DOCUMENTS:
THE PERSPECTIVES OF CONCERNED CITIZENS

Appended Documents

The following documents critical of biosolids recycling are representative of myriad critiques available in correspondence, on the Internet, and in gray literature. They are included here because they represent the concerns of many citizens who live and work in communities where biosolids recycling programs are sited. If biosolids programs are to become sustainable and publicly accepted, they will need to constantly address the concerns, perceptions, and human feelings expressed in these kinds of documents.

<u>A Concerned Citizen's Outrage</u>

Question: Why are you in favor of poisoning farmland and range land in the U.S. or anywhere? Why doesn't NYC keep its waste material in New York State, and "beneficially" use it there, if it's such a wonderful fertilizer? And that excuse that New York lands have "freezing" weather in the winter? Don't even go there with that lame excuse.

Within three to four years, this "recycling success story you… and WEF have in your mistruths of fact, will have been exposed, and land application will have been severely curtailed in the US, not increased, as some claim.

What is your true motivation to promote the sludging of America…? What could you possibly be getting out of your activities? As far as being an ecologist, and a poison promoter, you have great hypocrisy and conflict. The two, cannot co-exist. If you support and promote industrial contaminated sewage from NYC or anywhere being transferred to other states, and dumped anywhere on agricultural lands, you are not a true environmentalist or ecologist.

The truth all comes out in the wash…. You…do not have a leg to stand on regarding science and medical fact. Didn't your mother ever tell you "It's not nice to try to make a fool of Mother Nature?"

What a Crock of Sludge.

--Bill Addington of Sierra Blanca, TX, August 2001 e-mail to New York City Biosolids Program

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<u>The Critical Perspective of an Environmental Organization</u>

WHY WE ARE OPPOSED TO THE LAND APPLICATION OF SEWAGE SLUDGE?

BECAUSE the Federal Clean Water Act states sewage sludge is a "pollutant".

BECAUSE the Harper-Collins Dictionary of Environmental Science describes sludge as: "A viscous, semisolid mixture of bacteria and virus-laden organic matter, toxic metals, synthetic organic chemicals, and settled solids removed from domestic and industrial waste water at sewage treatment plants.

BECAUSE official U.S. EPA policy is to dispose of landfill leachates, radioactive wastes, toxic commercial, industrial, and in many cases Superfund wastes, into public sewer systems, to be combined with residential septage and other pathogenic sources, with the resultant sewage sludge to be spread on agricultural land in rural America.

BECAUSE FEDERAL LAW (40CFR 403.12) P)(2) permits every business and industry in the United States to dump 33 pounds of hazardous wastes into public sewers every month with no reporting requirements.

BECAUSE the U.S. EPA's TRI (Toxics Release Inventory) and public records indicated industrial pretreatment programs are inadequate, ineffective and/or not being enforced in states around the nation with regard to controlling the discharge of toxic industrial chemicals into public sewers.

BECAUSE the U.S. EPA acknowledges Class B sewage sludge contains human pathogens, slaughter-house wastes, mortuary discharges, and infectious hospital and institutional wastes, including disease-causing bacteria, viruses, virulent antibiotic resistant microbes, protozoa, intestinal parasites, and ova of parasitic worms.

BECAUSE the U.S. EPA has never conducted a risk assessment on the harm to human health from the pathogens in surface applied sludge, including waterborne pathogens and airborne viruses, bacteria, endotoxins, molds, fungi, etc.

BECAUSE the U.S. EPA acknowledges land applied sewage sludge emits toxic (odor-causing) gases including dimethyl sulfide, dimethyl disulfide, methyl mercaptan, trimethylamine and ammonia, which CDC, NIOSH, OSHA, DOT and other government agencies warn can cause great harm to human health if inhaled or ingested.

BECAUSE a 1999 Risk Assessment conducted by Scot Dowd, Charles Gera, Ian Pepper, and Suresh Pillai indicates people within 1000 - 1600 feet of sludge sites or sludge stockpiles are at significant risk (far in excess of U.S. EPA acceptable risk of 1-10,000) from airborne sludge viruses and bacteria.

BECAUSE a report published in Nov. 2000 Journal of Agromedicine—Dr. Susan Schiffman, Duke University and Dr. John Walker, U.S. EPA, lead authors—details the harm to human health from sludge odors, odorants, bioaerosols, and airborne particulates including "eye, nose, and throat irritation, headache, nausea, diarrhea, hoarseness, sore throat, cough, chest tightness, nasal congestion, palpitations, shortness of breath, stress, drowsiness, and alterations in mood" and "exposure to increased levels of particulates is associated with increased mortality risk, especially among the elderly and individuals with preexisting cardiopulmonary diseases, such as chronic obstructive pulmonary disease (COPD), pneumonia, and chronic heart disease."

BECAUSE the aforesaid sludge gases and sludge airborne pathogens combine to form a noxious miasma which adversely affects human health including neighbors of sludge sites.

BECAUSE the U.S.EPA acknowledges all sewage sludge, both Class A and Class B, contains toxic metals including arsenic, antimony, beryllium, cadmium, chromium, lead, molybdenum and mercury, dangerous pesticides; toxic, bioaccumulative poisons including dioxins and brominated flame retardants; and hazardous industrial wastes including cyanide, polynuclear aromatic hydrocarbons and other volatile and semi-volatile organic chemicals.

BECAUSE the landspreading of sewage sludge has caused sickness (and possibly even death) in people around the country—(known as "sludge syndrome") including nausea, vomiting, diarrhea, eye, nose and throat burning irritation, skin rashes and lesions, cysts, bloody noses, eye infections, asthma, and other respiratory illnesses, tumors, immune system damage, viral and bacterial infections, and a host of other physical maladies.

BECAUSE the landspreading of sewage sludge has caused sickness and death of fish, livestock, and family pets.

BECAUSE sludge nutrients, toxins, and pathogens are known to have contaminated drinking water wells, groundwater and surface waters around the country.

BECAUSE sewage sludge is known to contain nonylphenols, surfactants, phthalates, and other hormone disrupting chemicals which cause great harm not only to humans but also to wildlife and aquatic life.

BECAUSE the U.S. EPA has never conducted a risk assessment into the ecological risks of the harm to wildlife, soil biota, and other ecological biosystems from surface applied sewage sludge.

BECAUSE the U.S. EPA has harassed and retaliated against any scientist within its agency who dares to speak out in opposition to its sludge (or other waste management) policies, and hundreds of thousands of our tax dollars have been paid to these mistreated scientists to compensate them for the U.S. EPA's abuse of power.

BECAUSE the U.S. EPA has established the least protective sludge regulations of any developed country in the world (Canada and European countries use the "precautionary principle"—or "no net degradation to soil quality"—to set limits on toxic metals from sludge in agricultural soils 10-20 times lower than the U.S. EPA).

BECAUSE the U.S. EPA Inspector General in April stated: "EPA does not have an effective program for ensuring compliance with the land application requirements of Part 503"; and "Accordingly, while EPA promotes land application, EPA cannot assure the public that current land application practices are protective of human health and the environment."

BECAUSE state "environmental/regulatory" agencies across the nation are PROMOTING the land application of sewage sludge, and doing nothing to respond to sickness, water contamination and other concerns of rural Americans who are suffering the health and environmental consequences of this misguided policy.

BECAUSE the U.S. EPA has made a concerted effort to avoid any and all documentation and/or investigation of the sickness (and possibly death) of sludge victims—human and animals.

BECAUSE in 1999, the U.S. EPA WEAKENED the Part 503 sludge rule by REDUCING the frequency of pathogen testing, by changing requirements so that sludge certification is only to the "accuracy of the submitted information" and NOT to "compliance with the regulatory requirements", and by allowing "inadvertent" grazing of animals on sludged land within 30 days of application.

BECAUSE the U.S. EPA has given hundreds of thousands of our tax dollars to the Water Environment Federation—the lobbying and public relations arm of the waste industry—to fund their campaigns to debunk and discredit sludge victims and sludge opponents.

BECAUSE the Waste Management Institute of Cornell University, Ithaca, NY, has studied the land application of sewage sludge for many years and has published a report in the International Journal of Environment and Pollution, which concludes the U.S. EPA 503 sludge rules do not protect human health and the environment.

NOW, THEREFORE, RURAL AMERICA DEMANDS AN END TO THE LANDSPREADING OF SLUDGE.

--*The Pennsylvania Environmental Network's Sludge Leadership Team, July 2001*

A Biosolids Ban and Rationale

Section 4. Effective January 1, 2003, a new Chapter 8.05 shall be added to Title 8 of the Ordinance Code of Kern County to read as follows:

Section 2. Declaration of Urgency.
a. Municipal sewage sludges, also known as biosolids, are the by-product of the waste water treatment process which, with the increases in population and changes in the technology of waster water treatment processes, is creating a larger volume of biosolids being generated each year and being used in Kern County.
b. With the increasing use, and in some cases misuse, of biosolids, residents in areas of the County have made numerous complaints regarding misapplication or improper storage of biosolids, nuisance issues including odor, flies, dust, water quality and other health-related concerns, unsafe and deteriorating roads, vehicle accidents and spills, and concerns over the continued viability of productive agricultural land for crop uses after biosolids application.
c. Unregulated application of biosolids represents a significant risk of exposure to contaminants by people and animals, long-term impacts to groundwater supplies and the potential elimination of productive agricultural land from use through high concentrations of pollutants.
d. The Roads Department has also advised this Board that rural County roads being used for the transportation of biosolids for land application within the County are not designed for the intense and continual truck traffic associated with biosolids hauling which has resulted in the rapid and significant deterioration and damage. These conditions represent an immediate danger to the traveling public and causing, at times, temporary road closures. These conditions cannot be remedied without additional funds being made available to the Roads Department.
e. This Board further incorporates by reference the factual basis set forth in Resolution 98-266 articulating the need for an interim ordinance regulating the land application of biosolids and the imposition of a system of permit fees.

f. This Board has the requisite authority pursuant to Government Code sections 65858 and 66017 to adopt an interim urgency ordinance prohibiting uses inconsistent with regulations contemplated by this Board to be adopted after completion of public study and environmental review.
g. Therefore, this Board finds there is an immediate need for local regulations to ensure that biosolids land application processes are properly managed to protect the health and safety of County residents, imposition of an infrastructure mitigation fee to provide for the maintenance of County roads used to transport biosolids, and ensure the continued viability of the County's agriculture industry through the tracking of biosolids application to crop land, pending completion of a final ordinance regulating biosolids.

Section 3. Chapter 8.05 is hereby added to the Kern County Ordinance Code to read as follows:

CHAPTER 8.05: LAND APPLICATION OF BIOSOLIDS

8.05.010 PURPOSE AND INTENT
There are numerous unanswered questions about the safety, environmental effect, and propriety of land applying Biosolids or sewage sludge, even when applied in accordance with federal and state regulations. Biosolids may contain heavy metals pathogenic organisms, chemical pollutants, and synthetic organic compounds, which may pose a risk to public health and the environment if improperly handled. Land application of Biosolids may pose a risk to land, air, water, to human and animal health, and may cause loss of confidence in agricultural products from Kern County as well as the potential loss of productive agricultural lands.

In order to promote the general health, safety and welfare of Kern County and its inhabitants, it is the intent of this chapter that the land application of Biosolids shall be prohibited in the unincorporated area of Kern County.

The County recognizes that Exceptional Quality Biosolids, as defined in this chapter, are considered by the U.S. Environmental Protection Agency to be a product, whether distributed in bulk form, bags or other containers, that can be applied as freely as any other fertilizer or soil amendment to any type of land. Therefore, the provisions of this chapter do not apply to Exceptional Quality Biosolids unless specifically stated herein. Further, the provisions of this chapter do not apply to Compost, as defined herein, manufactured from Biosolids at composting facilities that are otherwise regulated by the County through Solid Waste and Conditional Use Permits.

--Kern County, available at http://www.co.kern.ca.us/rma/bsurgenc.htm#BOAC2

Additional Reading for Understanding Public Concerns
(see Annotated Bibliography for accessing the following):

- Harrison, et al., 1997 & 1999: *The Case for Caution*. This is now a classic critique of biosolids recycling, with a focus on trace organic (and inorganic chemical) availability. It has raised the ire many scientists who have studied the impacts of biosolids land application, biosolids industry people, and state and federal regulators. A rebuttal was developed by the New York State Department of Environmental Conservation (see New York State Department of Environmental Conservation, 1997).

- Sierra Club: National Sewage Sludge Guidance (see Sierra Club, 2002(a)). This guidance document was developed by three Sierra Club members of a subcommittee of the Club's solid waste committee. It is the first document from any significant national environmental group that strongly criticizes biosolids recycling. Those involved in biosolids management—including several long-time Sierra Club members—complained to Sierra Club leaders that the development of the guidance was limited to a small group of opponents and that their input was not fairly considered (the biosolids industry is not alone in sometimes having limited public participation in the development of its policies).

APPENDIX B

THE 2002 BIOSOLIDS PUBLIC KNOWLEDGE AND PERCEPTION SURVEY

<u>NOTE</u>: Most of the questions in the survey were open-ended, i.e. the respondent was not provided with a list of possible answers from which to choose. If answers were provided, it is clearly indicated in the text of the questions, below. The lists of answers that appear in ALL CAPITALS are categories of *expected* answers that interviewers used to categorize actual answers.

I1. <u>INTRODUCTION</u>: "Hello, this is ______________________ calling from the University of New Hampshire Survey Center. This month the University is conducting a <u>confidential</u> study of people across the nation about their attitudes and opinions on some environmental issues. All answers will be kept in strictest confidence and no individual answers will be reported. First, to see if your household is eligible, could you please answer a few questions?"

I1A. "Do you live at this residence all year round or are you on vacation?"

<u>1 YEAR ROUND RESIDENT</u>
2 SEASONAL, JUST VACATIONING → "Thank you very much, we are only interviewing year round residents"

<u>9 REFUSED</u>

I2. "In order to determine who to interview, could you tell me, of the adults aged 18 or older who currently live in your household -- including yourself -- who had the most recent birthday? I don't mean who is the youngest adult, but rather, <u>who had the most recent birthday</u>?"

1 INFORMANT B SKIP TO I5
2 SOMEONE ELSE (SPECIFY): ________________ --SKIP TO I4
3 DON'T KNOW <u>ALL</u> BIRTHDAYS, ONLY SOME -- CONTINUE WITH I3 BELOW
4 DON'T KNOW ANY BIRTHDAYS OTHER THAN OWN -- SKIP TO I5

9 REFUSED -- ENTER NON-RESPONSE INFORMATION

I3. "Of the ones that you <u>do</u> know, who had the most recent birthday?"

A INFORMANT _____ B SKIP TO I5
B SOMEONE ELSE (SPECIFY): ____________________________

I4. ASK TO SPEAK TO THAT PERSON

INTRODUCTION: "Hello, this is ______________________ calling from the University of New Hampshire Survey Center. This month the University is conducting a confidential study of people across the nation about their attitudes and opinions on environmental issues. You have been identified as the adult in your household who had the most recent birthday. Is this correct?"

1 YES
2 APPOINTMENT

9 REFUSAL

I5. "Thank you very much for helping us with this important study. We really appreciate your help. Before we begin I want to assure you that all of your answers are strictly confidential. They will be combined with answers from other people across the country. Your telephone number was randomly selected from all families in the US. This call may be monitored for quality assurance."

RECORD SEX OF RESPONDENT

1 MALE
2 FEMALE

9 NA

RESI "First, do you own or rent your current residence?"

1 OWN – CONTINUE WITH QZIP
2 RENT – ASK QTYPE

9 NO ANSWER/REFUSED

TYPE "Is that an apartment or a house that you are renting?"

1 APARTMENT/CONDO – THANK AND TERMINATE
2 HOUSE – CONTINUE WITH QZIP

9 NO ANSWER/REFUSED

QZIP "What is your zip code?" (RECORD ZIP CODE BELOW)

____

99998 DK - DO NOT PROBE
99999 NA / REFUSED

Q1. "How many years have you lived in your town?" IF "ALL MY LIFE" ASK – "About how many years is that?" RECORD EXACT NUMBER OF YEARS OF RESIDENCE

|___|

1 ONE YEAR OR LESS
97 96 YEARS OR MORE
98 DON'T KNOW/NOT SURE
99 NO ANSWER/REFUSED

Q2. "Would you say that you live in a rural, suburban or urban community?"

1 RURAL
2 SUBURBAN
3 URBAN
4 OTHER:____

8 DON'T KNOW
9 NO ANSWER/REFUSED

Q3. "Have you ever lived on a farm, ranch, or in a farming or ranching community?" IF YES: "Did you live on a farm, or in a farming community… a ranch… or in a ranching community?"

1 FARM
2 FARMING COMMUNITY
3 RANCH
4 RANCHING COMMUNITY
5 COMBINATION – (VOLUNTEERED)

6 NO, NEVER LIVED IN FARMING/RANCHING COMMUNITY

8 DON'T KNOW
9 NO ANSWER/REFUSED

Q4. "Do you, or anyone in your household, usually do any farming or gardening?"

1 YES
2 NO – SKIP TO Q7

8 DON'T KNOW – SKIP TO Q7
9 NO ANSWER/REFUSED – SKIP TO Q7

Q5. “What type of fertilizer, if any, do you use on your lawn or garden or on your farm?”

1 CHEMICAL
2 ANIMAL MANURE
3 COMPOSTED YARD WASTE (LEAVES, CLIPPINGS)
4 BIOSOLIDS/SLUDGE/MILORGANITE/SLUDGE COMPOST
5 OTHER: ________________________________
6 NONE/DON’T USE – SKIP TO Q7

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q6A. “Why do you prefer this type of fertilizer?”

1 EASE OF USE, CONVENIENCE
2 SAFER FOR FAMILY & PETS
3 LESS IMPACT ON THE ENVIRONMENT
4 CHEAPER
5 ONLY TYPE AVAILABLE
6 OTHER: ________________________________
7 NONE/DON’T USE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q6B. How likely would you be to use a fertilizer that was made from animal manures that had an barnyard odor and looked like moist soil?

9 VERY LIKELY
10 SOMEWHAT LIKELY
11 UNCERTAIN
12 NOT TOO LIKELY
13 NOT AT ALL LIKELY

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q6C. How likely would you be to use a fertilizer that was made from human manures and sewage that had a barnyard odor and looked like moist soil?

1 VERY LIKELY
2 SOMEWHAT LIKELY
3 UNCERTAIN
4 NOT TOO LIKELY
5 NOT AT ALL LIKELY

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q7. “Do you ever seek out and purchase and eat foods that are specifically labeled as being organically grown?” IF YES, ASK: “Would you say you do that occasionally … frequently … or all the time?”

1 YES, OCCASIONALLY
2 YES, FREQUENTLY
3 YES, ALL THE TIME
4 ONLY THING I EAT (VOLUNTEERED)
5 NO

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q8. “How much would you agree that the term Environmentalist applies to you? Would you say that you agree strongly... agree somewhat ... disagree somewhat ... or, strongly disagree?

1 AGREE STRONGLY
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 DISAGREE STRONGLY

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q9. “I’m now going to ask you several questions about the sewage from your home. Sewage is the mixture of waste and water that goes down toilets, sinks, and drains. First of all, what happens to the sewage after it leaves your home?

1 A PUBLIC SEWAGE TREATMENT PLANT
2 A HOME SEPTIC SYSTEM
3 A GROUP SEPTIC SYSTEM
4 OTHER ________________________

8 DON’T KNOW – DO NOT PROBE
9 NO ANSWER/REFUSED

Q10A. “Have you, yourself, ever visited a sewage treatment plant?”

1 YES
2 NO – SKIP TO Q11

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q10B. "Which of the following statements best describes your overall impression of the sewage treatment plant you saw? (READ RESPONSES 1 TO 5)

1 They are a necessary protector of our environment,
2 They are probably a good idea,
3 I don't know if it is necessary,
4 They may not be needed, or
5 They are detrimental to our environment"

8 DON'T KNOW
9 NO ANSWER/REFUSED

Q11. "Have you ever heard of the term BIOSOLIDS?"

1 YES
2 NO/DON'T KNOW THE TERM – SKIP TO Q13

9 NO ANSWER/REFUSED – SKIP TO Q13

Q12. "How would you define the term BIOSOLIDS?" (RECORD VERBATIM RESPONSE. PROBE FOR SPECIFICS)

Q13. "Biosolids are the solid matter removed from sewage that has been treated and tested so they can be recycled as a fertilizer. Based on what you know about biosolids, what is your overall reaction to the process of recycling biosolids as fertilizer?" (RECORD VERBATIM RESPONSE. PROBE FOR SPECIFICS)

FORM A:

Q14A. "I want you to imagine the following scenario. Suppose your next door neighbor had spread recycled biosolids on their lawn or garden as fertilizer. Which ONE of the following statements BEST describes your attitude towards your neighbor's use of biosolids? Would you say you ... (READ NUMBERS 1 TO 6)

1 Think its great ... recycling useful products is a good idea,
2 It's probably OK – otherwise the government wouldn't let them do it,
3 I would prefer they not to do it because of safety or odor issues,
4 I would ask them to stop – it's too "yucky,"

5 I'd move my family away – it's too dangerous to my family's health, or
6 I would think that it was none of my business – it's their land, not mine."

8 DON'T KNOW
9 NO ANSWER/REFUSED

Q15A. "If you had questions about your neighbors use of biosolids, who would you ask FIRST?" "Who would you ask SECOND?"

DO NOT READ RESPONSES. ENTER FIRST AND SECOND RESPONSE

1 US ENVIRONMENTAL PROTECTION AGENCY
2 STATE HEALTH OR ENVIRONMENTAL OFFICIALS
3 SEWAGE TREATMENT PLANT OPERATORS
4 LOCAL HEALTH DEPARTMENT
5 UNIVERSITY RESEARCHERS
6 COMPANY WHO DELIVERED BIOSOLIDS
7 NON-GOVERNMENTAL ENVIRONMENTAL ORGANIZATIONS
8 FRIENDS OR NEIGHBORS
9 OTHER – SPECIFY ______________________________

10 DON'T KNOW
11 NO ANSWER/REFUSED

FORM B:

Q14B. "I want you to imagine the following scenario: Suppose your next door neighbor had spread sewage sludge on their lawn or garden as fertilizer. Which ONE of the following statements BEST describes your attitude towards your neighbor's use of sewage sludge? Would you say you ... (READ NUMBERS 1 TO 6)

1 Think its great ... recycling useful products is a good idea,
2 It's probably OK – otherwise the government wouldn't let them do it,
3 I would prefer they not do it because of safety or odor issues,
4 I'd ask them to stop – it's too "yucky,"
5 I'd move my family away – it's too dangerous to my family's health, or
6 I would think that it was none of my business – it's their land, not mine.

8 DON'T KNOW
9 NO ANSWER/REFUSED

Q15B. "If you had questions about your neighbors use of sewage sludge, who would you ask FIRST?" "Who would you ask SECOND?"

DO NOT READ RESPONSES. ENTER FIRST AND SECOND RESPONSE

1 U.S. ENVIRONMENTAL PROTECTION AGENCY
2 STATE HEALTH OR ENVIRONMENTAL OFFICIALS
3 SEWAGE TREATMENT PLANT OPERATORS
4 LOCAL HEALTH DEPARTMENT
5 UNIVERSITY RESEARCHERS
6 COMPANY WHO DELIVERED BIOSOLIDS
7 NON-GOVERNMENTAL ENVIRONMENTAL ORGANIZATIONS
8 FRIENDS OR NEIGHBORS
9 OTHER – SPECIFY ______________________________

10 DON'T KNOW
11 NO ANSWER/REFUSED

Q16. "Now I want to ask you several questions about using recycled biosolids. How likely would you be to use recycled biosolids on your own yard, garden or farm? Would you be very likely … somewhat likely … not very likely … or not at all likely?"

1 VERY LIKELY
2 SOMEWHAT LIKELY
3 NOT VERY LIKELY
4 NOT AT ALL LIKELY
5 DON'T HAVE YAR, GARDEN OR FARM (VOLUNTEERED)

8 DON'T KNOW/NOT SURE
9 NO ANSWER/REFUSED

Q17. "How likely would you be to allow your children to play on a yard treated with recycled biosolids? Would you be very likely … somewhat likely … not very likely … or not at all likely?"

1 VERY LIKELY
2 SOMEWHAT LIKELY
3 NOT VERY LIKELY
4 NOT AT ALL LIKELY
5 DON'T HAVE ANY CHILDREN (VOLUNTEERED)

8 DON'T KNOW/NOT SURE
9 NO ANSWER/REFUSED

Q18. "What, specifically, would you need to know in order to be more comfortable about recycled biosolids being used near your home?" RECORD VERBATIM RESPONSE. PROBE FOR SPECIFICS: "Anything else?"

Q19A. “Would it change your level of concern to know that biosolids applied near your home were from your LOCAL sewage treatment facility? Does this increase or decrease your level of concern about recycling biosolids?”

IF DECREASE: “Would you say it greatly decreases your concern or just somewhat?”
IF INCREASE: “Would you say it greatly increases your concern or just somewhat?”

1 GREATLY DECREASES MY CONCERN
2 SOMEWHAT DECREASES MY CONCERN
3 NO CHANGE IN CONCERN – (VOLUNTEERED)
4 SOMEWHAT INCREASES MY CONCERN
5 GREATLY INCREASES MY CONCERN

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q19B. “Would it change your level of concern to know that biosolids being applied near your home were from a LARGE CITY like Chicago, New York, or Los Angeles? Does this increase or decrease your level of concern about recycling biosolids?”

IF DECREASE: “Would you say it greatly decreases your concern or just somewhat?”
IF INCREASE: “Would you say it greatly increases your concern or just somewhat?”

1 GREATLY DECREASES MY CONCERN
2 SOMEWHAT DECREASES MY CONCERN
3 NO CHANGE IN CONCERN – (VOLUNTEERED)
4 SOMEWHAT INCREASES MY CONCERN
5 GREATLY INCREASES MY CONCERN

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q19C. “Would it change your level of concern to know that biosolids being applied near your home were produced from sewage that included a LIMITED AMOUNT OF INDUSTRIAL WASTE? Does this increase or decrease your level of concern about recycling biosolids?”

IF DECREASE: “Would you say it greatly decreases your concern or just somewhat?”
IF INCREASE: “Would you say it greatly increases your concern or just somewhat?”

1 GREATLY DECREASES MY CONCERN
2 SOMEWHAT DECREASES MY CONCERN
3 NO CHANGE IN CONCERN – (VOLUNTEERED)
4 SOMEWHAT INCREASES MY CONCERN
5 GREATLY INCREASES MY CONCERN

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q19D. “Would it change your level of concern to know that biosolids being applied near your home DID NOT COST YOUR NEIGHBOR ANYTHING; THEY WERE OBTAINED FOR FREE? Does this increase or decrease your level of concern about recycling biosolids?”

IF DECREASE: “Would you say it greatly decreases your concern or just somewhat?”
IF INCREASE: “Would you say it greatly increases your concern or just somewhat?”

1 GREATLY DECREASES MY CONCERN
2 SOMEWHAT DECREASES MY CONCERN
3 NO CHANGE IN CONCERN – (VOLUNTEERED)
4 SOMEWHAT INCREASES MY CONCERN
5 GREATLY INCREASES MY CONCERN

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q19E. “Would it change your level of concern to know that biosolids being applied near your home were REVIEWED AND CERTIFIED EACH YEAR BY AN INDEPENDENT EXPERT AUDITOR? Does this increase or decrease your level of concern about recycling biosolids?”

IF DECREASE: “Would you say it greatly decreases your concern or just somewhat?”
IF INCREASE: “Would you say it greatly increases your concern or just somewhat?”

1 GREATLY DECREASES MY CONCERN
2 SOMEWHAT DECREASES MY CONCERN
3 NO CHANGE IN CONCERN – (VOLUNTEERED)
4 SOMEWHAT INCREASES MY CONCERN
5 GREATLY INCREASES MY CONCERN

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q19F. “Would it change your level of concern to know that biosolids applied near your home were produced by a process supervised by a LOCAL CITIZENS ADVISORY COMMITTEE? Does this increase or decrease your level of concern about recycling biosolids?”

IF DECREASE: “Would you say it greatly decreases your concern or just somewhat?”
IF INCREASE: “Would you say it greatly increases your concern or just somewhat?”

1 GREATLY DECREASES MY CONCERN
2 SOMEWHAT DECREASES MY CONCERN
3 NO CHANGE IN CONCERN – (VOLUNTEERED)
4 SOMEWHAT INCREASES MY CONCERN
5 GREATLY INCREASES MY CONCERN

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q19G. “Would it change your level of concern if your neighbor or the biosolids manager contacted you in advance and talked with you about your neighbor's use of biosolids? Does this increase or decrease your level of concern about recycling biosolids?”

IF DECREASE: “Would you say it greatly decreases your concern or just somewhat?”
IF INCREASE: “Would you say it greatly increases your concern or just somewhat?”

1 GREATLY DECREASES MY CONCERN
2 SOMEWHAT DECREASES MY CONCERN
3 NO CHANGE IN CONCERN – (VOLUNTEERED)
4 SOMEWHAT INCREASES MY CONCERN
5 GREATLY INCREASES MY CONCERN

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q19H. “Most scientists say there is negligible risk associated with recycling biosolids. Does this increase or decrease your level of concern about recycling biosolids?”

IF DECREASE: “Would you say it greatly decreases your concern or just somewhat?”
IF INCREASE: “Would you say it greatly increases your concern or just somewhat?”

1 GREATLY DECREASES MY CONCERN
2 SOMEWHAT DECREASES MY CONCERN
3 NO CHANGE IN CONCERN – (VOLUNTEERED)
4 SOMEWHAT INCREASES MY CONCERN
5 GREATLY INCREASES MY CONCERN

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q20. “Who do you think should be responsible for testing and overseeing the use of biosolids?” (READ RESPONSES 1 TO 5)

1 “State and/or federal Government officials,
2 Sewage plant operators,
3 University researchers,
4 Local Government officials, or
5 Landowners where recycled biosolids are being used?”
14 OTHER: ____

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q21. “Which of these do you think is the BEST use for biosolids …
(READ NUMBERS 1 TO 5. ROTATE RESPONSES)

1 as fertilizer for soils in which food crops are grown,
2 as fertilizer for home lawns or gardens,
3 as fertilizer for forest soils to grow trees,
4 to improve soil and recover plant growth in areas damaged by mining, dredging or construction, or
5 to produce gases that can be burned to generate electricity.”

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q22. “I’m now going to read you several arguments in favor of recycling biosolids and I want you to tell me how much you agree with each statement. First …” (ROTATE Q22 – Q26)

“Recycling biosolids disposes of a waste product … Do you agree or disagree that this is a strong argument in favor of recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q23. “Recycling biosolids returns nutrients and organic matter back into the soil … Do you agree or disagree that this is a strong argument in favor of recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q24. “Recycling biosolids prevents erosion and improves water quality … Do you agree or disagree that this is a strong argument in favor of recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q25. “Recycling biosolids is beneficial and involves minimal risk … Do you agree or disagree that this is a strong argument in favor of recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q26. “Recycling biosolids saves money for sewage treatment plants and communities … Do you agree or disagree that this is a strong argument in favor of recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q27. “Which of these do you think is the STRONGEST argument FOR recycling biosolids?” (READ NUMBERS 1 TO 5. ROTATE RESPONSES)

1 “It disposes of a waste product,
2 Recycles nutrients and organic matter back into the soil,
3 Prevents erosion and improves water quality,
4 Is beneficial and involves minimal risk, or
5 Saves money for sewage treatment plants and the communities they serve?”

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q28. “I’m now going to read you some of the arguments that others have made AGAINST recycling biosolids and I want you to tell me how much you agree with each argument.” (ROTATE Q28 – Q33)

“There has been inadequate testing of biosolids … Do you agree or disagree that this is a strong argument against recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q29. “Biosolids have a bad odor … Do you agree or disagree that this is a strong argument against recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q30. “There is poor oversight and enforcement by government officials … Do you agree or disagree that this is a strong argument against recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q31. “Biosolids are harmful to your health … Do you agree or disagree that this is a strong argument against recycling biosolids?

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
15 NO ANSWER/REFUSED

Q32. “Biosolids lead to land or water contamination … Do you agree or disagree that this is a strong argument against recycling biosolids?”

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q33. “Not enough is known about biosolids … Do you agree or disagree that this is a strong argument against recycling biosolids?"

IF AGREE: "Do you strongly agree or just somewhat?"
IF DISAGREE: "Do you strongly disagree or just somewhat?"

1 STRONGLY AGREE
2 AGREE SOMEWHAT
3 NEITHER AGREE NOR DISAGREE (VOLUNTEERED)
4 DISAGREE SOMEWHAT
5 STRONGLY DISAGREE

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q34. “Which of these do you think is the strongest argument AGAINST recycling biosolids … (READ NUMBERS 1 TO 6. ROTATE RESPONSES)

1 Inadequate testing,
2 Bad odors,
3 Poor oversight and enforcement by government officials,
4 Adverse health impacts,
5 Land or water contamination, or
6 Not enough is known?”

8 DON’T KNOW
9 NO ANSWER/REFUSED

Q35. “If you were seeking information about biosolids, which of the following sources of information do you think would be the MOST trustworthy? (READ RESPONSES 1 TO 9, ROTATE RESPONSES. READ ALL BEFORE ACCEPTING AN ANSWER)

“Who is the SECOND most trustworthy?” (READ RESPONSES AGAIN EXCEPT PREVIOUS ANSWER.)

“Who is the THIRD most trustworthy?” (READ RESPONSES AGAIN EXCEPT PREVIOUS ANSWERS.)

1 U.S. Environmental Protection Agency,
2 State health and environmental officials,
3 Sewage treatment plant operators,
4 Local health department,
5 University researchers,
6 Private companies that sell biosolids,
7 Non-profit environmental organizations,
8 Friends or neighbors, or
9 Independent auditor of biosolids programs?”

10 DON'T KNOW
11 NO ANSWER/REFUSED

Q36. "Of the informational sources you just identified as being the MOST trustworthy, what specifically about them made you say that?" RECORD VERBATIM RESPONSE. PROBE FOR SPECIFICS: "Anything else?"

Q37. "Of the sources you think of as being the LEAST trustworthy, what specifically about them makes you think that? RECORD VERBATIM RESPONSE. PROBE FOR SPECIFICS: "Anything else?"

Q38. "It is likely that a few times a year, you walk on turf or grass, in parks, or near construction sites or farms where biosolids are used. Knowing this, please answer the following questions. Of the following activities, which do you feel poses a greater possible threat to your health?"

"Do you feel that your contact with biosolids poses a smaller or larger possible threat to your health than PESTICIDE RESIDUES IN FOOD?" [READ OPTIONS 1 & 3]

1 Biosolids are a smaller threat to my health than pesticide residues in food
2 NEUTRAL/SAME - VOLUNTEERED
3 Biosolids are a larger threat to my health than pesticide residues in food

8 DON'T KNOW
9 NO ANSWER/REFUSED

Q39. "Do you feel that your contact with biosolids poses a smaller or larger possible threat to your health than DRIVING TO WORK?" [READ OPTIONS 1 & 3]

1 Biosolids are a smaller threat to my health than driving to work
2 NEUTRAL/SAME - VOLUNTEERED
3 Biosolids are a larger threat to my health than driving to work

8 DON'T KNOW
9 NO ANSWER/REFUSED

Q40. "If you had to choose, which ONE of the following types of people would you trust for accurate information about environmental issues such as recycling biosolids … (READ RESPONSES 1 TO 11)
"Which would you say is your second choice?"

ROTATE RESPONSES. RECORD TOP 1ST AND 2ND RESPONSE

1 A news broadcaster,
2 A scientist,
3 A water quality engineer,

4 A TV/movie star,
5 An elected official,
6 A school teacher,
7 A local health agent,
8 A farmer,
9 A spokesperson from non-profit environmental organization,
10 A spokesperson from private company, or
11 A next door neighbor,?”

12 DON’T KNOW
13 NO ANSWER/REFUSED

D1. “Now for a few final questions. What is the highest grade in school, or level of education that you've completed and got credit for ... [READ RESPONSES 1 TO 7]

1 Eighth grade or less,
2 Some high school,
3 High school graduate, (INCLUDES G.E.D.)
4 Technical school,
5 Some college,
6 College graduate, or
7 Postgraduate work?"

8 DON’T KNOW
9 NO ANSWER/REFUSED

D2. “Do you consider yourself to be currently working in, or have you received any education in, a scientific field?”

1 YES
2 NO

8 DON’T KNOW
9 NO ANSWER/REFUSED

D3. “What is your current age?"

|___| |___| (RECORD EXACT NUMBER OF YEARS OLD -- E.G., 45)

96 NINETY-SIX YEARS OF AGE OR OLDER
97 REFUSED
98 DON’T KNOW
99 NO ANSWER

D4. “In general, where would you say that you get the majority of your news and current information? From friends and neighbors ... newspapers ... magazines ... the radio ... from television ... or the Internet?”

1 FRIENDS AND NEIGHBORS
2 NEWSPAPERS
3 MAGAZINES
4 RADIO
5 TELEVISION
6 OTHER: ______________________________
7 INTERNET

8 DON’T KNOW
9 NO ANSWER/REFUSED

D5. “How many of the persons who <u>currently</u> live in your household are under 18 years of age, including babies and small children?"

0 NONE
1 ONE
2 TWO
3 THREE
4 FOUR
5 FIVE
6 SIX
7 SEVEN OR MORE

8 DK/NOT SURE
9 NO ANSWER/REFUSED

D6. “Which of the following best describes your race? Is it ...White ... African-American ... Hispanic ... Asian ... Native-American ... or some other race?”

1 WHITE (CAUCASIAN)
2 BLACK (AFRICAN-AMERICAN)
3 HISPANIC
4 ASIAN
5 NATIVE AMERICAN
6 OTHER – SPECIFY: ______________________________

8 DON’T KNOW
9 NO ANSWER/REFUSED

D7. “Including yourself, how many adults CURRENTLY live in your household?"

1 ONE
2 TWO
3 THREE
4 FOUR
5 FIVE
6 SIX
7 SEVEN OR MORE

8 DON'T KNOW
9 NO ANSWER/REFUSED

D8. "Not counting business lines, extension phones, or cellular phones -- on how many different telephone NUMBERS can your household be reached?"

1 ONE
2 TWO
3 THREE
4 FOUR
5 FIVE
6 SIX
7 SEVEN OR MORE

8 DON'T KNOW
9 NO ANSWER/REFUSED

D9. "How much TOTAL income did you and your family receive in 2001, not just from wages or salaries but from all sources -- that is, before taxes and other deductions were made? Was it ... (READ CATEGORIES)

	ANNUAL	MONTHLY EQUIVALENT
01	Less than $15,000	LESS THAN $1,250
02	$15,000 - $29,999	$1,250 - $2,499
03	$30,000 - $44,999	$2,500 - $3,749
04	$45,000 - $59,999	$3,750 - $4,999
05	$60,000 - $74,999	$5,000 - $6,249
06	$75,000 - $99,999	$6,250 - $8,333
07	$100,000 or more?"	$8,334 AND OVER

97 REFUSED
98 DON'T KNOW
99 NO ANSWER

Thank and terminate.

APPENDIX C

SURVEY RESPONSE FREQUENCIES: 2002 BIOSOLIDS PUBLIC KNOWLEDGE AND PERCEPTION

NOTE: The following data have been edited because of space constraints. Complete survey responses (600+ pages, including tabulation of verbatim quotes of responses to some questions) may be obtained from the New England Biosolids and Residuals Association.

Q2. Town description

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Rural	411	38.5	38.5	38.5
	Suburban	431	40.3	40.3	78.8
	Urban	213	20.0	20.0	98.7
	DK/Not sure	13	1.3	1.3	100.0
	Total	1069	100.0	100.0	

Q3. Ever lived on a farm/ranch

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Farm	259	24.2	24.2	24.2
	Farming community	122	11.4	11.4	35.6
	Ranch	22	2.0	2.0	37.6
	Ranching community	34	3.2	3.2	40.8
	Combination	35	3.2	3.2	44.0
	No/Never	598	55.9	55.9	100.0
	DK/Not sure	0	.0	.0	100.0
	Total	1069	100.0	100.0	

Q4. Do any farming or gardening

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	602	56.4	56.4	56.4
	No	467	43.6	43.6	100.0
	Total	1069	100.0	100.0	

Q5. Type of fertilizer do you use

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Chemical	217	20.3	36.1	36.1
	Animal manure	99	9.2	16.4	52.4
	Composted leaves	73	6.8	12.1	64.5
	Biosolids/sludge	9	.9	1.5	66.0
	Non/don't use fertilizer	118	11.1	19.7	85.7
	Organic - N.O.S.	16	1.5	2.6	88.3
	DK/Not sure	71	6.6	11.7	100.0
	Total	602	56.4	100.0	
Missing	System	467	43.6		
Total		1069	100.0		

Q6A. Why prefer this type of fertilizer

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Ease of use	155	14.5	37.8	37.8
	Safer for family	20	1.9	4.9	42.7
	Less env. impact	55	5.2	13.5	56.2
	Cheaper	44	4.1	10.7	66.8
	Only type avail.	16	1.5	4.0	70.8
	None/Don't use	7	.7	1.8	72.6
	DK/Not sure	23	2.1	5.5	78.2
	Works best	65	6.1	16.0	94.1
	Reputation/ads/habit	24	2.2	5.9	100.0
	Total	410	38.4	100.0	
Missing	NA/Refused	4	.3		
	System	655	61.3		
	Total	659	61.6		
Total		1069	100.0		

Q6B. How likely to use animal manure

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very likely	178	16.7	43.0	43.0
	Somewhat likely	117	11.0	28.3	71.3
	Uncertain	9	.8	2.1	73.5
	Not too likely	52	4.9	12.5	86.0
	Not at all likely	53	4.9	12.8	98.8
	DK/Not Sure	5	.5	1.2	100.0
	Total	414	38.7	100.0	
Missing	System	655	61.3		
Total		1069	100.0		

Q6C. How likely to use human manure

		Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Very likely	32	3.0	7.8	7.8
	Somewhat likely	50	4.7	12.1	19.9
	Uncertain	8	.8	2.0	21.8
	Not too likely	79	7.4	19.0	40.9
	Not at all likely	237	22.2	57.3	98.2
	DK/Not Sure	7	.7	1.8	100.0
	Total	414	38.7	100.0	
Missing	System	655	61.3		
Total		1069	100.0		

Q7. Do you seek out organic foods

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes/Occasionally	260	24.3	24.3	24.3
	Yes/Frequently	113	10.6	10.6	34.9
	Yes/All the time	38	3.6	3.6	38.4
	Only thing I eat	1	.1	.1	38.5
	No	649	60.7	60.7	99.2
	DK/Not Sure	9	.8	.8	100.0
	Total	1069	100.0	100.0	

Q8. Does environmentalist apply to you

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	194	18.2	18.2	18.2
	Agree somewhat	620	58.0	58.2	76.4
	Neither	48	4.5	4.5	80.9
	Disagree somewhat	125	11.7	11.7	92.6
	Disagree strongly	51	4.7	4.7	97.3
	DK/Not sure	29	2.7	2.7	100.0
	Total	1066	99.7	100.0	
Missing	NA/Refused	3	.3		
Total		1069	100.0		

Q9. What happens to your sewage

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	A public plant	559	52.3	52.5	52.5
	Home septic	344	32.2	32.3	84.8
	Group septic	22	2.0	2.0	86.9
	DK/Not sure	140	13.1	13.1	100.0
	Total	1065	99.7	100.0	
Missing	NA/Refused	4	.3		
Total		1069	100.0		

Q10A. Ever visited a sewage plant

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	355	33.2	33.2	33.2
	No	713	66.7	66.7	99.8
	DK/Not sure	2	.2	.2	100.0
	Total	1069	100.0	100.0	

Q10B. Attitude toward sewage plant

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	They are necessary	248	23.2	69.8	69.8
	A good idea	81	7.6	22.9	92.7
	I don't know	1	.1	.3	93.1
	Not needed	4	.4	1.2	94.2
	Detrimental	6	.5	1.6	95.9
	DK/Not sure	15	1.4	4.1	100.0
	Total	355	33.2	100.0	
Missing	System	714	66.8		
Total		1069	100.0		

Q11. Ever heard of biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	449	42.0	42.1	42.1
	No	619	57.9	57.9	100.0
	Total	1069	100.0	100.0	
Missing	NA/Refused	0	.0		
Total		1069	100.0		

Q13. Define biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Human waste	46	4.3	10.3	10.3
	Sewage from plant	36	3.4	8.1	18.5
	Animal waste	3	.3	.8	19.2
	Human & animal waste	8	.8	1.9	21.1
	Solid waste product	2	.2	.5	21.6
	Biological waste	3	.3	.7	22.3
	Biolog.waste leftover post treatment	10	1.0	2.3	24.6
	Treatment bi-product	2	.2	.5	25.1
	Environmental waste	2	.2	.5	25.7
	Post-processing matter	0	.0	.0	25.7
	Solid waste, NEC	32	3.0	7.1	32.8
	Waste, NEC	8	.8	1.8	34.6
	Fertilizer	4	.4	.9	35.4
	Treated solids return as fertilizer	1	.0	.1	35.6
	Any solid that biodeg. over time	3	.3	.6	36.2
	Bacteria	3	.2	.6	36.7
	Bacteria put into sewage	5	.5	1.2	38.0
	Biochemical waste	1	.1	.3	38.3
	Biodegradable	11	1.0	2.5	40.8
	Biodegradable solids	6	.6	1.4	42.2
	Biodegradable waste	3	.2	.6	42.7
	Anything that dissolves	0	.0	.1	42.8
	Biological solids	12	1.2	2.8	45.6
	Biological waste	3	.3	.7	46.3
	Breakdown of waste	1	.1	.2	46.4
	Bi-product of sewer sys./waste treatment	22	2.1	4.9	51.4
	Chemical solid waste	2	.2	.4	51.8
	Chemicals in solid waste	4	.4	.9	52.7

	Unbreakdownable solids	7	.6	1.5	54.2
	Solids	22	2.0	4.9	59.1
	Post-draining waste	8	.8	1.8	60.9
	Leftovers	3	.3	.7	61.7
	Sludge	6	.5	1.3	62.9
	Compost	3	.3	.7	63.7
	Organic material/waste	17	1.6	3.9	67.5
	Other	17	1.6	3.7	71.3
	DK/Can't define	128	12.0	28.7	100.0
	Total	447	41.8	100.0	
Missing	NA/Refused	3	.2		
	System	620	58.0		
	Total	622	58.2		
Total		1069	100.0		

Q13. Reaction to biosolids process

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	'Good/Positive'	486	45.5	52.6	52.6
	If it is safe	11	1.0	1.2	53.8
	Fine if not near me	2	.2	.3	54.0
	For fertilizer	6	.6	.7	54.7
	If it works	29	2.7	3.1	57.8
	Depends	24	2.2	2.6	60.4
	+ farms/- home	5	.5	.6	61.0
	If treated	12	1.2	1.3	62.3
	Depend content/contamination	9	.9	1.0	63.3
	+ lawn,flowers/- garden	5	.5	.6	63.9
	If good for environ	8	.8	.9	64.8
	Against it/disagree/disgusting	153	14.3	16.5	81.3
	Against using human biosolids	4	.3	.4	81.7
	Skeptical/leary/concerns	52	4.9	5.6	87.3
	Open to idea	6	.5	.6	87.9
	Needs more study/research	4	.4	.4	88.4
	Worried about spreading disease/virus	14	1.3	1.5	89.9
	Odor concerns	9	.9	1.0	90.9
	Indifferent	40	3.7	4.3	95.2
	Other	1	.1	.1	95.3
	Need more info	44	4.1	4.7	100.0
	Total	924	86.5	100.0	
Missing	Refused	7	.7		
	System	137	12.9		
	Total	144	13.5		
Total		1069	100.0		

Q14A. Attitude toward neighbor use of biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Think its great	111	10.4	20.7	20.7
	Probably OK	124	11.6	23.1	43.8
	Prefer not do it	144	13.5	26.9	70.7
	Ask them to stop	39	3.7	7.3	78.0
	I'd move away	2	.2	.3	78.3
	Not my business	101	9.4	18.8	97.1
	DK/Not sure	16	1.5	2.9	100.0
	Total	537	50.2	100.0	
Missing	NA/Refused	2	.2		
	System	530	49.6		
	Total	532	49.8		
Total		1069	100.0		

Q15A. Who would you ask about biosolids-1st

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EPA	18	1.7	3.4	3.4
	State health off.	32	3.0	6.2	9.5
	Plant operators	14	1.3	2.6	12.1
	Local Health dept	57	5.3	10.8	22.9
	University Research	18	1.7	3.5	26.4
	Company delivering	1	.1	.2	26.6
	Non gov. env. org.	9	.9	1.8	28.3
	Friends	292	27.4	55.4	83.8
	Other	46	4.3	8.8	92.5
	DK/Not Sure	39	3.7	7.5	100.0
	Total	527	49.3	100.0	
Missing	NA/Refused	12	1.1		
	System	530	49.6		
	Total	542	50.7		
Total		1069	100.0		

Q15A. Who would you ask about biosolids-2nd

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EPA	41	3.9	9.3	9.3
	State health off.	59	5.6	13.4	22.7
	Plant operators	23	2.2	5.2	27.8
	Local Health dept	72	6.8	16.3	44.1
	University Research	22	2.0	4.9	49.0
	Company delivering	31	2.9	7.0	56.0
	Non gov. env. org.	6	.6	1.4	57.5
	Friends	53	4.9	11.8	69.3
	Other	65	6.0	14.5	83.8
	DK/Not Sure	72	6.7	16.2	100.0
	Total	445	41.6	100.0	
Missing	NA/Refused	13	1.2		
	NO SECOND RESPONSE	81	7.6		
	System	530	49.6		
	Total	624	58.4		
Total		1069	100.0		

Q15A. Who ask about biosolids - other

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Police	3	.3	.3	.3
	Property manager/owner	4	.3	.4	.7
	City/town/county officials/gov	32	3.0	3.3	4.0
	Research by self	4	.4	.4	4.4
	Research at library/internet	48	4.5	4.9	9.3
	Teacher	3	.3	.3	9.6
	Referral/lawyer	6	.5	.6	10.2
	Scientist/expert	6	.6	.7	10.9
	No questions, ask no one	4	.3	.4	11.2
	NA	861	80.6	88.8	100.0
	Total	970	90.8	100.0	
Missing	System	99	9.2		
Total		1069	100.0		

Q14B. Attitude toward neighbor use sludge

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Think its great	54	5.1	10.3	10.3
	Probably OK	117	11.0	22.3	32.6
	Prefer not do it	161	15.0	30.5	63.1
	Ask them to stop	65	6.1	12.3	75.5
	I'd move away	14	1.3	2.6	78.1
	Not my business	93	8.7	17.8	95.9
	DK/Not sure	22	2.0	4.1	100.0
	Total	526	49.2	100.0	
Missing	NA/Refused	4	.4		
	System	539	50.4		
	Total	543	50.8		
Total		1069	100.0		

Q15B. Who would you ask about sludge-1st

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EPA	28	2.6	5.3	5.3
	State health off.	33	3.1	6.4	11.7
	Plant operators	18	1.7	3.5	15.2
	Local Health dept	91	8.5	17.4	32.6
	University Research	11	1.0	2.1	34.6
	Company delivering	4	.4	.7	35.4
	Friends	255	23.8	48.8	84.2
	Other	41	3.9	7.9	92.1
	DK/Not Sure	41	3.9	7.9	100.0
	Total	522	48.9	100.0	
Missing	NA/Refused	7	.7		
	System	539	50.4		
	Total	547	51.1		
Total		1069	100.0		

Q15B. Who would you ask about sludge-2nd

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EPA	40	3.7	9.7	9.7
	State health off.	64	6.0	15.5	25.3
	Plant operators	19	1.8	4.6	29.9
	Local Health dept	79	7.4	19.3	49.2
	University Research	13	1.2	3.2	52.4
	Company delivering	28	2.6	6.7	59.1
	Non gov. env. org.	7	.7	1.8	60.9
	Friends	37	3.5	9.1	70.0
	Other	55	5.2	13.5	83.5
	DK/Not Sure	68	6.3	16.5	100.0
	Total	411	38.5	100.0	
Missing	NA/Refused	16	1.5		
	NO SECOND RESPONSE	102	9.6		
	System	539	50.4		
	Total	658	61.5		
Total		1069	100.0		

Q15B. Who ask about sludge - others

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	People who use them	2	.2	1.7	1.7
	People who sell them	3	.3	3.1	4.9
	Property manager/owner	0	.0	.2	5.1
	City/town/county officials/gov	46	4.3	41.7	46.8
	Environmental office	2	.2	1.7	48.4
	Research by self	7	.7	6.5	55.0
	Research at library/internet	27	2.5	24.5	79.5
	Community/nbhd assoc.	0	.0	.4	79.9
	Friend	1	.1	1.0	80.9
	Family	8	.7	6.8	87.7
	Neighbor	1	.1	.9	88.6
	Referral/lawyer	4	.3	3.4	92.0
	University	4	.4	3.9	95.9
	Scientist/expert	0	.0	.2	96.1
	Neighborhood group	2	.1	1.4	97.5
	No questions, ask no one	3	.2	2.4	99.8
	DK	0	.0	.2	100.0
	Total	111	10.4	100.0	
Missing	System	958	89.6		
Total		1069	100.0		

Q16. Likelihood of using biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very likely	106	10.0	10.0	10.0
	Somewhat likely	283	26.5	26.5	36.4
	Not very likely	267	25.0	25.0	61.5
	Not too likely	340	31.8	31.9	93.3
	Don’t have yard	15	1.4	1.4	94.7
	DK/Not sure	56	5.3	5.3	100.0
	Total	1068	100.0	100.0	
Missing	NA/Refused	1	.0		
Total		1069	100.0		

Q17. Likelihood of letting children play in yard w/biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Very likely	91	8.5	8.6	8.6
	Somewhat likely	238	22.3	22.3	30.9
	Not very likely	206	19.3	19.3	50.1
	Not too likely	367	34.4	34.4	84.5
	Don’t have yard	71	6.7	6.7	91.2
	DK/Not sure	94	8.8	8.8	100.0
	Total	1068	99.9	100.0	
Missing	NA/Refused	1	.1		
Total		1069	100.0		

Q18. Info to be comfortable with biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Everything/all/more info	115	10.8	10.8	10.8
	Basics	22	2.1	2.1	12.9
	Directions for use	2	.2	.2	13.1
	Brochure/flyer/literature	16	1.5	1.5	14.6
	Complete explanation of process	90	8.4	8.4	23.0
	Treatment knowledge	42	4.0	4.0	27.0
	Composition/content	61	5.7	5.7	32.7
	Cost effectiveness	6	.5	.5	33.2
	Quality/effectiveness	3	.3	.3	33.5
	Track record	15	1.4	1.4	34.9
	Research done/testing-research results	56	5.2	5.2	40.1
	Safety report/issues	193	18.1	18.1	58.3
	Health issues	61	5.7	5.7	64.0
	Viruses/bacterial/germs/disease	60	5.6	5.6	69.6
	Side effects	27	2.5	2.5	72.2
	Hazards/risks	38	3.6	3.6	75.8
	Chemicals (used/in)	17	1.6	1.6	77.4
	Odor	26	2.4	2.4	79.8
	Long-term effects	20	1.8	1.9	81.7
	Depends on uses & where used	5	.4	.4	82.1
	Environmental effects	8	.7	.7	82.9
	Don't like/disapprove of it	43	4.0	4.0	86.9
	No problem	19	1.7	1.8	88.7
	Already use	3	.2	.2	88.9
	Already know	13	1.2	1.2	90.1
	Don't want to know	29	2.7	2.7	92.8
	DK/Not sure	76	7.1	7.2	100.0
	Total	1065	99.6	100.0	
Missing	NA/Refused	4	.4		
Total		1069	100.0		

Q19A, Concern re biosolids-from local plant

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greatly decreases	26	2.5	2.5	2.5
	Somewhat decreases	106	9.9	10.0	12.5
	No Change	661	61.9	62.4	74.9
	Somewhat increases	109	10.2	10.3	85.2
	Greatly increases	83	7.8	7.9	93.0
	DK/Not sure	74	6.9	7.0	100.0
	Total	1060	99.1	100.0	
Missing	NA/Refused	9	.9		
Total		1069	100.0		

Q19B. Concern re biosolids-from large city

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greatly decreases	29	2.7	2.7	2.7
	Somewhat decreases	41	3.8	3.8	6.6
	No Change	564	52.7	52.8	59.4
	Somewhat increases	159	14.9	14.9	74.3
	Greatly increases	223	20.9	20.9	95.2
	DK/Not sure	51	4.7	4.8	100.0
	Total	1067	99.8	100.0	
Missing	NA/Refused	2	.2		
Total		1069	100.0		

Q19C. Concern re biosolids-from industrial waste

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greatly decreases	50	4.7	4.7	4.7
	Somewhat decreases	82	7.7	7.7	12.4
	No Change	217	20.3	20.3	32.7
	Somewhat increases	244	22.8	22.8	55.5
	Greatly increases	425	39.8	39.9	95.4
	DK/Not sure	49	4.6	4.6	100.0
	Total	1067	99.8	100.0	
Missing	NA/Refused	2	.2		
Total		1069	100.0		

Q19D. Concern re biosolids-if for free

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greatly decreases	29	2.7	2.7	2.7
	Somewhat decreases	62	5.8	5.8	8.5
	No Change	695	65.0	65.1	73.6
	Somewhat increases	136	12.8	12.8	86.4
	Greatly increases	99	9.3	9.3	95.7
	DK/Not sure	46	4.3	4.3	100.0
	Total	1067	99.9	100.0	
Missing	NA/Refused	1	.1		
Total		1069	100.0		

Q19E. Concern re biosolids-if certified annually

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greatly decreases	145	13.5	13.6	13.6
	Somewhat decreases	372	34.8	34.9	48.4
	No Change	328	30.7	30.7	79.1
	Somewhat increases	95	8.9	8.9	88.0
	Greatly increases	77	7.2	7.2	95.2
	DK/Not sure	51	4.7	4.8	100.0
	Total	1067	99.8	100.0	
Missing	NA/Refused	2	.2		
Total		1069	100.0		

Q19F. Concern re biosolids-if supervised locally

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greatly decreases	118	11.0	11.1	11.1
	Somewhat decreases	343	32.1	32.1	43.2
	No Change	368	34.5	34.5	77.8
	Somewhat increases	117	11.0	11.0	88.8
	Greatly increases	78	7.3	7.3	96.1
	DK/Not sure	42	3.9	3.9	100.0
	Total	1066	99.8	100.0	
Missing	NA/Refused	3	.2		
Total		1069	100.0		

Q19G. Concern re biosolids-if contacted first

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greatly decreases	133	12.5	12.6	12.6
	Somewhat decreases	377	35.3	35.5	48.1
	No Change	360	33.6	33.8	81.9
	Somewhat increases	86	8.1	8.1	90.1
	Greatly increases	55	5.2	5.2	95.3
	DK/Not sure	50	4.7	4.7	100.0
	Total	1062	99.4	100.0	
Missing	NA/Refused	7	.6		
Total		1069	100.0		

Q19H. Concern re biosolids-if scientists say OK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Greatly decreases	81	7.6	7.6	7.6
	Somewhat decreases	302	28.2	28.3	35.9
	No Change	271	25.3	25.4	61.3
	Somewhat increases	193	18.0	18.1	79.3
	Greatly increases	159	14.9	14.9	94.3
	DK/Not sure	61	5.7	5.7	100.0
	Total	1067	99.8	100.0	
Missing	NA/Refused	2	.2		
Total		1069	100.0		

Q20. Who should test or oversee biosolid use

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	State or federal	464	43.4	43.8	43.8
	Sewage plant opp.	72	6.7	6.8	50.6
	University/independent reser.	239	22.4	22.6	73.2
	Local government	111	10.4	10.5	83.6
	Landowners	73	6.8	6.9	90.5
	Combination/all of above	58	5.4	5.5	96.0
	DK/Not sure	42	4.0	4.0	100.0
	Total	1059	99.1	100.0	
Missing	NA/Refused	10	.9		
Total		1069	100.0		

Q21. Best use of biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Fertilizer for crops	94	8.8	8.9	8.9
	Fertilizer for lawns	79	7.4	7.5	16.4
	Fertilizer. for forests	171	16.0	16.2	32.6
	For damaged areas	269	25.1	25.4	58.1
	To generate electricity	323	30.2	30.6	88.7
	DK/Not sure	120	11.2	11.3	100.0
	Total	1056	98.8	100.0	
Missing	NA/Refused	13	1.2		
Total		1069	100.0		

Q22. Agree: recycling biosolids disposes product

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	407	38.1	38.3	38.3
	Agree somewhat	420	39.3	39.5	77.9
	Neither	24	2.3	2.3	80.2
	Disagree somewhat	90	8.4	8.5	88.6
	Disagree strongly	66	6.2	6.2	94.9
	DK/Not sure	54	5.1	5.1	100.0
	Total	1063	99.4	100.0	
Missing	NA/Refused	6	.6		
Total		1069	100.0		

Q23. Agree: recycling biosolids nutrients to soil

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	418	39.1	39.3	39.3
	Agree somewhat	401	37.6	37.7	77.0
	Neither	26	2.5	2.5	79.5
	Disagree somewhat	71	6.6	6.7	86.2
	Disagree strongly	58	5.5	5.5	91.7
	DK/Not sure	89	8.3	8.3	100.0
	Total	1064	99.5	100.0	
Missing	NA/Refused	5	.5		
Total		1069	100.0		

Q24. Agree: recycling biosolids prevents erosion

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	167	15.6	15.7	15.7
	Agree somewhat	275	25.7	25.9	41.7
	Neither	84	7.8	7.9	49.6
	Disagree somewhat	178	16.6	16.7	66.3
	Disagree strongly	181	16.9	17.1	83.3
	DK/Not sure	177	16.5	16.7	100.0
	Total	1061	99.3	100.0	
Missing	NA/Refused	8	.7		
Total		1069	100.0		

Q25. Agree: recycling biosolids beneficial

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	187	17.5	17.6	17.6
	Agree somewhat	349	32.6	32.8	50.4
	Neither	62	5.8	5.9	56.3
	Disagree somewhat	174	16.3	16.4	72.7
	Disagree strongly	132	12.3	12.4	85.1
	DK/Not sure	159	14.9	14.9	100.0
	Total	1063	99.5	100.0	
Missing	NA/Refused	6	.5		
Total		1069	100.0		

Q26. Agree: recycling biosolids saves money

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	270	25.2	25.4	25.4
	Agree somewhat	389	36.4	36.7	62.1
	Neither	59	5.6	5.6	67.7
	Disagree somewhat	123	11.5	11.6	79.3
	Disagree strongly	58	5.5	5.5	84.8
	DK/Not sure	161	15.1	15.2	100.0
	Total	1061	99.3	100.0	
Missing	NA/Refused	8	.7		
Total		1069	100.0		

Q27. Strongest argument for recycling biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Disposes waste	223	20.8	21.2	21.2
	Recycles nutrients	393	36.7	37.4	58.7
	Prevents erosion	86	8.1	8.2	66.9
	Is beneficial	120	11.3	11.5	78.4
	Save money	136	12.8	13.0	91.4
	DK/Not sure	90	8.5	8.6	100.0
	Total	1049	98.2	100.0	
Missing	NA/Refused	20	1.8		
Total		1069	100.0		

Q28. Argument against biosolids: inadequate testing

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	289	27.1	27.3	27.3
	Agree somewhat	291	27.2	27.4	54.7
	Neither	66	6.2	6.2	60.9
	Disagree somewhat	101	9.4	9.5	70.4
	Disagree strongly	75	7.0	7.0	77.4
	DK/Not sure	239	22.4	22.6	100.0
	Total	1061	99.2	100.0	
Missing	NA/Refused	8	.8		
Total		1069	100.0		

Q29. Argument against biosolids: bad odor

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	299	28.0	28.1	28.1
	Agree somewhat	246	23.1	23.2	51.3
	Neither	57	5.3	5.4	56.6
	Disagree somewhat	158	14.8	14.8	71.4
	Disagree strongly	86	8.1	8.1	79.5
	DK/Not sure	218	20.4	20.5	100.0
	Total	1065	99.6	100.0	
Missing	NA/Refused	4	.4		
Total		1069	100.0		

Q30. Argument against biosolids: poor oversight by gov.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	340	31.9	32.1	32.1
	Agree somewhat	284	26.6	26.8	58.9
	Neither	68	6.4	6.4	65.4
	Disagree somewhat	115	10.8	10.9	76.2
	Disagree strongly	54	5.0	5.1	81.3
	DK/Not sure	198	18.5	18.7	100.0
	Total	1059	99.1	100.0	
Missing	NA/Refused	10	.9		
Total		1069	100.0		

Q31. Argument against biosolids: harmful to health

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	249	23.3	23.5	23.5
	Agree somewhat	216	20.2	20.4	43.9
	Neither	57	5.3	5.3	49.2
	Disagree somewhat	196	18.3	18.5	67.7
	Disagree strongly	100	9.4	9.5	77.2
	DK/Not sure	242	22.6	22.8	100.0
	Total	1060	99.1	100.0	
Missing	NA/Refused	9	.9		
Total		1069	100.0		

Q32. Argument against biosolids: contamination

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	290	27.2	27.4	27.4
	Agree somewhat	245	22.9	23.1	50.4
	Neither	48	4.5	4.5	55.0
	Disagree somewhat	181	16.9	17.0	72.0
	Disagree strongly	110	10.3	10.4	82.3
	DK/Not sure	187	17.5	17.7	100.0
	Total	1061	99.3	100.0	
Missing	NA/Refused	8	.7		
Total		1069	100.0		

Q33. Argument against biosolids: not enough info

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agree strongly	491	45.9	46.1	46.1
	Agree somewhat	278	26.1	26.2	72.3
	Neither	34	3.2	3.2	75.5
	Disagree somewhat	117	10.9	11.0	86.5
	Disagree strongly	81	7.6	7.6	94.1
	DK/Not sure	63	5.9	5.9	100.0
	Total	1064	99.6	100.0	
Missing	NA/Refused	4	.4		
Total		1069	100.0		

Q34. Strongest argument against biosolids

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Inadequate testing	105	9.8	9.9	9.9
	Bad odors	59	5.5	5.6	15.5
	Poor oversight by gov.	148	13.8	14.1	29.6
	Adverse health impact	139	13.0	13.2	42.8
	Environmental contamination	82	7.7	7.8	50.6
	Not enough is known	460	43.0	43.7	94.3
	DK/Not sure	60	5.6	5.7	100.0
	Total	1052	98.4	100.0	
Missing	NA/Refused	17	1.6		
Total		1069	100.0		

Q35. Most trustworthy source of info-1st

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EPA	354	33.2	33.7	33.7
	State health off.	138	12.9	13.1	46.8
	Plant operators	32	3.0	3.1	49.9
	Local Health dept	67	6.3	6.4	56.3
	University Res.	225	21.1	21.4	77.7
	Company delivering	9	.9	.9	78.6
	Non gov. env. org.	101	9.5	9.6	88.2
	Friends	11	1.0	1.0	89.3
	Independent audit	81	7.6	7.7	96.9
	DK/Not Sure	32	3.0	3.1	100.0
	Total	1053	98.5	100.0	
Missing	NA/Refused	16	1.5		
Total		1069	100.0		

Q35. Most trustworthy source of info-2nd

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EPA	167	15.6	16.8	16.8
	State health off.	226	21.2	22.8	39.6
	Plant operators	53	5.0	5.4	44.9
	Local Health dept	106	9.9	10.7	55.6
	University Res.	178	16.7	18.0	73.6
	Company delivering	20	1.9	2.0	75.6
	Non gov. env. org.	98	9.2	9.9	85.5
	Friends	24	2.3	2.4	87.9
	Independent audit	102	9.6	10.3	98.2
	DK/Not Sure	18	1.7	1.8	100.0
	Total	993	92.9	100.0	
Missing	NA/Refused	4	.4		
	NO SECOND RESPONSE	72	6.7		
	Total	76	7.1		
Total		1069	100.0		

Q35. Most trustworthy source of info-3rd

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	EPA	101	9.5	11.3	11.3
	State health off.	139	13.0	15.5	26.9
	Plant operators	69	6.5	7.7	34.6
	Local Health dept	159	14.9	17.8	52.4
	University Res.	120	11.2	13.4	65.8
	Company delivering	31	2.9	3.4	69.2
	Non gov. env. org.	95	8.9	10.6	79.8
	Friends	32	3.0	3.6	83.4
	Independent audit	105	9.8	11.7	95.1
	DK/Not Sure	44	4.1	4.9	100.0
	Total	894	83.7	100.0	
Missing	NA/Refused	5	.4		
	NO SECOND RESPONSE	98	9.2		
	System	72	6.7		
	Total	174	16.3		
Total		1069	100.0		

Q36. Why choose most trustworthy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Credited source	1	.1	.1	.1
	Federal gov./EPA	140	13.1	13.3	13.4
	State/local dept/officials/gov	46	4.3	4.4	17.8
	Trust Non-specific	53	4.9	5.0	22.8
	Reputation	15	1.4	1.4	24.2
	Academic trust	104	9.8	9.9	34.2
	Track record/background	14	1.3	1.3	35.5
	Qualified	18	1.7	1.7	37.2
	Depends on who financed	12	1.2	1.2	38.4
	No monetary reasons/motives	99	9.2	9.4	47.7
	Trust locals	15	1.4	1.5	49.2
	Most knowledgeable/experienced	109	10.2	10.3	59.5
	Public's best interest	20	1.8	1.9	61.3
	Non-profit (trust)	38	3.5	3.6	64.9
	Accountability/regulations	16	1.5	1.5	66.4
	Non-gov./independent	74	6.9	7.0	73.4
	Test results/research	43	4.0	4.0	77.4
	Acquaintance (trust them)	18	1.7	1.7	79.2
	Personal knowledge	17	1.6	1.6	80.8
	It's their job	20	1.9	1.9	82.7
	Neutrality/objective	68	6.4	6.5	89.2
	Don't trust anyone	12	1.1	1.1	90.3
	Don't agree with biosolids	7	.7	.7	91.0
	DK/Not sure	95	8.9	9.0	100.0
	Total	1053	98.5	100.0	
Missing	NA/Refused	16	1.5		
Total		1069	100.0		

Q37. Why choose least trustworthy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Lack of knowledge/experience/testing	106	9.9	10.2	10.2
	Too far removed	4	.3	.4	10.6
	Lack qualifications	11	1.1	1.1	11.6
	Do not trust/not truthful	59	5.5	5.6	17.3
	Biased	39	3.6	3.7	21.0
	Not/too little regulation	9	.8	.9	21.8
	Poor management	10	.9	.9	22.8
	Skeptical of EPA	19	1.7	1.8	24.6
	Do not trust government	88	8.2	8.4	33.0
	Don't trust locals/local companies	5	.5	.5	33.5
	Don't trust local gov	10	1.0	1.0	34.5
	States are partial	3	.3	.3	34.8
	No interest in public/community	11	1.0	1.1	35.9
	Don't trust non-profits	8	.7	.7	36.6
	Lack of funding	1	.1	.1	36.7
	Interest conflict/alt.motives/agenda	81	7.6	7.8	44.5
	Politics	21	2.0	2.0	46.5
	Profit insentive/$/selling product	287	26.8	27.5	74.0
	Out for themselves	57	5.3	5.5	79.5
	Too expeditious	1	.1	.1	79.6
	Corruption/cover-up	26	2.5	2.5	82.2
	Environmentalists/env.too extreme	14	1.4	1.4	83.5
	Trust all/no reason to not trust	8	.8	.8	84.3
	Don't trust anyone	7	.6	.7	85.0
	Other	15	1.4	1.4	86.4
	DK/Not sure	142	13.3	13.6	100.0
	Total	1042	97.5	100.0	
Missing	NA/Refused	27	2.5		

Total		1069	100.0		

Q38. More harmful: biosolids or pesticides in food

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Smaller threat	674	63.1	63.9	63.9
	Neutral	122	11.5	11.6	75.5
	Larger threat	136	12.8	12.9	88.4
	DK/Not sure	122	11.4	11.6	100.0
	Total	1055	98.7	100.0	
Missing	NA/Refused	14	1.3		
Total		1069	100.0		

Q39. More harmful: biosolids or driving to work

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Smaller threat	672	62.8	63.7	63.7
	Neutral	69	6.5	6.6	70.3
	Larger threat	213	20.0	20.2	90.5
	DK/Not sure	100	9.4	9.5	100.0
	Total	1055	98.7	100.0	
Missing	NA/Refused	14	1.3		
Total		1069	100.0		

Q40. Who would you trust for info re biosolids-1st

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	News Broadcaster	19	1.8	1.8	1.8
	Scientist	379	35.5	36.2	38.0
	H2O Engineer	172	16.0	16.4	54.4
	Movie star	3	.3	.3	54.7
	Elected official	13	1.3	1.3	56.0
	School teacher	11	1.0	1.0	57.1
	Local health agent	112	10.5	10.7	67.8
	Farmer	72	6.7	6.9	74.7
	Spokes nonprofit	220	20.6	21.1	95.8
	Spokes private co.	6	.6	.6	96.4
	Neighbor	20	1.9	1.9	98.3
	DK/Not sure	18	1.7	1.7	100.0
	Total	1046	97.9	100.0	
Missing	NA/Refused	23	2.1		
Total		1069	100.0		

Q40B. Who would you trust for info re biosolids-2nd

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	News Broadcaster	18	1.7	2.0	2.0
	Scientist	188	17.6	20.3	22.2
	H2O Engineer	197	18.5	21.2	43.5
	Movie star	5	.4	.5	44.0
	Elected official	16	1.5	1.8	45.7
	School teacher	31	2.9	3.3	49.0
	Local health agent	157	14.6	16.8	65.9
	Farmer	83	7.8	9.0	74.8
	Spokes nonprofit	155	14.5	16.7	91.5
	Spokes private co.	11	1.0	1.2	92.7
	Neighbor	28	2.6	3.0	95.7
	DK/Not sure	40	3.7	4.3	100.0
	Total	929	87.0	100.0	
Missing	NA/Refused	21	2.0		
	NO SECOND RESPONSE	119	11.1		
	Total	139	13.0		
Total		1069	100.0		

D1. Level of education

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Eighth grade or less	20	1.9	1.9	1.9
	Some high school	44	4.1	4.2	6.1
	HS grad	261	24.5	24.8	30.9
	Tech school	41	3.8	3.9	34.8
	Some college	232	21.7	22.0	56.8
	College grad	281	26.3	26.7	83.5
	Postgrad work	171	16.0	16.2	99.7
	DK/Not sure	3	.3	.3	100.0
	Total	1053	98.5	100.0	
Missing	NA/Refused	16	1.5		
Total		1069	100.0		

D2. Any education in scientific field

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	322	30.1	30.1	30.1
	No	724	67.7	67.7	97.8
	DK/Not sure	8	.7	.7	98.6
	NA/Refused	15	1.4	1.4	100.0
	Total	1069	100.0	100.0	

D4. Where do you get your news and info

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Friends	38	3.6	3.6	3.6
	Newspapers	339	31.8	32.4	36.0
	Magazines	39	3.6	3.7	39.7
	Radio	100	9.3	9.5	49.2
	Television	397	37.1	37.9	87.1
	Other	4	.4	.4	87.4
	Internet	104	9.7	9.9	97.3
	DK/Not sure	5	.4	.5	97.8
	All sources	15	1.4	1.4	99.2
	Books/journals/periodicals	3	.3	.3	99.5
	personal experience	5	.5	.5	100.0
	Total	1048	98.1	100.0	
Missing	NA/Refused	21	1.9		
Total		1069	100.0		

D5. Children under 18 in household

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	None	594	55.6	56.6	56.6
	One	183	17.1	17.5	74.1
	Two	170	15.9	16.2	90.3
	Three	63	5.9	6.0	96.3
	Four	23	2.2	2.2	98.5
	Five	10	1.0	1.0	99.4
	Six	3	.3	.3	99.7
	Seven or more	1	.1	.1	99.8
	DK/Not sure	2	.2	.2	100.0
	Total	1049	98.2	100.0	
Missing	NA/Refused	20	1.8		
Total		1069	100.0		

D6. Race

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	White	921	86.2	88.2	88.2
	Black	40	3.8	3.9	92.1
	Hispanic	37	3.5	3.5	95.6
	Asian	17	1.6	1.6	97.2
	Native American	16	1.5	1.6	98.8
	Other	11	1.0	1.0	99.8
	DK/Not sure	2	.2	.2	100.0
	Total	1044	97.7	100.0	
Missing	NA/Refused	25	2.3		
Total		1069	100.0		

D9. Family income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than $15,000	37	3.5	3.6	3.6
	$15,000 to $29,999	109	10.2	10.6	14.3
	$30,000 to $44,999	137	12.8	13.4	27.7
	$45,000 to $59,999	141	13.2	13.8	41.5
	$60,000 to $74,999	108	10.1	10.6	52.1
	$75,000 to $99,999	127	11.9	12.5	64.6
	$100,000 or more	172	16.1	16.9	81.5
	Refused	139	13.0	13.6	95.1
	DK/Not sure	50	4.7	4.9	100.0
	Total	1019	95.4	100.0	
Missing	NA/Refused	50	4.6		
Total		1069	100.0		

APPENDIX D

WERF WORKSHOPS ON PUBLIC PARTICIPATION AND THE PUBLIC PARTNERING INITIATIVE

Ned Beecher

I also have been doing a lot more listening than I once would. Specific examples or how the [consensus building] meeting has changed how we do business? I can't think of any one thing, but I feel that the meeting has changed the way I approach everything. I now seek out others' opinions and try to find areas where we can agree rather than trying to argue the points where we probably never will agree.

--Michael Moore, Environmental Compliance and Monitoring Manager, Orange County Sanitation District and Chair, Water Environment Federation Residuals Management Committee, 2004

Introduction

The reviews of literature and case studies and the results of the survey pointed to the need for greater interaction with the public on the part of biosolids management programs. This report provides recommendations for how biosolids managers can increase constructive relationships with communities, neighbors, and other public stakeholders.

But an important aspect of developing stronger public input and participation in biosolids management is training. Most people are well trained in their fields of expertise. For technical jobs such as wastewater treatment and biosolids management, the focus of training is on critical operations and maintenance of infrastructure, proper operating practices, worker safety, etc. How to interact with the public is not a common training topic.

And even for those larger biosolids management programs that have the benefit of a public affairs and/or public relations person, they are unlikely to be trained in the concepts and strategies recommended for effective, constructive public input and participation.

Recognizing this, a workshop was held April 11, 2002, as part of this project, to provide training to project advisors, including biosolids managers and other stakeholders from around North America. Dr. Lawrence Susskind, Professor at the Massachusetts Institute of Technology and lead author and editor of *The Consensus Building Handbook*, provided basic training on the "mutual gains approach" to addressing public conflicts and "How to Work with Your Critics." The mutually agreed to summary of this workshop is included below.

In addition, the Water Environment Research Foundation (WERF), sponsor of this research, and the Water Environment Federation (WEF) presented workshops in 2001 and 2002 at WEF's national conference (WEFTEC). These workshops presented many of the developing conceptual models of WERF public partnering, developed from this project and a parallel project on public perception and participation in water reuse programs. (See Water Environment Research Foundation, 2001 and 2002.)

Following on this work, the Water Environment Research Foundation (WERF) is developing a "Public Partnering" initiative to bring diverse stakeholder involvement and public participation into its research work.

Approaches to Public Participation

Public participation in public policy has been a growing focus of research (Berry and Scherer, 1990; Chess and Purcell, 1999; Cohen, 1995; Hartley, 2003; International Association for Public Participation, 2000; National Research Council, 2001; National Wind Coordinating Committee, 2002; Renn et al., 1995; Rich et al., 1995; Rowe and Frewer, 2000; Rosenbaum, 1983; Scherer, 1993; Tuler and Dietz, 2001; U.S. Environmental Protection Agency—Office of Policy, Economics, and Innovation, 2001). Several key findings were expressed early on (1980s), such as the benefits of early public involvement in decision-making processes around potentially contentious policies or decisions. But, more recently, there has been an effort to better understand how the specific details of public participatory processes impact the effectiveness of the particular public participation process (Chess and Purcell, 1999; Renn et al., 1995).

While there are several schools of thought and many alternatives strategies for gaining public participation (e.g. hearings, citizen advisory committees), the focus within the biosolids management industry has been on addressing public outrage, since that has been the most distressful problems experienced by most biosolids managers. Thus, the work of Peter Sandman (2000) has been sought out and absorbed by some biosolids managers. The workshop conducted as part of this project focused on the work of Susskind and Field (1996). The workshops conducted by WERF at WEFTEC focused, in part, on aspects of work by Chess and Hartley (2003).

Working with Critics

The mutual gains approach and consensus building, developed by Susskind, Field, and others involved with the MIT-Harvard Public Disputes Program over the past three decades, as well as the fields of risk communications and risk perception, include some powerful concepts:

♦ Foremost is to understand that traditional, typical responses of organizations, managers, and proponents of a given action are often not effective. Recognizing this is critical. When something does not work, why keep doing it?

- Address critics with technical responses and more information often does not work. It is important at first to acknowledge the concerns and/or fears being expressed and provide a caring response that meets the needs of the concerned public.
- Work together to develop mutual understanding of the issues is helpful (called “joint fact finding” by Susskind and Field, 1996).
- Share power and trying to find solutions that are mutually-agreeable, and compensating those who are accepting greater risk, are useful strategies.
- Develop trust by being caring and doing what you say you are going to do (say what mean, mean what you say, don’t be mean).
- Focus on developing constructive long-term relationships with stakeholders.

See more information in Susskind and Field, 1996, or Susskind, et al., 1999.

The Developing Concept of WERF Public Partnering

This paper and the WERF project on public perception and participation around water reuse issues (Hartley, 2003) have led WERF to develop a conceptual framework for developing public participation. The strategy can be envisioned as pairs of core related concepts built under a basic, overarching umbrella:

***The Umbrella*: Build public relationships: “Not just public relations, public relationships!”**

Communication & Information **Trust & Fairness**

Motivation & Commitment

Put simply, this conceptual framework is built on the idea that managers of potentially contentious programs should take time to focus on developing public relationships with key stakeholders. To do so, it is helpful to be constantly aware of key concepts:

1. Communication – proper communication, including two-way dialogue, is key
2. Information – must be accurate and presented so it helps the recipient
3. Trust & Fairness are critical parts of constructive relationships
4. Motivation – the manager must be motivated to work with the public
5. Commitment – the public agency must be committed to providing the resources necessary to ensure good public participation and the building of public relationships.

More details are available from WERF or see Hartley, 2003, or Water Environment Research Foundation, 2001.

Several of the authors of this report and those involved in the report on public perceptions of water reuse (Hartley, 2003) have helped WERF develop Public Partnering Protocols for

Research. In 2003, WERF created and implemented a Biosolids Research Summit as a first step in its Public Partnering Initiative. In 2004, the new protocols began to be used in three pilot projects.

Project Workshop on Public Participation: April 11, 2002, Revere, MA

The remainder of this appendix is documents from the one-day workshop on public participation, held as part of this project, on April 11, 2002, in Revere, MA.

Workshop Introductory Memorandum

The following introductory information was provided to all participants in advance of the workshop and reviewed by all at the beginning of the workshop. In addition, participants received and were asked to read, prior to the workshop, copies of chapters from *Dealing with an Angry Public* and *The Consensus Building Handbook* titled “Why is the Public Angry,” “The Mutual Gains Approach,” “Choosing Appropriate Consensus Building Techniques and Strategies,” and “Joint Fact-Finding and Use of Technical Experts.”

To: April 11 attendees and project reviewers
From: Merrick Hoben, Consensus Building Institute (CBI) and Ned Beecher, NEBRA
Date: March 27, 2002
Re: Advance reading, April 11 workshop on sewage sludge/biosolids public participation, Revere, MA

Greetings:

We thank you for your interest in the April 11 workshop in Boston. We are looking forward to your comments, suggestions, and ideas.

This workshop is something new for us and perhaps for you. NEBRA has asked for CBI’s assistance because they have experience in bringing together people with divergent perspectives in this kind of meeting. We hope that participants will benefit from learning more about consensus building tools and developing ideas for increasing public involvement in biosolids/sewage sludge management programs. The NEBRA-Water Environment Research Foundation project team will certainly benefit from the input to their project from this workshop.

This packet of information is provided to you in advance so that you may be familiar with some basic information about consensus building and public participation concepts before entering the meeting. We would appreciate it if you could read these materials so that everyone will have some common understanding of the terms and concepts that will be discussed. Our time is limited, and this homework will help ensure as great a benefit as possible from the workshop.

Enclosed are:
- Workshop Agenda
- Directions/Map to the meeting location and key information
- Workshop Groundrules
- Current list of confirmed participants

♦ Introduction to the Facilitators and CBI
♦ Project Summary: The NEBRA/WERF Project on Biosolids Public Knowledge, Understanding, Opinion, and Public Participation Regarding Biosolids Recycling (March 25, 2002)
♦ Advance readings provided by CBI

We thank you for your willingness to participate in this workshop and for your input. We look forward to seeing you April 11th.

And if you have any question, suggestions, or concerns, please do not hesitate to contact one of us.

Merrick Hoben	Ned Beecher
Consensus Building Institute (CBI)	New England Biosolids & Residuals Assoc. (NEBRA)
Cambridge, MA	Tamworth, NH
617-492-1414, ext. 27	603-323-7654
Merrick@cbuilding.org	Ned.Beecher@nebiosolids.org

Goals
The goals of the workshop are to:

6. Provide biosolids stakeholders with insight regarding the research and information gathered by the NEBRA team on community involvement.
7. Introduce biosolids stakeholders to a range of relationship-building techniques and processes.
8. Initiate a meaningful dialogue among representatives of constituent groups on biosolids and the public interest issues they raise.
9. CBI President and MIT Professor Lawrence Susskind will be facilitating this important event pro bono. Dr. Susskind is the author of several books on conflict resolution and consensus building, and an expert in the area of land use and environmental disputes.

Below, please find information on the impetus for this workshop, agenda, and directions. If you plant to attend, please RSVP NEBRA Project Manager Ned Beecher by either email or phone (ned.beecher@nebiosolids.org / 603.323.7654).

Why This Workshop?

Though biosolids-processing technology has improved over the years, there has not been sufficient focus on the issues of public education and involvement. With this concern in mind, NEBRA has now completed work on a comprehensive study of community involvement that they would like to discuss with the broader public.

In early 2000, NEBRA sought CBI’s pro bono services to discuss how consensus building and community involvement might assist NEBRA members in improving relationships among stakeholders and helping resolve conflicts as they arise.

Together, CBI and NEBRA designed the April 11 all-day workshop to review NEBRA's research and to gain input from reviewers. The meeting will be facilitated by CBI President / MIT Professor Dr. Lawrence Susskind.

Expectations Of Meeting Participants

Role of Participants

- Participants will seek **understanding** rather than assuming motives, attributes, and assumptions of others.
- Each person is encouraged to **generate options and ideas without fear of commitment**.
- Each person will make every effort to **stay on track with the agenda** and to move the deliberations forward. Each person will avoid grandstanding (extended comments and questions) in order to allow everyone a fair chance to speak and to contribute.
- Participants will communicate **respectfully**. Only one person will speak at a time as called upon by the facilitator. Participants will refrain from personal attacks. Each person will express his or her own views rather than speaking for others at the table.
- Where possible, each person should seek to speak not only their own views, but also for the constituent groups they represent. However, each person is participating as an individual and **cannot bind their constituents** to any statements made or potentially agreed-upon advice reached by the workshop group.

Role of CBI Facilitators

- Manage the meeting and **keep participants on track** with the agenda
- Ensure **compliance with the ground rules**
- Identify and **synthesize points** of agreement and disagreement
- **Prepare a post-workshop summary** of the discussion without attribution by individual or organization. *

*[The summary will capture key ideas and issues as well as areas of agreement and disagreement, and will be distributed to all parties at the same time for comment. The summary will then be finalized by the facilitators and redistributed, with all errors and omissions remaining the sole responsibility of CBI.]

Workshop Summary

Introduction

This document summarizes the proceedings of the NEBRA & Consensus Building Institute (CBI) Workshop on treated sewage sludge public participation. The one-day workshop represented the final stage of a two-year research effort by NEBRA-WERF to better understand the factors which affect public acceptance of treated sewage sludge programs nation-wide.

Given divergent points of view on the "Biosolids / treated sewage sludge" issue, NEBRA asked CBI, a non-profit mediation firm based in Cambridge, MA (www.cbuilding.org), to facilitate the one-day dialogue. CBI agreed to offer its neutral services pro bono in order to further dialogue on this issue. CBI President Dr. Lawrence Susskind led the CBI team, with support from CBI Vice President Patrick Field, and CBI Senior Associate Merrick Hoben.

While a broad range of stakeholders were invited to the workshop, the 35 attendees (see Appendix I) consisted mostly of private industry and government representatives, and a few community representatives. Opponents of treated sewage sludge land application chose not to attend because they disagreed with NEBRA's past approach to addressing their concerns and felt they had not been adequately involved or consulted in the planning of the workshop—and therefore believed the forum would not adequately meet their interests.

Following is a summary of the key questions and information shared during the workshop. This summary is not intended to be a transcript of the event, but rather an effort to capture many of the key concepts shared during the day. All errors and omissions are the sole responsibility of CBI.

The summary includes a description of the workshop's goals, the general process of presentation (Powerpoint slides are available upon request) by CBI, questions asked and answers given throughout the day, and a summary of afternoon breakout group findings.

Workshop Goals

The goals of the workshop were to:

1. provide "biosolids /treated sewage sludge" stakeholders with insight regarding the research and information gathered by the NEBRA team on community involvement;
2. introduce "biosolids /treated sewage" sludge stakeholders to a range of relationship-building techniques and processes; and to
3. Initiate a meaningful dialogue among representatives of constituent groups on "biosolids / treated sewage sludge" and the public interest issues they raise.

CBI Presentations

Following a welcome and introductions by NEBRA, Dr. Susskind spoke on key principles for working more effectively and improving relationships with critics. The material, from the MIT and Harvard Program on Negotiation, covered why traditional responses to public concerns are often inadequate and the need for an alternative approach.

Dr. Susskind compared the mutual gains approach to improving relationships to more typical approaches of working with diverse interests on complex public sector issues. One approach is simply to seek to educate others about your interests, programs, and objectives through radio, TV, and print—with the goal of public acceptance, or at least, improved understanding. Another approach is to engage the public in two-way communication, such as through surveys, public meetings, and focus groups, again with the goal of public acceptance and some adjustment to plans and projects to address concerns and issues raised. The third way, the Mutual Gains approach, is to seek to not strive for "public acceptance," but rather to build long term relationships, seek credible and legitimate information, and work to solve problems and reach solutions that meet the interests of many, not just a few, parties.

This alternative Mutual Gains approach to improving relationships among stakeholders consists of six core principles:

1. Acknowledge the concerns of the other side.

2. Encourage joint fact-finding.
3. Offer contingent commitments to minimize impacts if they do occur; promise to compensate unintended effects.
4. Accept responsibility; admit mistakes, and share power.
5. Act in a trustworthy fashion at all times.
6. Focus on building long-term relationships.

Dr. Susskind explained each principle and followed with case examples of how to operationalize the concepts in the context of a difficult public dispute. CBI also presented information on the steps in the consensus building process, with emphasis on the importance of conducting a conflict assessment in order to determine whether and how a consensus building effort could be helpful in a given situation (overheads available upon request).

In the afternoon, Dr. Susskind turned to the treated sewage sludge issue, addressing some of the strongest concerns that CBI has heard from critics to the industry's approach, and how the mutual gains principles can be applied in these specific circumstances.

Following this, participants were asked to form three discussion groups to brainstorm on how to implement an alternative approach to treated sewage sludge community involvement efforts in the context of their own experience.

Participant Questions/CBI Responses

Many specific questions about consensus building were raised during the workshop. Below is a summary of these questions and CBI's responses.

What is the definition of consensus building? How does one measure success and failure?

Consensus building is a method of involving multiple parties in the search for a agreement about how best to proceed with a policy matter of some kind of resource allocation decision. set of best practices for problem solving among multiple parties.

Consensus building overlaps with dispute resolution but it does not only apply to disputes. We often use the term consensus building to refer to situations in which a dispute has not yet emerged and there is a desire to consult with an array of parties likely to be affected by a policy or decision before it is made. As a decision-making model, consensus building is an alternative to Robert's Rules of Order. Dispute resolution, in contrast, only applies if a dispute among stakeholders has already crystallized.

In the field of conflict management, both consensus building and dispute resolution are used interchangeably with the term mediation since both processes often involve a neutral process manager who is not a stakeholder. There are very explicit "best practices" with regard to the work that a mediator does in both consensus building and dispute resolution processes. There is some overlap in the tasks involved in the two processes and there is some divergence. The same professional neutrals, however are usually involved in both processes. It is possible, we should point out, for both processes to proceed without a "neutral," although the chances of reaching agreement in either situation are substantially increased if a professional mediator is involved.

The Mutual Gains approach is a set of negotiation strategies that allow for constructive communication among stakeholders that is more likely to result meeting the primary interests of those involved in the dispute or policy decision.

A common misconception is that consensus building is about achieving unanimity and making sure everyone gets what they want. Rather, building consensus is defined as a process through which stakeholders voluntarily commit to try to resolve a conflict in a way that everyone can live with. It implies that participants work in good faith and think creatively about how to best meet their needs, while adequately responding to the needs of others. Consensus building is successful when the process and potential outcome are perceived by all as 1) fair, 2) efficient (leaving no unclaimed value on the table), and 3) produce enhanced relationships among the stakeholders. It fails when stakeholders are left worse off due to their participation in the process.

Why would a stakeholder (e.g. a private company) do this? Doesn't consensus building cost a lot and take a lot of time?

Some workshop participants were uneasy about the idea of instigating this kind of approach. "Wouldn't it mean standing up and painting a target on ourselves and saying, 'come on and take your shots at us?'" Taking this step can feel risky and whether or not to take it depends on comparing the potential benefits against the current situation.

While a consensus building process may indeed take considerable time and money, it is almost always less expensive than protracted law suits that produce less than satisfactory outcomes.

In order for a consensus building process to be undertaken, there are three critical steps:

1) A 'champion' of an alternative approach to the traditional way of handling the dispute or issue needs to step forward. An agency with public mandate is a good candidate for this, or it may involve a combination of key stakeholder groups.

2) This sponsor needs to be willing to engage in an evaluation (i.e. Conflict Assessment) of whether or not consensus building is appropriate in this case. The assessment process is used to help clients figure out if a consensus-building effort is feasible and appropriate in their particular situations. The process also provides us with an opportunity to scope the issues and identify the range of stakeholders concerned about those issues. If after conducting an assessment, we decide that the situation is amenable to assisted negotiation, we use the information we have gathered to design a consensus-building process. In this way, we can ensure that the consensus building process will be set up for success from the outset. Specifically, the assessment consists of an objective evaluation of issues that concern stakeholders regarding the conflict at hand, identification of key stakeholder groups, their priorities, options they see for moving forward, as well as obstacles to reaching a resolution.

3) Each stakeholder must evaluate for himself/herself what their next best alternative is to a consensus building (assisted negotiation) process, and whether they would be willing to commit to the effort required. If their alternative (away from the negotiation table) is faster, cheaper, and more likely to result in better outcome for them, then that stakeholder should not participate in consensus building.

For more information on conducting conflict assessments and considering consensus building see www.cbuilding.org and *The Consensus Building Handbook*, (Susskind, Sage Publications 2000) which is listed on the site.

What's the difference between private and public entities attempting a consensus building approach?

Public agencies (regulators) often state that they are prohibited from communicating with the public before they have made up their mind what to do or before a formal complaint has been filed. In our view, this is an incorrect view of what an agency is and isn't allowed to do. For example, the EPA has often used negotiated rule making (see www.epa.gov) to produce regulatory proposals. One of the keys is for agencies to start consensus-building processes early, before it is time to make a final decision.

It is critical that a professional neutral apart from the agency manage the structure of negotiation. The outcome of a negotiated rule making is not a formal rule, but rather a consensus-based proposal that needs to be formally promulgated by the agency. These consensus-building efforts are supplements to and not replacements for existing, formalized, required decision-making processes. Another possible way of incorporating this approach is to create, in laws and regulations, the option (but not a requirement) for the use of a formal, well-defined consensus building process in creating regulation or policy.

A conflict assessment, conducted by a neutral, is a key part of counter balancing stakeholder concerns about who has control / influence over the rule-making process. For more information on consensus building with permitting processes, see the description of the FERC project at www.cbuilding.org.

How can one best respond in this framework to stakeholders that have hidden agendas or goals?

One of the purposes of a conflict assessment is to help shape and clarify expectations regarding the way stakeholders will behave toward one in a subsequent consensus building process and to uncover key interests that must be met. The key is to establish clear and agreed upon ground rules that will govern the dialogue. Effective, clear ground rules should help stakeholders: 1) decide whether to participate in consensus building at all; and, 2) strengthen the validity of the process—even if some parties seek to derail the process later. It is worth noting that all parties have "agendas" going into any decision-making process—they have goals, expectations, and interests they wish to meet. The secret to effective consensus building is providing a framework for negotiation that elicits honest and frank discussion of all key issues and interests. In turn, this can help parties find realistic common ground, generate reasonable options, and package solutions that meet the interests of all who participate (note we do not say meet all the interests of some, nor all the interests of everyone, but rather, meet enough of the interests of all in order for everyone to concur).

What if the issues are not well defined? Does consensus building still work?

Participants asked about the usefulness of consensus building in situations in which there is no current public anger or broken public trust.

It is certainly easier for concerned stakeholders to see the benefit of consensus building when the conflict is well defined and at a boiling point. However, there is a broad and important need for the use of consensus-based processes as a means of defining the issues in the policy arena before they reach crisis proportions. This is most important in political debates, which can benefit greatly from a 'manager' of the complex conversation and multiple viewpoints inherent in value-laden deliberations. An example of such work can be found in the national energy policy debate that CBI facilitated (www.nepi.org).

Conversely, the lack of definition of the issues may be the reason that a consensus building effort may not be appropriate in a given situation. Indeed, if the questions for dialogue are not clear, it may result in wasted time and energy among stakeholders. This is why the conflict assessment stage (described above p.5, point 2), is so critical to determining whether a given conflict / issue is suitable for a consensus building effort.

How do you deal with public opinion 'scare tactics'?

This is really a question about how consensus building accounts for conflicting scientific viewpoints and the incorporation of the public interest. First, stakeholders must make a mental shift from interpreting a person's 'scare tactic' to one of legitimate recognition and understanding of that individual's concerns and interests. In other words, don't label your critics as "scare mongers." They might very well label you as "truth avoiders." Most of the public is willing to weigh public policy choices on the merits and is open to rational, clear arguments. These are what we call "guardians." They want to hear and understand the issues on the merits, not via one-sides' interpretation. However, if the concerns of those with strongly held views are ignored, the guardians are likely to side with opponents, especially if there is a claim of unfairness, or the perception of bad faith. Stakeholder needs for information must be met, presentations should be easily accessible, and the possibility of different interpretations of the same information must be kept open.

In the case of treated sewage sludge programs, it's advisable, in our view, that conversation begin by asking a neutral to contact concerned publics and invite them into a consensus building effort. Some perceive that there is a PR risk associated with entering into a dialogue with one's critics—if you're talking, you must be admitting you are wrong or mistaken. In our view, this is absolutely incorrect. Not talking and avoiding one's critics is sure to be seen as an effort to discount and disregard others and hide the "truth." Taking the initiative to help form an honest dialogue can improve one's image as well as one's substantive relationships.

What if there are changes mid-stream to the original agreement reached via consensus building?

This is a decision-making procedure issue. Those who will be affected by the decision need to be closely involved from the outset, and preferably those who negotiate an agreement should also be involved in its implementation. Any good agreement should anticipate changes, new information, and the possible need for adjustments. This anticipation can be written into agreements through monitoring arrangements and dispute resolution procedures. On the other hand, it may be that politics intervenes and new decision makers or higher-level decision makers overturn hard won agreements. Unfortunately, this does happen. The best protection against this poor outcome is to involve key decision makers early and often in the consensus building process.

[In the NY Roundtable for example, agreements fall apart at the end. This was perhaps because the parties became scared of what they were agreeing to and had overestimated the power and influence they had in making the proposed changes. There was a significant difference in world views at the NY roundtable (and in this debate overall): those who work daily with sewage sludge and manage it with current technology and those who tend not to be dealing with it directly are interested in addressing uncertainties by applying the precautionary principle. In the end, perhaps the Roundtable parties felt that no agreement was better for them than the draft agreement. Participants also felt some aspects of the process were not well managed by the facilitator. Some workshop participants suggested that perhaps there should be an analysis of lessons learned from the NY Roundtable process, to inform any future process.

Can a consensus building approach be used at both the national and local scale? Is there a difference?

The" biosolids/treated sewage sludge" issue is an international, national, and local concern all in one. Addressing it through consensus building is a matter of adjusting to scale (e.g. local, regional, national, international). They're many examples of successful consensus building at the global scale, including issues as controversial as climate change. The key to working at this level is to augment the traditional system by developing parallel negotiation forums for stakeholders who are normally left out. For descriptions of this work see the CBI website under Trade and Environment. These processes can also be very effective at the local scale, bringing together neighbors to jointly negotiate agreements they can all live with. Examples at CBI include improving air quality in communities large and small, and implementing technically feasible, publicly acceptable remedial actions at large Superfund sites.

What if the negotiated outcome is likely only a "yes or no" on a discrete issue? (E.g. class B land application is permissible / not permissible).

The idea of two choices is often the result of framing the issues too narrowly—for example, should we use treated sewage sludge or not. The process of understanding the values and priorities of the various parties often reveals areas of joint concern on non-central issues and the possibility for other areas of mutual gain. In mutual gains negotiation, this is called creating value. Also, there needs to be consideration on the part of stakeholders about the relative value of options put on the table. The important questions are: "What will I likely receive if I do not work to resolve the questions on the table?" "What else that is being negotiated can meet my interests and satisfy those of other stakeholders?" Even opponents on issues as divisive as abortion and gun control, can, in some circumstances, find common areas of agreement and action—even if the fundamental issue remains at an impasse.

Our critics did not come to this meeting? Why? What's wrong?

It is CBI's understanding that many critics did not attend this workshop because they felt they were not adequately involved or consulted regarding what this workshop would be about, and whether or not issues of importance to them would be discussed. Many thought that resulting dialogue would be one-sided and not provide adequate opportunity for them to voice their concerns about past and future dialogue on the issues of "biosolids/treated sewage sludge" application. Furthermore, at least some critics state that they have been treated with disrespect in the past, that their views have been discounted or reviled, and that misinformation has been disseminated and good science ignored.

It is important to note that the idea of expanding the workshop participants to include more perspectives was added late in the planning process, and that organizers failed to make adequate communications to make broader attendance happen more effectively.

A mutually identified leader of the opposition to "biosolids/treated sewage sludge" land application, Ellen Harrison, was involved in the creation of the workshop, and also attended along with Betty Hall. In addition, there were a variety of perspectives among the "biosolids/treated sewage sludge" management stakeholders who did attend (e.g. disagreement about the use of the word "biosolids").

How do you address conflict when it seems to be a question of such differing worldviews (e.g. values, approaches to an issue)?

Even issues as polarized as abortion rights have been successfully addressed through consensus building. With "biosolids / treated sewage sludge", approaches to utilization and disposal face are similarly divided.

One approach appears to use risk assessment using experimentally determined input parameters. The other approach appears to base acceptable practices on the precautionary principle.

In either case, progress is a function of setting up an effective communication process.

During the workshop, Larry mentioned a mutual gains 'TV game show' he created that tried to make finding common ground on difficult issues. The show did not go far, but it did tackle some issues where there were deep differences in worldviews and still found common ground, even though the overall disagreement remained.

How long does a conflict assessment take? How much does it cost?

It depends on the specific dispute. A conflict assessment regarding treated sewage sludge at a regional (and possibly national level) would likely take three months from start to finish, involve between 40-60 interviews, and cost roughly $30-50K. The product would be a clear reflection of all stakeholder points of view (information gathered by confidential interviews, organized by category, without name attribution), description of stakeholder priorities and concerns, identification of obstacles, options for potential resolution suggested by interviewees, and a recommendation about whether a consensus building process would likely result in a productively negotiated resolution. If yes, the assessment team suggests a specific design and procedures for a future consensus building dialogue.

What preliminary agreements/assumptions need to be in place to begin a consensus building process?

The convener (sponsor) must be open to all possible outcomes that stakeholders agree they can live with. Stakeholders must commit to a good faith effort to formulate adequate solutions for all. Likewise, stakeholders are not obligated to compromise, and are free to leave the process voluntarily at any time. Moreover, it is incumbent upon the proponents of the process to be particularly sensitive to the perceptions of those who are wary of an alternative approach to resolving the conflict.

There must be agreed upon behavior for dialogue (ground rules), and management of that communication handled by a professional and trusted neutral.

What about when there are multiple stakeholders and complex scientific concerns?

We suggest a process called joint fact finding in which the objective of the stakeholder group is to come to an agreed understanding of their differences over scientific concerns and seek to find sources of scientific information that they mutually accept as a basis of discussion. This involves carefully helping stakeholders select their representatives for joint fact finding; jointly selecting experts; and helping representatives to communicate with their constituents, to synthesize ideas clearly, and to facilitate caucusing away from the table.

Workshop Group Breakout Sessions—Key Concepts/Issues

In the afternoon, breakout groups were asked to keep notes regarding how to operationalize the concepts of mutual gains and consensus building in the context of treated sewage sludge debates. Following are some of the thoughts that were noted:

How to better acknowledge the concerns of stakeholders?

- ♦ Make attempt to more thoroughly reflect stakeholder concerns in a variety of sources: meetings, papers for publication, product labeling, research agenda, collaborative websites, and regulatory fact sheets.
- ♦ A useful exercise, suggest by CBI, is to have opponents attempt to state the other sides' arguments.

How to improve the quality and validity of research?

- ♦ Develop joint fact-finding teams that include non-WERF members.
- ♦ Build a collaborative website bulletin board, chat room for broader discussion and engagement with concerned publics.
- ♦ Review of research findings by all sides before distribution.
- ♦ Develop a joint fact finding "incident SWAT team" to investigate reports of poor land application, health concerns.
- ♦ Acknowledge concerns of the other side and admit past mistakes before initiating joint scientific efforts.

How to act responsibly and in a trustworthy fashion?

- Consider the power of language in the use of the term “biosolids”. [Note: some stakeholders stated that the term “biosolids” has become obstructive, and can be seen as a propaganda tool. They suggest that new language could be used that is acceptable to both sides. “Treated sewage sludge” was suggested as a possible term. Some stakeholder strongly disagree that a new term is necessary, and view “biosolids” as a legitimate, accurate and acceptable term”.]
- Build trust by being inclusive of all views at meetings; take time to listen to concerns thoroughly and respond effectively – think and avoid acting defensively.
- Say what you mean, and mean what you say—follow up and do it.
- Don’t promise anything you can’t deliver.
- Note that there are different kinds of science, and that “indigenous science” and local data, while not formal, has validity.

How to improve research practices in ways that build trust

- Consider greater involvement of all stakeholders in ongoing research.
- Sources of funding must be considered in terms of how this influences perception of neutrality.
- There could be more involvement of all stakeholders toward influencing research agendas, study designs, and peer review processes.
- There could be greater joint oversight of the research process itself.
- Consider how the EMS process can utilize the mutual gains approach.

Keys to improving future dialogue with stakeholders

- Balanced representation of parties
- Mutually defined good science
- Bridging scientific and social outreach skills
- Better defining and understanding the values and views of all stakeholders
- Agreeing that disagreement is a legitimate outcome
- Indemnification/liability guarantees
- Effectively responding to poor public experiences and rebuilding trust
- Acknowledging that this issue is problematic and that concerns are understandable given the nature of the issue (the ‘yuck factor’)
- Meet more often with key stakeholders to help build relationships.

Other Issues Raised

- How to deal with the fact that this issue is both local and national?
- How to change behavior to build trust, and not erode it?
- How to identify all that feel affected by this issue, and avoid just talking to ourselves?
- How to shift control and power over this discussion to be more inclusive of local concerns?
- How to define and build new processes for communication that lead to new venues for discussion and resulting ideas and options?
- How to demonstrate our good intentions for moving forward by bringing new faces to the dialogue and seeking professional neutral assistance?

- How to fund a potential consensus building process?

Conclusion

The workshop concluded at 4:30 p.m. The facilitators thanked the participants for their efforts during the day and encouraged them to think about how the ideas presented could improve relationships among diverse parties with a stake in the use of treated sewage sludge/biosolids.

APPENDIX E

TIMELINES OF DEVELOPMENTS IN BIOSOLIDS RECYCLING PUBLIC PERCEPTION AND UNDERSTANDING

Assessing Trends in Public Perception of Biosolids Across North America

With the information gathered in the Literature Review (Chapter 1.0), it was possible to develop graphs that portray the development of biosolids recycling and public acceptance in the United States over a period of time–for instance, during the past decade. The point of these graphs is that various significant events stand out: the late 1980s - early 1990s debate about the EPA risk assessment, the promulgation of 40 CFR Part 503 regulations, national media coverage (e.g. CNN's *Moneyline*), the 1996 National Research Council review, the 2002 National Research Council review, etc. (Note that different stakeholders in the biosolids recycling debate may choose different events as being more or less significant.)

Putting together these developments provides a picture of the evolving national biosolids recycling situation. As implied by the arrows in the figures, the national biosolids recycling program has momentum– it is not static, but is constantly being impacted by developments. For example: Scientific knowledge and experience in the field of biosolids recycling rapidly expanded during the 1980s and 1990s. As Page and Chang (1994) noted (perhaps over-optimistically): "In 1993, the questions raised by scientists during the 1973 sludge workshop have all been answered. While there are loose ends to be settled, there is adequate technical information for professionals in waste management to plan and design sewage sludge land application systems." For many people working with biosolids, the certainty expressed by these and other researchers provided a level of confidence in biosolids recycling that had never existed before. This is depicted at the bottom of Figure E-1.

Another significant development was the1997 publication of the Cornell Waste Management Institute (CWMI) "Cornell Recommends" and "The Case For Caution," in which concerns were raised about the rigor of the EPA risk assessment and the long-term effects of sewage sludge land application. "The Case for Caution" became a central document in debates regarding biosolids recycling. For example, in Kern County, it was repeatedly cited in the decision to impose a ban on Class B biosolids land application (see section 2.2.13 in Chapter 2.0). This impact is depicted at the bottom of Figure E-4.

In July of 2002, the National Research Council of the National Academy of Sciences release a second review of the science behind the Part 503 regulations. This review has been seen by many stakeholders as a major, significant event that will impact the direction of the nation's biosolids recycling programs in the years to come. This development is also shown in both Figures E-1 and E-4.

The four timelines, Figures E-1 to E-4, provide a picture of developments, over the past decade, of scientific understanding, regulations, public outreach and acceptance efforts, and public concern and opposition. These trends parallel the steadily increasing rate of biosolids recycling in the U.S., depicted at the top of Figure E-1.

Biosolids managers who are aware of the history and key developments of biosolids recycling in North America might better understand the context in which their biosolids management program operates. Many biosolids managers have been most aware of the development of the science and regulations behind biosolids recycling (Figures E-1, E-2), but less aware of the trends in public concerns (Figure E-4). Having an understanding of all four trends may help in making better decisions about biosolids management and public outreach and participation.

There is momentum behind each of the timeline trends pictured below. All are likely to continue in the same direction in the near future, driven, in part, by the expected continued growth of the rate of biosolids recycling in the U.S.:

- Scientific understanding will continue to increase at a steady rate, although the dramatic rate of growth in scientific understanding of the 1980s-early 1990s may not be repeated; however, recent concerns have spurred some increased focus on research over the level of the 1990s;
- Regulations, which develop more slowly, will also continue their slow momentum, with additional state and local regulations growing; but the dramatic rate of development of Part 503 in the late 1980s-early 1990s is not likely to be repeated soon;
- Public outreach, acceptance, and participation efforts are likely to continue to increase at the current rate, or, perhaps, more quickly;
- Public concern and opposition are likely to continue steady growth for the foreseeable future– especially at the local level, as new programs are introduced to new publics and more small (and, perhaps, more larger) environmental groups increase opposition (e.g. Sierra Club, 2001).

Notes on Timelines

Not all significant events have been included in the following timelines. The intention is to provide a rough graphical representation of the parallel development of scientific understanding (Figure E-1); regulations (Figure E-2); outreach and public acceptance efforts (Figure E-3); and public concerns and opposition (E-4)

Figure E-1: Developments and Momentum of Biosolids Recycling in the U.S. – Scientific Understanding Timeline

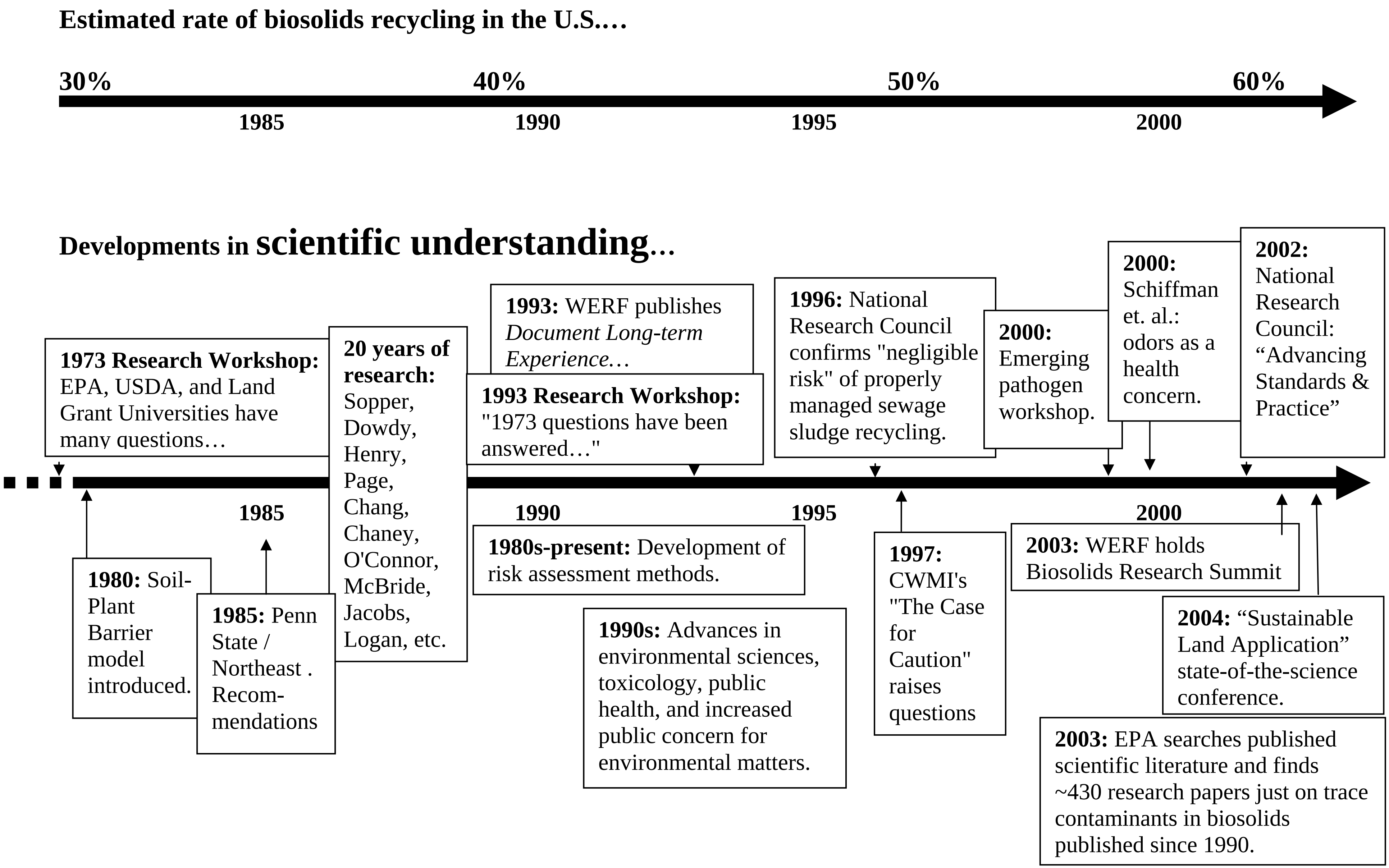

Figure E-2: Developments and Momentum of Biosolids Recycling in the U.S. – Regulations Timeline

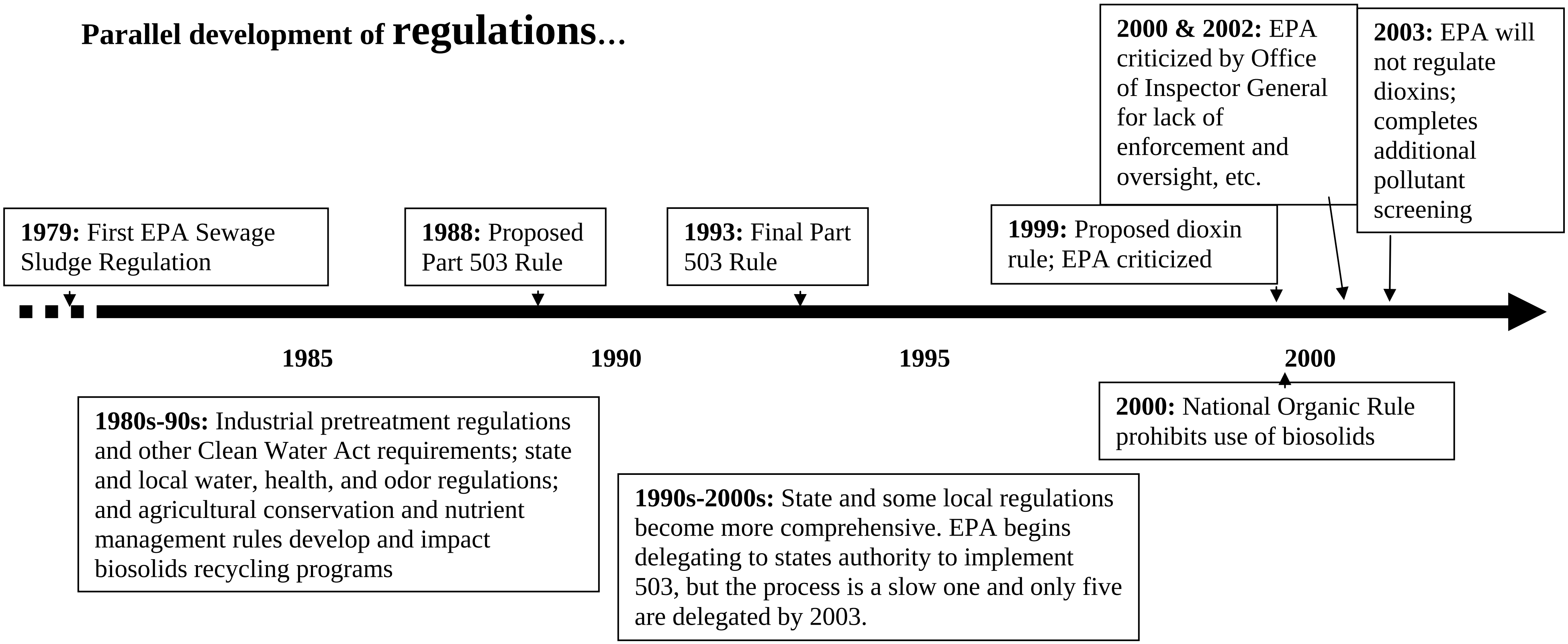

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Figure E-3: Developments and Momentum of Biosolids Recycling in the U.S. – Outreach and Public Acceptance Efforts Timeline

Parallel development of outreach and public acceptance efforts…

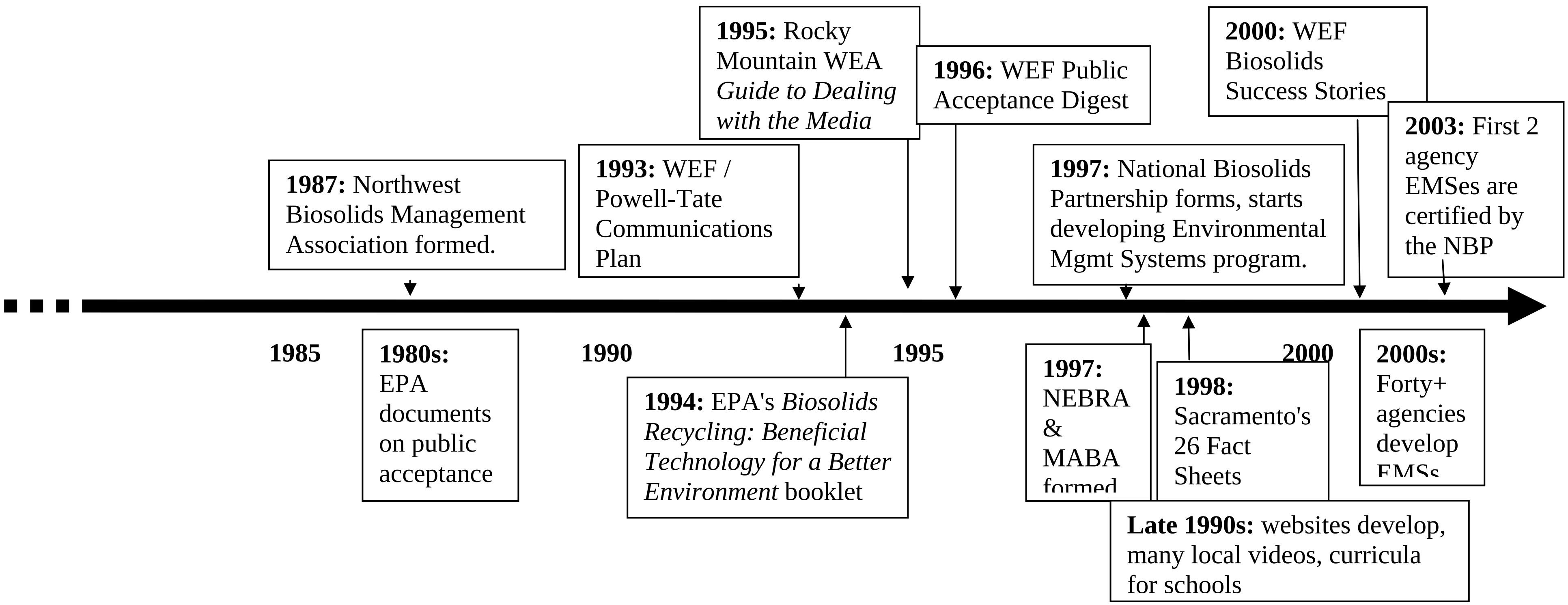
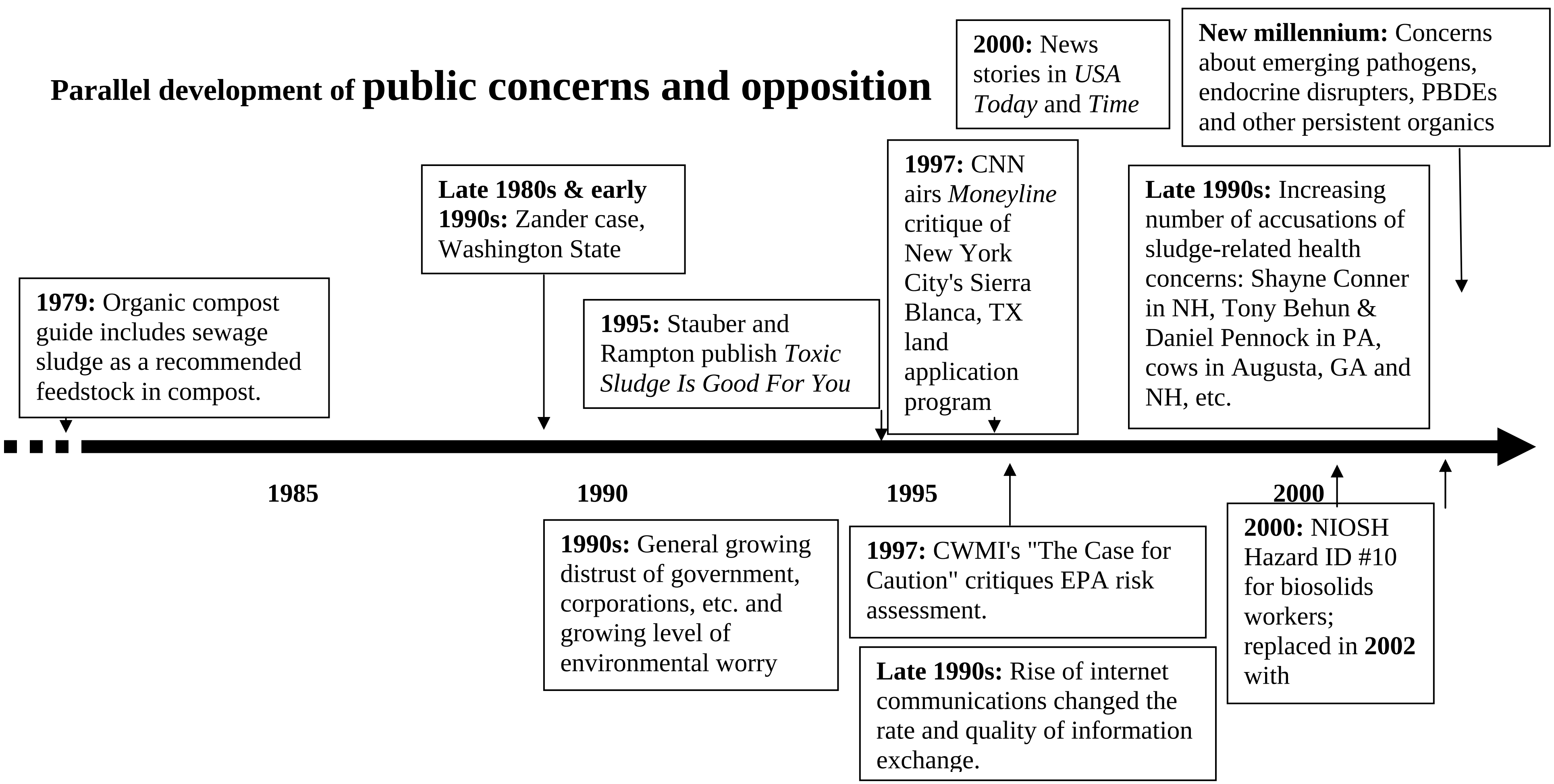


Figure E-4: Developments and Momentum of Biosolids Recycling in the U.S. – Public Concerns and Opposition



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"There is no doubt about it, the basic satisfaction in farming is manure, which always suggests that life can be cyclic and chemically perfect and aromatic and continuous."
-- E.B. White

ANNOTATED BIBLIOGRAPHY

Comprehensive, But Not Exhaustive

This bibliography is a comprehensive listing of significant papers and gray literature, mostly from the 1990s through 2002, relating to biosolids recycling and social science evaluations of public knowledge, opinion, and behavior around other environmental issues. However, it is not intended to be exhaustive and some literature of significance to the topic may have been overlooked. The authors welcome feedback, including suggestions for inclusion in future editions.

Using this Bibliography

This bibliographical listing includes numerical ratings (in **bold**) regarding the significance of the particular entry to the topic of biosolids recycling public perception and participation (#1=highest significance, #5=lowest significance), as determined subjectively by the bibliography editors (project team). Also included are keywords (in **bold**) followed by short descriptions of the papers developed specifically for this project. In some instances, longer abstracts have been included.

The electronic version of this document (see www.nebiosolids.org/werf) can be searched for particular topics of interest using the "Find" and "Find Next" commands. This bibliography is best used in conjunction with the Literature Review (Chapter 1): find your particular topic of interest in that document, look up in the bibliography the documents referenced there, and then search the bibliography for more information using keywords that are part of the citations you have read on the subject. Note that the most significant, useful resources for biosolids management professionals—the documents to read today and to keep handy for reference—are listed at the end of the report's final chapter regarding recommendations.

A large percentage of the literature and information included in this bibliography is available on the Internet. Internet addresses (urls) are included for many of the documents listed below. The electronic version of this bibliography allows you to use direct hyperlinks to Internet addresses if the document is read on a computer that is connected to the Internet with a browser running. Some addresses may prove to be outdated.

Finally, it is important to recognize that the documents listed below and cited in the Literature Review are not necessarily peer reviewed may or may not contain technically accurate information. Many are not at all objective—a wide variety of perspectives and a wide variety of quality of information have been included. It is advisable to carefully assess the source(s) and reliability of any and all information.

Bibliography Keywords

Biosolids Issues	**Type of Program**	**Program Issues/Social Science**
chemicals	Class A	acceptance, public acceptance
dioxin	Class B	bad management
dust	composting	ban
groundwater	facility siting	behavior
metals	heat drying	best management practices
nutrients	incineration	communication
nitrogen	land application	concerned citizen
odor	landfilling	credibility
pathogens	manure	education, public education
soils	septage	EMS (environmental management system)
spills	water reuse	enforcement
stockpiling		environmental attitudes
surface water		environmental justice
trucking		fairness
wildlife impacts		hazard
		health
		information
		lack of public information/data
		liability
		media
		outrage
		oversight
		participation
		personal control
		politics
		profit motive
		risk communication
		risk perception
		siting, facility siting
		technology
		trust
		understanding, risk understanding
		worker
		yuck

Acknowledgments

The authors wish to acknowledge the consultation and assistance provided by Dr. Elaine Vaughan, whose expertise and knowledge of the behavioral sciences informed the development of parts of this bibliography. Appreciation is also extended to the many individuals across the continent who have provided resources and input on topics, cases, and papers of significance, as well as those who have provided document peer review, especially Troy Hartley and Robert Bastian, for several annotated entries, and Trille Mendenhall, who has collected a treasure trove of historic biosolids information over the course of a career.

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25 Environmental Groups Ask Harvard President Not to Allow Poisoning of the Medical School Quad Lawn. 2000. http://www.riles.org/HarvardPR.htm. **#2. Concerned citizens, outrage.** This response to a NEBRA demonstration of biosolids use shows how a biosolids promotional event can create backlash and outrage.

Acohido, Byron. 2000. Districts Battle Over Biosolids, Compost. *Waste News*, October 30. **#4. Odors.**

Adams, Paul L. 1998. The Blue Ribbon Sludge Program, A discussion of the status and organization of the sludge program in New Hampshire with recommendations for changes and improvements. Unpublished paper. **#3. Concerned citizens. Trace chemicals. Pollution prevention.** A proposal for addressing public concerns in New Hampshire through a cooperative committee formed to recommend policy.

Adams, Paul L. 2001. Nashua's Sludge Could Create Harm to the Environment. Letter to the Editor, New Hampshire.

Adams, Paul L. 2001. Specter of Disease Reason to Ban Sludge, letter to the *Union Leader*, NH. January 16. **#4. Pathogens, opposed.**

Adkins, Gary. 1975. 'Outstanding Project'–But Sludge Stinks, Neighbors Say. *Illinois Issues*, August. (Available at http://www.lib.niu.edu/ipo/ii7508234.html.)

Agency for Toxic Substances and Disease Registry. 1990(?). *A Primer on Health Risk Communication Principles and Practices.* Public Health Service, U. S. Department of Health and Human Services. #2. **Risk communication, health.** Helpful resource on risk communication, earning trust, and working with the public around sensitive issues.

Albuquerque, City of. 2000. Wastewater. Website: http://www.ci.albuquerque.nm.us/wastewater/compost.html, Public Works Department, Wastewater Utilities Division. **#4.** Encouraging public acceptance.

Alexander, R. 1993. Market Surveys and Market Development. In *National Extension Compost Utilization Conference*, Minneapolis, MN: Minnesota Extension Service/Cooperative Extension System. 41-43. **#3, composting, health, safety issues.**

Alexander, Ron. 2001. Tapping Potential for Compost Use in Highway Applications. *BioCycle*, 42(6):57-60, June.

Alexandria (VA) Sanitation Authority. 1996. Where Does It Go From Here? Tracing the Path of Your Wastewater. Vidoetape, 19 mins.

Allee, D.J. 1993. What is Extension's Public Policy Education Role in Composting? In *National Extension Compost Utilization Conference*, Minneapolis, MN: Minnesota Extension Service/Cooperative Extension System. 125-129. **#2, public policy education, composting.**

Alpert, Joel. 1999. A Comparison of Biosolids, Manures, and Chemical Fertilizers. E & A Environmental unpublished report. **#3. Manures, metals, nutrients.** Details how, in comparison to manure and chemical fertilizers, the use of New York City biosolids in land application programs result in roughly equivalent trace metal loadings for each pound of nitrogen (N) applied.

American Arbitration Association. 1999. *Environmental Dispute Avoidance and Dispute Resolution.*

American Broadcasting Company (ABC) News. 1995. *Prime Time Live.* February 8. **#3. Bad management.** National exposure of problems with illegal management of sewage sludge at "Mount San Diego." "ABC's Diane Sawyer stated that most wastewater solids 'can be safely and legally disposed of or recycled.'"

American City and County. 1993. Contaminated Sludge Sale Leaves Farmer Fruitless. *American City and County*, May. **#3. Land application.** Article about the use of Miami-Dade biosolids on a papaya plantation in the Bahamas and the resultant accusation of harm from the biosolids on the part of the farmer (see WEF fact sheets, 1997).

American Water Works Association Research Foundation. 2001. *Guidance to Utilities on Building Alliances With Watershed Stakeholders.* **#2. Public participation.** Identifies typical watershed stakeholders and their objectives in watershed planning. Outlines step-by-step procedures for building mutually-beneficial alliances (cooperative working groups) with stakeholders.

Ammons, N. and M. R. Hill. 2000. Public Participation Necessary. *Water Environment and Technology*. 12(9):79-83. **#2, public participation/involvement.**

Amsco, Inc. 1991. Articles of Interest Related to Municipal Sludge Land Application Programs.

Anderson, Connie. 1992. Smell That "Fresh Air". *The Similkameen Spotlight.* October 28. **#2. Odor. Trucking. Land application. NIMBY. Lack of trust.** Same page, different perspective. This citizen is against biosolids based on terrible *aroma*.

Anderson, David. 1992. What's the Big Stink*? The Vancouver Sun*. December 3. **#3. Odor. Pathogens. Nutrients. Land application. University involvement. NIMBY. 'Yuck' factor.** Citizens voted against secondary treatment.

Anderson, Jack. 1999. Govt. Fails to Regulate Sludge Dumping. Syndicated column, *Laconia Citizen*, NH, January 2. **#3. Metals, chemicals, lack of enforcement/oversight, lack of trust.** "Pat Costner, who owned and operated a small wastewater analysis lab before taking her current job with Greenpeace, told our associate Ashley Barker that 'very few industries know what's in their discharge. They will know fairly broad parameters, but they won't know every chemical that's in there. If a city has a pretreatment program, it will only address a fairly limited number of chemicals."

Antelope Valley Communities Against L.A. Sewer Sludge. 2000. http://www.nosludge.org/page2.htm.

Arnold, Ken, Robert Magai, Richard Hoorman, and Randall Miles. 1999. *Safety and Benefits of Biosolids*. University Extension, University of Missouri-Columbia. http://muextension.missouri.edu/xplor/envqual/wq0427.htm

Arrandale, Tom. 1998. Biomass Appeal. *Governing.* September.

Ashcraft, John B. et al. 1988(a). Sludge Concerns Appear Invalid With Cooperation. Editorial in *The Enquirer-Journal.* July 31.

Ashcraft, John B. et al. 1988(b). Union is Not an Outhouse: Mecklenburg Can Keep Trash. *The Enquirer-Journal*. February 17.

Associated Press, The. 1997. Chemicals Found in Fertilizers. *The Greenville News*. July 27.

Associated Press, The. 1999. Amelia Bans Human Waste Fertilizer. *Richmond Times-Dispatch*. April 9. **#3.**

Associated Press, The. 1999. Compost Odor Makes Farmers Target of Lawsuit. *The Associated Press State and Local Wire*, State and Regional section. May 24.

Augusta Chronical Editorial Staff. 1998. The Mess at Messerly. www.augustachronicle.com. November. **#4.**

Austin, TX, City of. 2000. Dillo Dirt: An Award-Winning Program. Product description. http://www.ci.austin.tx.us/water/dillo.htm.

Bailey, E. 2000. Bitter dispute sprouts over Los Angeles sewage sludge. *Los Angeles Times*. May 11.

Bakersfield Californian, The. 2000. County Fights State Over Waste Disposal Guidelines. October 5. **#4. Land application, Class B, regulatory climate, politics.** Continuing coverage of biosolids in Kern County, CA.

Barbarick, K.A. and D.G. Westfall. 1999. Biosolids Recycling. Colorado State University Cooperative Extension. November 12. http://colostate.edu/Depts/coopExt/PUBS/CROPS/00547.html.

Barnett, Megan. 2002. Making a Stink: Neighbors Say Sewage Sludge Fertilizer Makes Them Ill. *U. S. News and World Report*, August 5, pp. 48-50. **#1. Health effects, concerned citizens, media.** A significant national media article discussing concerns about biosolids recycling and potential health impacts.

Baroldi, L.T., and M.D. Moore. 1994. Regulator/Generator Partnership: The Kern County Experience. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA. Water Environment Federation. 77-83. **#2, land application, heavy metals, water contamination and pathogens, active citizenry.**

Baron, J., J.C. Hershey, and H. Kunreuther. 2000. Determinants of Priority for Risk Reduction: The Role of Worry. *Risk Analysis*, 20(4), 413-27**. #1: risk perception, worry, emotion, trust of technology.** One hundred twenty-two members (experts) of the Society for Risk Analysis completed a questionnaire and 150 non-experts completed a similar questionnaire. Both questionnaires were about priorities on persona and government action for risk reduction, severity of the risk, number of people affected, worry, and probabilities of risk for self and others. The differences in responses were explained in terms of worry. Worry, in turn, was affected by probability judgements, which were lower for experts than non-experts (in other words, experts saw the risks of the particular concern as smaller). In other studies, risk judgements have been shown to be affected by factors such as catastrophic potential (how severe would the worst case be), dread, novelty (how new and unknown is the thing causing the risk), naturalness (is the thing causing the risk man-made or natural?), voluntariness (is the affected individual able to control his or her exposure to the thing that is risky?), degree to which risk is unknown (the uncertainty factor), and equity (how fairly is the potential risk distributed). Worry may motivate people to take protective action, unlike other factors. But all factors appear to reinforce the notion that risk perception is widely variant between experts and non-experts (Note: this research reinforces the 1993 study by Sandman, et. al., below).

Bastian, Robert K. 1985. Institutional Barriers to Technological Innovation in Municipal Wastewater and Sludge Management Practices. *Public Waste Management and the Ocean Choice.* Massachusetts Institute of Technology, Cambridge, MA.

Bastian, Robert. 1986. "Institutional Barriers to Technological Innovation in Municipal Wastewater and Sludge Management Practices" IN: Stolzenbach, K.D., J.T.Kildow & E.T. Harding (eds). Public Waste Management and the Ocean Choice. MITSG 85-36. MIT Sea Grant College Program. Cambridge, MA. April. **#2. Public perceptions.** This paper includes a review of early surveys and studies on public attitudes regarding biosolids/treated sewage sludge recycling.

Bastian, R. 1993. Where Do We Stand on Regulations? *Sewage Sludge: Land Utilization and the Environment*, Bloomington, MN: Soil Science Department and USDA-ARS, University of Minnesota. August 11-13. **#5, Part 503 regulations as of 1993.**

Bastian, Robert K. 1997(a). Biosolids Management in the United States: A State-of-the-Nation Overview. *Water Environment & Technology* 45-50. May.

Bastian, Robert K. 1997(b). The Biosolids (Sludge) Treatment, Beneficial Use, and Disposal Situation in the USA. *European Water Pollution Control* 7(2):62-79.

Bastian, Robert K. 2000. Seeing the Future Through the Eyes of the Past. *The Forest Alternative*. University of Washington, Seattle, WA.

Bastian, Robert K. 2000. The Forest Alternative: Principles and Practices of Residuals Use. Chapter 1 Seeing the Forest through the Eyes of the Past, pp. 3-10. University of Washington. Summer.

Bay State Fertilizer. 2000. Description of this Massachusetts-produced biosolids fertilizer. http://www.mwra.com/sewer/html/baystate.htm.

Bedell, C. 2000. County fights state over waste disposal guidelines. *The Bakersfield Californian*. October 5.

Beecher, Ned.1996. Regulatory Shift Impacts Biosolids Recycling in New Hampshire. *BioCycle*, February. **#1 Local bans. Land application. Odor. Metals. NIMBY. Lack of trust. Regulatory climate.** Discusses the history of New Hampshire's lack of regulations leading to odor complaints, public outcry, and emergency regulations.

Beecher, Ned. 1998. The New New England Biosolids and Residuals Association: Why? and Whereto? *Journal of the New England Water Environment Association*, Vol 32, No. 1. **#3.**

Beecher, Ned. 1999(a). Education, Advocacy at Heart of New England Association. *BioCycle* 40(8):75-78. August. **#2.** In the summer of 1997, the New England Biosolids and Residuals Association (NEBRA) was created to address the need for dissemination of accurate technical information about biosolids recycling. The Board of Directors includes farmers, treatment plant operators, biosolids managers, and environmental consultants from Massachusetts, Maine, New Hampshire, and Vermont. NEBRA has been providing resources to over 100 individual and organization members, the media, public officials, and interested citizens. NEBRA is modeled after the Northwest Biosolids Management Association, based in Seattle. Since its inception, NEBRA has focused much of its attention on information-sharing.

Beecher, Ned. 1999(b). Cultivating New England Biosolids Recycling. *Journal of the New England Water Environment Association*, Vol 33, No. 2. 136-157. **#1 Land application. Class A. Class B. Nutrients. Metals. Chemicals. Pathogens. Odor. BMPs. Lack of trust. Public involvement. Regulatory climate.** This is a report from a survey of biosolids stakeholders and an assessment of the unique obstacles to biosolids recycling in New England and recommended actions for addressing those obstacles.

Beecher, Ned. 2000. Recycled Biosolids, letter to *USA Today*, October 19.

Beecher, Ned. 2002. Managing Sludge, letter to *The Coos County Democrat*. February 20. New Hampshire.

Beecher, Ned and William E. Toffey. 1999. Since Politics is Local, We Must All Hang Together. *Proceedings of the Joint Residuals Conference.* Alexandria, VA: Water Environment Association. **#2. Cooperation, communication.** A description of the formation of two new regional biosolids/residuals associations and the need for industry-wide cooperation and communication.

Beeson, R.C., R. Fluck, D. Graetz, G. Kidder, M. Marshall, T. Obreza, G.H. Snyder, A. Shiralipour, and W.H. Smith. 1996. *First Annual Report, A Markets Development Program for Composts in Florida*. University of Florida, Institute of Food and Agricultural Sciences, Center for Biomass Programs. Submitted to the Center for Solid and Hazardous Waste for the Department of Environmental Protection, State of Florida. April 30.

Behnke, Gordon and Tom Amundson. 1993. Using Biosolids in Your Backyard: Turning "NIMBY's" into "YIMBY's". *Entering a New Era*. Alderbrook, WA. Northwest Biosolids Management Association Annual Biosolids Management Conference. #**1. Odor. Class A. NIMBY.** Discusses how to develop a market locally from the public.

Belkin, Lisa. 2002. The Odds of That. *New York Times Magazine*, August 11. pp. 32-61. **#2. Risk perception, environmental attitudes.** Examines the concept of "coincidence in an age of conspiracy." Humans tend to want to see trends or meaning in purely coincidental happenstances. But statisticians know that coincidences are to be expected, and that we tend to notice only certain ones, often creating conspiracy theories or assigning to them undeserved significance.

Benbrook, Charles M. and Roger N. Allbee. 1993. Minimizing Risks and Sharing Liability from Application of Sludge and Sludge By-Products on Agricultural Land. Report from a Symposium Sponsored by the Springfield District Farm Credit Council, Springfield, MA. November 29-30. **#1. Liability.** Addresses the liability issue.

Bender, Michael. 2000. The 'Sludgefest' Continues Over EPA's Part 503 Standard, Talking Toxics. *Waste Dynamics Northeast.* May. **#3. Concerned citizens, chemicals, Part 503, lack of trust., politics.** Discusses the issues of 2000: "The Case for Caution," NIOSH HID #10, USEPA Office of Inspector General Report, U.S. House Science Committee hearing (see Harrison, E.Z.), proposed dioxin standard, and National Sludge Alliance. "'We are not getting to the bottom-line question that the science says that this is not safe,' said Charlotte Hartman of the National Sludge Alliance."

Berger, Ida E. 1997. The Demographics of Recycling and the Structure of Environmental Behavior. *Environment and Behavior*, 29(4), 515-531. **#1: environmental attitudes, public acceptance, technology acceptance.** The influence of socioeconomic and demographic variables on environmentally responsible behaviors was examined in data from 43,000 households. The data showed that socioeconomic and demographic variables play an important role as antecedents to consistent behaviors. The size of residential area, type of dwelling, education, and income are significant determinants of whether recycling facilities are available and will be used. Having convenient access to a recycling program mediates the relationship between socioeconomic factors and recycling practice. Environmental behaviors are structured around specific environmental issues such as water, energy, or waste disposal and suggest that recycling [or any other environmental acceptance, *ed*.] may operate as a first step toward the adoption of other behaviors.

Berry, Michelle and Clifford W. Scherer. (1990). Utilizing Surveys as Community Participation Mechanisms: Toward a Citizen Empowerment Strategy. Presented at the First United States Conference on Municipal Solid Waste Management; Solutions for the 90s sponsored by the U.S. Environmental Protection Agency, Washington, D.C., June 13-16.

Beutel, Trudi. 1994. Sewage Plant Scores Low. *South Delta Today*. December 2. **#3. Metals. Water reuse. Concerned citizen involvement. Education. Local ban.** Please reference response by Greater Vancouver Regional District (GVRD) on Dec. 11.

Bigsby, David. 1992. Making Sludge Work For Us. *Monday Magazine*. September. **#2. Odors. Pathogens. Land application. Successful programs.** King County is cited as being a successful biosolids recycling program. Used as model.

Billings, Loren. 1997. Citizens Win; Coleman Agrees to Withdraw Sludge Application: Owner Will Use Topsoil to Reclaim Gravel Pit. *The Conway Daily Sun*, NH, 9 (70), April 14.

Billings, Loren. 1997. Sludge Spreading: Organic Bounty or Toxic Threat? *The Conway Daily Sun*. July 14. New Hampshire.

Binder, D. L. and D. H. Sander. 2000. Biosolids Research: Sewage Sludge vs. Nitrogen Fertilizer. http://ianr.unl.edu/ianr/lanco/enviro/biosolids/research.htm.

Bio Gro Systems, Inc. 1988. Commonly Asked Questions About Sludge Recycling and Land Application. Pamphlet distributed by the Charlotte-Mecklenburg Utility Department's Biosolids sludge recycling program.

BioCycle. 1990. How to Tackle a Siting Challenge. 31(5):38-39. **#1, appearance, perceived odors, transfer station/recycling facility, NIMBY.**

BioCycle. 1993. From Stripmines to Forests: Thirty Years of Land Reclamation with Biosolids. October.

BioCycle. 1996. Vindication for Biosolids Land Application Project in Texas. 37(4):8. **#3. hazardous materials, land application, miscommunication by media, Sierra Blanca TX.**

BioCycle. 1997. County Bans Biosolids For Land Application. **#2. Ban, land application.** "The concern wasn't so much about the health effects of land application, but that it would harm the public's perception of the agricultural industry."

BioCycle. 1999. Compost Site Comes Back From the Brink. May. #**3.** Composting facility benefits from adopting an Environmental Management System (EMS).

BioGro Systems. *From Waste to Resource: Land Application.* Videotape. 15 minutes. **#3.**

City of Lincoln, 2000. Biosolids Land Application Program: A Partnership Between the City of Lincoln, UNL Cooperative Extension in Lancaster County and County Crop Producers. http://www.ianr.unl.edu/ianr/lanco/enviro/biosolids/overvew.htm, retrieved November 27, 2000. **#2. Public participation.**

Bisogno, T. 1995. The Sludging of America, Sewage Waste Spread on Farms and Landfills is Causing Chronic Health Problems. *E / The Environmental Magazine*, May/June: 19-22. www.emagazine.com. May-June. **#3, land application, health effects.**

Bleifuss, Joel. 1995. Nightmare Soil. *In These Times*, October 16-29: 12-16. A rebuttal by Alan Rubin, USEPA, is available. **#2. Metals, chemicals, pathogens, concerned citizens.** Summarizes parts of the book *Toxic Sludge is Good For You* (see Stauber, 1995, below). Includes discussions of Sierra Blanca, TX, support by EPA of WEF and other proponents, the Powell-Tate communications plan, and Abby Rockefeller: "'We need to make the public understand what is going on,' she says. 'Because you can't what people and industries pour down the drain, the toxicity of the sludge is unpredictable….But people don't know this because the EPA and some of the major environmental groups like the Natural Resources Defense Council and the Environmental Defense Fund [tacit supportes of the EPA's sludge-fertilizer policy] have kept their mouths shut on the subject. I had thought I could get support from environmental groups, but I was being naïve.'"

Blethen Maine Newspapers. 2001. Lyman's Sludge Debate is Likely to be Repeated. January 8. **#4. Urbanization.**

Block, Dave and Robert Rynk. 2000. Fire Destroys Hartford In-Vessel Composting Facility: From the Perspective of a Compost Operator, Key Questions Arise About How The Fire Could Have Been Prevented. *BioCycle*. 41(1): 51-52. January.

Bosomworth, C. Myrna. 1992. A Clean Valley, Please. *The Similkameen Spotlight.* October 28. **#2. Odor. Trucking. Land application. Someone else's biosolids are unacceptable.** Citizen speaks in support of sludge use, but states concerns with odors and transportation.

Boston University School of Public Health, Department of Environmental Health. 2001. Press Advisory. October 29.

Braile, R. 1998. Environmentalists Blast State Plans on Waste Control. *Boston Globe, NH Weekly*. November 15.

Braile, R. 2000. Disposal Methods for Sludge are Scrutinized. *The Boston Globe, NH Weekly*. August 27. **#3, groundwater pollution, nitrates, best management practices.**

Braman, Jonn. 1998. Princeton Will Be Main Show at Fall Symposium. *The Similkameen Spotlight*. April 21. **#3. Odor. Dust. Land application. Successful project. Education.** This biosolids land reclamation project improved environmental health noticeably (see Case Study #4).

Braman, Jonn. 1999. Braman Answers Questions on Biosolids in Keremeos. *The Keremeos Review.* March 18. **#2. Groundwater. Surface water. Nutrients. Land application. Landfilling. Lack of trust. Profit motive/lower cost.** Braman, biosolids manager, open about procedures.

Braman, Jonn. 2000. A Safe And Environmentally Responsible Product. *The Ashcroft Journal.* August 15. **#2. Pathogens. Land application. Incineration. Landfilling. Liability (responsibility). Education.** Braman responding to concerns directly.

British Columbia Lung Association. 2000. Changes in Princeton Bring Breath of Fresh Air. May. **#2. Dust. Land application. Successful program. NIMBY.** The BC Lung Association accredited biosolids reclamation for cleaning air in Princeton and vanquishing dust storms. There was opposition while the project was happening, but even the "naysayers who were adamant did a complete turnaround," once they saw the results. This article describes a significant benefit of biosolids recycling as a tool for addressing a significant environmental and public health problem. More on this in Case Study #4.

Brobst, R.B. 1994. Biosolids Project Acceptance; New York City's Biosolids are Land Applied to the Eastern Plains of Colorado. In *The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective,* Washington, D.C.: Water Environment Federation. 9-13–9-24. **#1, land application, heavy metals, environmental impact, lack of trust, public involvement throughout process, urban/rural someone else's biosolids.** A look at public acceptance success with a potentially very controversial project. Local public participation, open communications, strong oversight and enforcement, and making things better locally were critical. "Public awareness of health, safety, and environmental issues is increasing. Environmental professionals must be prepared to present their message in a matter that fosters confidence and encourages input. The “best professional judgment” takes the concern of the public and, within reason, places these concerns as permit conditions. The EPA’s policy (i.e., the 1984 Beneficial Reuse Policy and the 1991 Interagency Policy on Beneficial Use of Sewage Sludge) of strongly supporting the beneficial reuse of biosolids is closely linked to its objective of reducing the volume of waste generated. Improving the productivity of our land using the soil conditioning properties and nutrient content of biosolids has human health and environmental advantages beyond those that are directly associated with applying biosolids to the land. Secondary or related benefits of reusing biosolids result from a reduction in the adverse human health effects of incineration and decreased dependence on chemical fertilizers."

Brockway, Dale G., Phu V. Nguyen. 1986. Municipal Sludge Application in Forests of Northern Michigan: A Case Study. *The Forest Alternative.* University of Washington, Seattle, WA.

Brooks, John P., Charles P. Gerba, and Ian L. Pepper, 2004. Biological Aerosol Emission, Fate, and Transport form Municipal and Animal Wastes. Journal of Residuals Science & Technology: vol. 1, no. 1, January.

Broten, Delores. 2001. When the Sludge Hits the Field…and the Water, and the Lettuce…. *Watershed Sentinel.* December 2000-January 2001. **#3. European standards, metals, pathogens, chemicals.** British Columbia. A typical environmental press story focused on the potential risks of using treated sewage sludge.

Brubaker, Gregory F., Gerald Conway, and Ken Kellum. 2000.Using Computerized Operations a nd Management Tools to Enhance Environmental Stewardship And Regulatory/Public Acceptance of Biosolids Land Application Programs. Water Environment Federation TEC Paper. October.

Brubaker, Gregory F., Gerald Conway, Ken Kellum. Using Computerized Operations and Management Tools to Enhance Environmental Stewardship and Regulatory/Public Acceptance of Biosolids Land Application Programs. October 2000, (28) WEFTEC conference paper.

Brusch, Kelly. 2004. Residents fear renewed use of sludge on farmland will bring health problems. *North County Times.* April 10. (San Diego & Riverside Counties, CA). Retrieved April 22, 2004 from http://www.nctimes.com/articles/2004/04/11/news/californian/23_29_374_10_04.html .

Buck, Fielding. Reporting Health Risk Stories. Obtained from *FACSNET* in 2003: http://www.facsnet.org/tools/ref_tutor/risk/wiener.php . **#2. Risk communications, media.** A primer for reporters and others regarding how best to present risk information (see also Kamrin et. al.)

Buckley, S.W., and T.J. Muirhead. 1994. Composting Success: An Odor-free Beneficial Use Product. In *Proceedings of the Water Environment Federation 67th Annual Conference & Exposition, WEFTEC ’94*, Chicago, IL: Water Environment Federation. October 15-19. 677-686. **#2, composting, odor, public education/outreach.**

Bunn, Michael. 1995. Reader wants Nutrifor Used On Blockades. *The Similkameen Spotlight.* September 13. **#3.W. Stockpiling. Land application. Concerned citizen involvement.** Writer poking fun at using biosolids as a method of defense (blockade, dumping).

Burbridge, Don. 1998. Nutrifor takes naturalists on demo tour. *The Similkameen Spotlight.* June 10. **#2. Dust. Successful project. Land application. Education.** Positive article on use of demonstration tour.

Burch, Michael R. 2000. Sludge Claims Waste Time, Money. Letter to *USA Today,* July 31**. #3. Worker safety.** "In more than 15 years of treating, hauling, and applying biosolids to land throughout Ohio, my company knows of no resulting health problems experience by our employees or customers or by the workers in any municipal wastewater treatment plants we serve."

Burke, Thomas A. 2002. The Science of Recycling Sewage Sludge. Washington, DC: National Academy of Sciences. September 6. **#3. Science. Technology.** An op-ed clarification of the 2002 National Research Council report on biosolids and EPA's Part 503 regulation by the Chair of the council committee. See also National Research Council, 2002.

Burros, Marian. 2000. U.S. Imposes Standards for Organic-Food Labeling, *New York Times*, December 21, 2000. **#3. Organic foods.** Reporting on the final adoption of the National Organic Rule that precludes the use of biosolids.

Bynum, James. 1999. EPA and the New Plagues. Copake, NY: National Sludge Alliance. March 31. http://www.purefood.org/toxic/toxicpoison.cfm. **#3. Concerned citizens, pathogens, metals, chemicals, lack of trust, etc.** Lengthy summation of concerns and descriptions of alleged harm to animals, etc.

Cable News Network (CNN). 1997. Hazardous Harvest: More Than a Bad Smell?, Denver Sludge is Stinky Biz, and EPA Defends Sludge Rules. *Moneyline,* special reports (television) by Bill Dorman, June 25, 26, and 27. http://cnnfn.cnn.com/1997/06/25/busunu/hazard_one_pkg/ **#3. Concerned citizens, metals, pathogens, chemicals, Part 503 rule.** A significant national media event.

California Water Environment Association. 1998. *CWEA Manual of Good Practice, Agricultural Land Application of Biosolids*. Prepared by the CWEA Steering Committee on Manual of Good Practice for Agricultural Land Application of Biosolids, Oakland, CA. **#1, land application, best management practices.** The California Water Environment Association (CWEA) has prepared this Manual of Good Practice for agricultural land application of biosolids. The purpose of this manual is to establish a standard of excellence when applying biosolids to agricultural land. Issues addressed include nuisance abatement, good neighbor relationships, and shared responsibilities among all parties with the goal of enhancing biosolids recycling. The objectives are to: 1) Promote responsible and informed biosolids management and public acceptance of biosolids recycling, 2) Recommend good management practices for agricultural land application of biosolids to ensure the safe and beneficial use of biosolids, and 3) Encourage statewide uniformity in the application of these practices. The primary audience for the Manual consists of four groups: Generators, Transporters, Appliers, and Growers. Growers include landowners and lease holders, if applicable. A secondary audience includes farm advisors; cooperative extension agents; local, regional, and state regulators; residents; consultants; environmental organizations; and the general public. The Manual is written with the assumption that the audience has a basic understanding of land application practices and the federal biosolids regulation. Those wishing to become more familiar with these are encouraged to attend the CWEA Biosolids Land Application Training Course. The course provides both classroom and in-the-field training over a two-day period.

Calverton Citizens' Association, 1996. *Calverton Current*. Calverton, MD: Calverton Citizens' Association. December.

Calverton Citizens' Association, 1997. *Calverton Current*. Calverton, MD: Calverton Citizens' Association. February.

Campbell, Diana. 2000. Utility's compost recipe keeps gardeners smiling. *Fairbanks Daily News - Miner*. July 4. **#2.** Talks about process in making biosolids and how popular the material is (high demand).

Campbell. 1991. Cartoon. September 29.

Canadian Press, The. 1993. Sludgemeister Saddled With Dirty Job Of Marketing Sewage. January 25. #**3. Nutrients. Pathogens. Land application. Appearance. Class A. Class B. Media campaign. University involvement.**

Canning, K. 1999. Biosolids Initiatives Promote Beneficial Reuse. *Pollution Engineering* 31(2):40-42. February. **#1. Land application, environmental management systems, best management practices.** Determined to educate the general public as well as stakeholders, USEPA and other agencies and organizations have launched a number of initiatives to encourage the beneficial reuse of biosolids. To ensure the regulatory side of the federal biosolids program is working properly, USEPA formed the Biosolids Program Initiative Team in 1998. The National Biosolids Partnership – a joint effort involving USEPA, the Association of Metropolitan Sewerage Agencies, and the Water Environment Federation – is currently focused on the development of a national environmental management system for biosolids. Regional biosolids groups support the beneficial reuse of biosolids by sharing knowledge about biosolids management with a variety of stakeholders and the general public. A number of stakeholders are realizing success by designating specific sites for biosolids recycling.

Cannon, C. 1996. Work Continues on Public Health Issues. *BioCycle* 37(5):83. **#3, aerosols, composting, concerned citizen.**

Cannon, Mary Ellen.1996. All Sludges Are Not Created Equal. Reader's Forum Column. *Coos County Democrat-Lancaster, NH*. 1-A. November 13.

Canody, Jeremy. 1997. Improving the Public's Perception of Biosolids. *Small Flows*, 11 (4): 5-6. National Small Flows Clearinghouse. **#2. Concerned citizen.** "According to John Walker, leader of EPA's Biosolids Management Implementation Team, the public and some environmentalist groups are concerned…for various reasons. These include problems with odors, fears about the potential for groundwater contamination, and fear that the federal and state regulations on biosolids reuse are not being properly followed." Each of these issues is discussed in this article.

Carlile, B.L. 1995. Perceptions of New York City Biosolids in Texas: The Sierra Blanca Ranch Report. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**2. Transportation. Land application. Profit motive/lower cost.** Talks about how this project brought a community back to life by providing jobs while nurturing the environment.

Carlile, B.L., and T. Gillane. 2001. Applying New York City Biosolids on a West Texas Ranch – Eight Years of Operation and Results. WEF Joint Residuals and Biosolids Management Conference, San Diego, CA. Discusses Sierra Blanca Merco Joint Ventures land application project.

Carpine, Joy. 1995. Sludge may be key to sweeping Scotch broom from Discovery Park. *Queen Anne/Magnolia News*. July 12. **#3. Pathogens. Trucking. Land application. Safety when transporting.**

Carpine, Joy. 1995. Stink Raised Over Sludge in Discovery Park. *Magnolia News*. August 9. **#2. Pathogens. Odor. Land application. NIMBY.** "I was more comfortable with it after the meeting."

Center for Environmental Communications. 1999. *Survey Report: opinions of selected respondents on the recycling of biosolids.* Unpublished report to the New England Biosolids and Residuals Association. **#3.** Provided input to report "Cultivating…" see Beecher, 1999, above.

Center for Food Safety, 2003. Petition Seeking an Emergency Moratorium on the Land Application of Sewage Sludge." **#1. Public perception, metals, chemicals, pathogens.** This petition, submitted to U. S. EPA by the Center for Food Safety on behalf of the Center and 72 other mostly small, local organizations, called for a moratorium on biosolids use because of various issues. U. S. EPA responded with a denial of the petition and detailed rebuttals to each allegation.

CH2M Hill. 1982(?). Sludge Management: Public Perceptions and Politics. A CH2M Hill study conducted by Consumer Concepts, Milwaukee, WI. **#2**. **Public perception, public participation.** "A survey of sewerage agencies identifying effective strategies for addressing public and political involvement in the waste treatment and sludge disposal management." Includes discussions of Boston MA, Centerville VA, Chicago IL, Houston TX, Los Angeles CA, Madison WI, New York NY, Philadelphia PA, St. Louis MO, St. Paul MN, Salem OR, and San Diego CA.

Chaney, Rufus, USDA Agricultural Research Service.1997. Review Comments on Cornell University's Draft Paper ("Case for Caution"). Unpublished letter. **#4**. This USDA scientist, who has studied biosolids use for three decades, provides a strong rebuttal to some of the claims of the "Case for Caution," especially concerning trace metals in biosolids.

Chaney, R. L. 1990(a). Public Health and Sludge Utilization. *BioCycle*, 31 (10): 68-73. **#3. Metals.** One of two articles in *BioCycle* summarizing the research, risk assessment, and resolution of technical issues that led to the final federal 40 CFR Part 503 biosolids rule.

Chaney, R. L. 1990(b). Twenty Years of Land Application Research. *BioCycle*, 31 (9): 54-59.

Chaney, Rufus L., James A. Ryan, and Sally L. Brown. 1999. Environmentally Acceptable Endpoints for Soil Metals. In W.C. Anderson, R.C. Loehr, and D. Reible (eds): *Environmental Availability of Chlorinated Organics, Explosives, and Metals in Soils*, Am. Acad. Environ. Eng., Annapolis, MD. ***#3*** Addresses concerns raised by Harrison/Cornell Waste Management Institute's "The Case for Caution."

Chapman, Liz. 2001. Neighbors Are Putting Up a New Stink About an Old Farming Practice. Lewiston, ME:*Sun Journal*, http://www.sunjournal.com/story.asp?slg=031801sludge. March 18.

Charlotte-Mecklenburg Utility Department (CMUD). Beneficial Use of Biosolids…A Success Story. Brochure.

Charlotte-Mecklenburg Utility Department. Artificial Soil Use as Landfill Cover Material. CMUD pamphlet.

Cherry, S.R. 2000(a). EPA's Secret Role in Toxic Sludge. *Insight on the News* 16(27):17. July 24. **#3. intended to scare, lack of trust EPA.**

Cherry, S.R. 2000(b). Sludge Excuses Still Stink. *Insight on the News*. May 29.**#2. Oversight, enforcement, concerned citizens.**

Cherry, S.R. 2000(c). Toxic Waste Used as Fertilizer? *Insight on the News*. May 15. **#3. lack of trust, oversight, enforcement.**

Chesapeake Occupational Health Services. 1991. Health surveillance program for compost workers: An epidemiological review. WSSC Site II, Silver Spring, MD.

Chess, Caron and Kristen Purcell, August 1999, "Public Participation and the Environment: Do We Know What Works?" *Environmental Science & Technology*, 33(16):2685-2692.

Chitwood, Tim. 2000. *Bright Side of Biosolids.* Columbus Ledger-Enquirer, Columbus, OH. **#4. Word biosolids v. sludge.**

Christen, Kris. Public Pressures Swiss to Ban Biosolids. *Water Environment & Technology.* March, pp.16-18.

Chrostowski, Paul C., Sarah Foster, and Damian Preziosi. 2002. *Scientific Peer Review of "The Case for Caution."* Presented at the New York Water Environment Association. Takoma Park, MD: CPF Associates. February 3-6.

Chrostowski, Paul C. and Robert G. O'Dette. 2002. Demystifying the Great Biosolids Debate: Sound Science Removes Emotion From Decisions About Biosolids Recycling. *Pollution Engineering*, 34: 8. Business News Publishing. August.

Circuit Court of Loudoun County, Virginia. 1990. *Ticonderoga Farms, Inc. v. Loudoun County, et al.; Ticonderoga Farms, Inc. v. Zoning Appeals Board of Loudoun County; William E. Detweiler, Zoning Administrator v. Ticonderoga Farms, Inc., et al.* Case Nos. (Chancery) 12368, (Law) 11075, (Chancery) 12545 Consolidated with Case No. (Law) 11075. August 17.

City of Salem. Protecting our Water Heritage. Brochure/Poster. Salem, OR.

Clapp, C.E., W.E. Larson, and R.H. Dowdy. 1994. *Sewage Sludge: Land Utilization and the Environment.* Madison, WI: American Society of Agronomy, Crop Science Society of America, and the Soil Science Society of America. **#3.** Comprehensive collection of papers regarding current knowledge at the time regarding biosolids recycling, including a review by Forste (see below) of public acceptance issues.

Clark, D. 1994. "Boulder Shouldn't Dump Sludge in Gunbarrel." *Boulder Daily Camera.*

Clark, K. 1998. Forum to Smooth Effluent Spread. *The Nelson Mail*. 3. January 26. **#4, inhibited recreational use, land application.**

Clayton Wastewater Sludge Gets Rave Reviews: Customers Line Up to Buy Products to Fertilize Farmland. 2001. *Atlanta Journal-Constitution*. June 25.

Clean Water Report. 2002(a). Both Sides in Land Application Will Take Views to the Public. Silver Spring, MD: Business Publisher's, Inc., 40(2):11-12. January 28.

Clean Water Report. 2002(b). NRC Report Important for Groups to Promote Their Viewpoint. Silver Spring, MD: Business Publisher's, Inc., 40(4):31,36. February 25.

Clean Water Report. 2002(c). Working Out Compromises. Silver Spring, MD: Business Publishers, Inc. 40 (21): 201, October 21. **#2. Concerned citizens, best management practices.** Reports on Virginia counties working negotiating agreements with biosolids users to ameliorate citizen concerns: ""The county may require new residents near farms to sign a disclosure statement with their real estate agents…. Officials also suggested farmers not spread biosolids near holidays; apply biosolids in a checkerboard fashion to avoid concentration; increase buffer zones near residential areas; study using other forms of biosolids, such as pellets; and hire independent consultants to test air, water, and soil quality after spreading is complete."

Cleveland, Charles B. 1976. Chicago: Joanne Alter, MSD Commissioner, Turns Engineering Ideas into Everyday Words. *Illinois Issues*, January. (Available at http://www.lib.niu.edu/ipo/ii760130.html.)

Clines, Francis X. 2000. The 2000 Campaign: The Battle For West Virginia; King Coal Casts Shadow on Governor's Race. *New York Times*, October 27, 2000. **#4. The word "sludge."** "It may be the ultimate political symbol for the coal fields of Appalachia: Just in time for the West Virginia governor's race, a slurry dam burst on the state's border with Kentucky, sending 250 million gallons of coal-dust sludge oozing down toward ..."

Cogger, Craig and Dan Sullivan. 1991. *Recycling Municipal Wastewater Sludge in Washington.* WSU College of Agriculture & Home Economics.

Cogger, Craig. 1993. Environmental Ethics: Why They Are Important to Us! *Entering a New Era*. Alderbrook, WA. Northwest Biosolids Management Association 5th Annual Biosolids Management Conference. #**2.** Looks at the ethics behind sustainability and how this is something that is of vital importance in not pushing nature's limits too far.

Cohen, Bonner. 1998. Blowing the Whistle on EPA's Misuse of Science, an Interview with Dr. David L. Lewis. *Environment News*, March. **#3. Metals, Part 503, regulatory climate.**

Cohen, Nevin, June 1995, "Technical Assistance for Citizen Participation: A Case Study of New York City's Environmental Planning Process," *American Review of Public Administration*, 25(2):119-135. **#1. Public participation.** While city-funded technical assistance have enabled citizen advisory groups to monitor environmental reviews and project design and to secure environmental improvements to proposed facilities, they have not helped to promote citizen acceptance of the technologies or their locations. Technical assistance has made environmental decisions more sensible, but not necessarily more democratic. The additional scrutiny provided by technically assisted citizens has prevented New York from making mistakes and has illuminated environmentally sound alternatives; yet, the technical advisors have done little to promote political consensus or to dramatically bolster citizen clout in administrative decision making. Factors that influence effectiveness of citizen advisory committees are discussed: composition of committee and credibility of its membership, members connected to advocacy groups with significant clout or resources, members' long-term commitment. If members are primarily people appointed by administration, then public may be suspicious of their conclusions. Timing of intervention - providing advice before city's proposals are finalized is preferable to a committee reacting to what city has already formalized. Politics of administration - a sympathetic administration to citizens and environmental interests is more likely to listen to advisory committee; if administration's hold on power is tenuous then more likely to pay attention to advisory committee.

Cohen, Nevin. 1997. The Politics of Environmental Risk: Perceptions of Risk in the State Legislatures. Urbana, IL: *Policy Studies Journal*. 25(3):470-484. Fall. **#3. Risk perception.**

Coleman, Cynthia-Lou and Clifford W. Scherer. (1990). Communication, Community Participation and Waste Management. Presented at the First United States Conference on Municipal Solid Waste Management; Solutions for the 90s sponsored by the U.S. Environmental Protection Agency, Washington, D.C., June 13-16.

Coleman, Steve and Fred Sherwin. Biosolids: A Rose by Any Other Name. Ontario, Canada: *The Star*. http://www.orleansnews.com/pages_star/biosolids.html.

Colorado Citizen Action Network.1998(?). Resolution in Support of Safe Communities, Farms and Food. Resolution and petition by citizen's group. http://www.ienearth.org/lowry.html. **#3. Radioactivity, Lowry Landfill, citizen concerns.**

Colorado Department of Public Health and Environment, Water Quality Control Division and the U.S. Environmental Protection Agency, Region 8. *Questions and Answers about Biosolids Recycling in Colorado.* **#2**.

Colorado State University. 2000. Research description. http://lamar.colostate.edu/~ippolito/biosolids/biosolids.html **#4**.

Communications System for the National Biosolids Partnership and Regional/Local Biosolids Groups. 1999. Suggestions from the "Re-Investing in Success" Workshop. Charlotte, NC. August 20.

Composting News. 2002. National Whistleblower Center Requests EPA Action on Sludge. March, pp.7,10-11.

Connelly, Shelagh. 2000. Beneficial Use, Politics, and the Cost of Upgrades, a presentation to the New England Water Environment Association Residuals Management Conference, November 16. **#3. Regulatory climate, septage, politics.** "The net effect of adopting regulations that are so stringent, in theory to protect the environment, may actually have the opposite effect as options to recycle are eliminated and communities are forced to landfill or incinerate…. What is the cost to municipalites of negative campaigning and 'politicizing of poop?' More rules, less trust from the public, policy driven by fear rather than science, mandate to 'make sludge safer.'"

Cooper, Chris. 1995. Save Our County from Perception. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1. Concerned citizen involvement. Education.** A regulator's standpoint in regards to public perception issues.

Cooper, Robert C. 1991. Public Health Concerns in Wastewater Reuse. *Water Science Technology*, 24(9), 55-65. **#2: risk acceptance, technology acceptance:** Specific public health concerns might fuel public opposition to wastewater reuse, and impede recycling of waters for groundwater recharge. There is particular emphasis on pathogens, and of trace organic compounds, which should not pose increased risk to those using the water if proper water quality standards are observed. The article is silent on social acceptance of wastewater discharge to potential drinking water supplies.

Cooper, S. 1998. Plant a Priority, Candidates Claim. www.augustachronicle.com. November. **#4, political.**

Cooperative State Research Service Technical Committee W-170. 1989. *Peer Review: Standards for the Disposal of Sewage Sludge, U.S. EPA Proposed Rule 40 CFR Parts 257 and 503*. A.L. Page and T.J. Logan, editors.

Cornell Waste Management Institute. Sewage Sludge Fact Sheets. http://www.cfe.cornell.edu/wmi/Sludge/Production.pdf

Cornell Waste Management Institute. 1996. *Land Application of Sewage Biosolids*, a video teleconference on sewage sludge/biosolids issues. Information available at http://www.cfe.cornell.edu/wmi/Sludge/biosolid.html Discussion of issues includes variety of perspectives and addresses neighbor concerns.

Cornell Waste Management Institute. 1997. Comparison of Sludge Standards: US EPA EQ versus Dutch Sludge (chart). October 15. http://members.tripod.com/~PA_Sludge/gifs/epa_neth.gif.

Cornell Waste Management Institute. 1997. Cornell Recommends. Available at http://www.cfe.cornell.edu/wmi/Sludge/Recommends.html.

Cornell Waste Management Institute. 2001. Ordinances. http://www.cfe.cornell.edu/wmi/Sludge/Role.pdf

Corraliza, Jose A. 2000. Environmental Values, Beliefs and Actions: A Situational Approach. *Environment and Behavior*, 32(6), 832-849. **#2: behavior, acceptance, attitudes, trust.** This study investigated the influence of the interaction between personal and situational variables in environmental behavior and the predictive power of values and beliefs. Three different kinds of questions (environmental beliefs, Schwartz's measure of values, and physical-environmental inhibition level) and one item of general environmental concern were presented, along with a 16-item list of environmental actions, to 125 randomly selected subjects. The conclusions were: (1) environmental behavior depends on personal and situational variables in an interactive way; (2) when high conflict level is generated between personal dispositions and situational conditions, the predictive power of attitudes tends to be minimal, whereas in the case of consistency between them it tends to be maximal. The influence of situational variables was found to depend on the environmental action considered. In some cases, situational variables were the most important, whereas in others, commitment or moral obligation played an essential role.

Couch, S.R. and S. Kroll-Smith. 1994. Environmental Controversies, Interactional Resources and Rural Communities: Siting vs. Exposure Disputes. *Rural Sociology*, 59(1), 25-44. **#1: Risk perception, siting, environmental risk.** There are differences in the types of social conflict in facility siting disputes and toxic contamination cases. An ecological-symbolic perspective and the concept of strong and weak ties are used to interpret the nature of social conflict in two rural PA communities. Community solidarity appears to be enhanced in siting disputes and undermined in exposure situations. The author follows two conflict paths that move from the presence or absence of the hazardous agent to individual perceptions, the generation of collective threat beliefs and formation of strong ties, the emergence of alternative leadership and its relationship to official authorities and formation of weak ties. In short, different types of disputes will have different effects on how a community responds.

County Commission. 2001. Jefferson County Use of Sludge Wins EPA Awards. Newsletter, Vol. 3, issue 4, June.

Court of Appeals of Ohio, Eleventh Appellate District, Trumbull County. 1995. *STATE ex rel. RONALD PAUL FOX, et al., Plaintiffs-Appellees, -vs- RICHARD ORWIG, et al., Defendants-Appellees, MARK BOCKELMAN, et al., Defendants-Appellants.* Case No. 94-T-5100. September 15.

Covello, Vincent. 1983. The Perception of Technological Risks: A Literature Review. *Technological Forecasting and Social Change*, Vol. 23, 285-297.

Covello, Vincent T. and F.W. Allen. 1988. *Seven Cardinal Rules of Risk Communication,* brochure. Washington, D.C.: U.S. Environmental Protection Agency.

Covello, V. and P. Sandman. 2001. Risk communication: evolution and revolution, in A. Wolbarst (ed.): *Solutions to an Environment in Peril.* Baltimore, MD: John Hopkins University Press, 164-178. **#1. Risk communication.** An excellent summary of the history and findings of risk communication research. Notes that obstacles to understanding risk include “the public’s desire and demand for scientific certainty. People are averse to uncertainty, and find a variety of coping mechanisms to reduce the anxiety it causes. This aversion often translates into a marked preference for statements of fact over statements of probability—the language of risk assessment.”

Covello, Vincent and Steven Wolf. 2003. Three Key Equations for Solving Public Meeting Nightmares. *Water Environment & Technology*. Alexandria, VA: Water Environment Federation, February. **#1. Risk communication.** Short synopsis of key risk communication concepts.

Craig, Rochelle. 2001. U. S. Filter Participates in STA Program, Guarantees High End Compost Product. *Waste Handling Equipment News*, September, p.6. **Product quality.**

Crawford, Scott. 1998. Paradise Sludged: Linda Lingle's Toxic Legacy. *Hawaii Environment & Health News* 1(1). September. http://www.hookele.com/hehn/98-09/sludged.html. **#3, land application, negative media campaign, carcinogens, metals, bad management, incorporation.**

Crittenden, Guy. 2001. Holy Sludge: Toronto's New Bylaw and Disposal Strategy for Biosolids Impacts Industry and Sets a National Precedent. http://www.hazmatmag.com/current/articles/0101.html. December/January.

Culos, Ermos. 2000. Let's Not Take This Crap From GVRD. *The Ashcroft Journal*. August 8. **#2. Pathogens. Land application. Facility Siting. Lack of public information. 'Yuck' factor. NIMBY. Lack of trust. Urban/rural conflict.** Culos feels betrayed by larger city coming in and disposing of waste.

Culos, Ermos. 2000. Stop the Mudballs. *The Ashcroft Journal.* August 29. **#2. Pathogens. Metals. Spills. Land application. Manure. 'Yuck' factor. Lack of trust. NIMBY.** Culos is restating his disagreement with biosolids applications.

Currie, Beth. 2000. Open Letter to the Town of Princeton. *The Similkameen Spotlight.* July 4. **#2. Dust. Land application. Education. Media campaign.** Currie submitted an article to celebrate a successful biosolids project.

Curtis, Maureen. 1995. Sewage for Sale, West Van Council Told Sludge Helps Heal Land. *NS News.* July. **#2. Stockpiling. Land application. Regulatory climate.** BC biosolids manager presents reuse options that replace ocean dumping.

Cusick, Daniel. 2000. Officials: Sludge Safe if Properly Managed. *Mobile Register.* March 28. http://www.enviroweb.org/issues/sludge/.**#3. Politics.** Coverage of the U.S. House Science Committee hearing March 2000.

Dahl, Diana and Roy Smith. 1998. Agricultural Use of Sludge: "Don't" is the Only Safe Guideline. *Hawaii Environment & Health News,* Vol. 1, No. 1. **#4. Lack of oversight/enforcement, testing, chemicals.**

Daily Commercial News and Construction Report. 1994. Lining Up For Sludge. March 8. **#3. Odor. Pathogens. Stockpiling. Land application. NIMBY. Profit motive/lower cost.** Landfill will use 27,000 cubic meters of biosolids.

Daley, Beth. 2001. As Big Dig Fill Rises, So Do Problems. *The Boston Globe*. June 21.

DaSilva, David. Sewage to Cover Landfill. *MetroValley Reporter*. **#2. Nutrients. Odor. Land application. Lack of trust. Education.** It was a high priority to communicate the benefits to the public and council members through presenting other successful biosolids projects.

Davidov, R. 1999. Baltimore City Turns Biosolids Into Composting Success. *Waste Age* 30(7):16-18. July. **#4, composting on adjacent site, best management practices.**

Davis, Charles E. 1993. *The Politics of Hazardous Waste*. Prentrice Hall, Englewood Cliffs, New Jersey. **#2: acceptance, hazards perception, public relations, siting, NIMBY.** This book traces the evolution of public acknowledgement and resistance to siting hazardous waste management facilities, as well as the political dimensions of spills or improper use. It reviews a number of celebrated cases that illustrate how political opposition influences the final disposition of policy matters and, in some instances, the technical choices that are made to resolve problems.

Decision Research. 2000. Riverside County Solid Waste Survey.

Denver Metro Wastewater Reclamation District. 2001. Metrogro biosolids program website. http://www.metrowastewater.com/environment/index.html.

Denver Publishing Company. 1998. Contamination Plans, an Underreported Story. *The Denver Rocky Mounty News*. 41A. August 19. **#3, sewage sludge from hazardous/nuclear facility, metals, dioxin, asbestos, plutonium, land application, concerned involvement.**

Desoff, Alan. 2001. Saga of Biosolids Ban Continues. *Water Environment & Technology,* 13(7)26-29. July.

Detergent Pollution. 2001. New York: *Chemical Week*. 163(39):32, October 24.

Doherty, Lyonel. 1999(a). Biosolids Still Worry Residents. *The Keremeos Review*. January 21. **#3. Groundwater. Nitrogen. Metals. Land application. Class A. Class B. Regulatory climate. Local soils/climate/natural conditions. Lack of trust. Education.** Public meeting held to inform all interested of project and impacts. High concerns regarding nitrate leaching.

Doherty, Lyonel. 1999(b). Council opposes application rates in biosolids plan. *The Keremeos Review.* February 4. **#3. Groundwater. Metals. Pathogens. Nutrients. Land application. Class A. Class B. Local soils/climate/natural conditions.** Biosolids professionals present specifics of biosolids applications, but council still remained skeptical.

Doherty, Lyonel. 1999(c). Rancher Still Trying To Find the Negative On Biosolids. *The Keremeos Review.* February 4. **#2. Pathogens. Metals. Nutrients. Land application. Lack of trust. Education. NIMBY.** Rancher encouraging concerned individuals to learn more about biosolids before judging the fertilizer. After researching himself, rancher supports biosolids reuse.

Dolan, Roger J. 1990. Letter to Peter Machno. August 16.

Donaldson, B.K. 2000. Sewage Sludge Composting: A Citizen's Perspective. In *Biosolids Management in the 21st Century Conference*, College Park, MD. 12-15. **#1, fears of odors/pathogens, composting, lack of public involvement in process, concerned citizen.** Discusses Calverton citizens' efforts to change and close the Washington Suburban Sanitary Commission's Site 2 composting facility bordering their town. In the face of determined politicians and water and sewer authorities, isolated businessmen and concerned citizens can be easily steamrolled when creating treatment facilities. Doing so, however, may well be to the detriment of all concerned. An example concerning sewerage sludge disposal is presented to support that conclusion.

Donovan, John F. 1993. Getting the Sludge Rule On Line. *BioCycle,* April 1993. **#4**.

Dorr, D. 2000. O'Fallon Gets Into Organic Fertilizer Supplement Business. *St. Louis Post-Dispatch, St. Charles County Post*. 4. July 5. **#4, disposal, Class A, lack of information.**

Douglas, Mary. 1992. Risk and Danger (essay). *Risk and Blame: Essays in Cultural Theory.* Routledge, London and New York. **#2: risk, risk perception, risk understanding, NIMBY, the "other" fear of technology.** This essay focuses on the relationship between risk perception and the political component of decision making around hazardous waste. Outside of the probabilistic sense, risk is a politically laden topic, with demonstrable impacts that may, if the political interpretation of risk is carried to extremes, injure people or damage their environment. Therefore, risk analysis that excludes moral ideas and politics from consideration is senseless and potentially dangerous. The author argues that technological risks are not fear of technology or the fear of death and disaster, but fear of oppression by authority empowered by new technology. The author acknowledges that scientific/technical illiteracy has increased the chasm between technologists and the public, and she assigns technologists a special responsibility to explain risk in a context that can be understood by that public.

Dowd, Scot E., Charles P. Gerba, Ian L. Pepper, and Sureah D. Pillai. 2000. Bioaerosol Transport Modeling and Risk Assessment in Relation to Biosolids Placement. *Journal of Environmental Quality,* 29:343-348. **#3. Aerosols, land application, Class B.** Annotated copy by Helane Shields, Alton, NH became important document for those opposed to biosolids land application in suggesting harm to neighbors from airborne contaminants.

Downing, B. 1997. From Septic Tanks To Ohio Farmland. *Akron Beacon Journal*. http://Wayne-Health.org/septage_1297.html. December 14. **#4, septage application.**

Draman, Grace A. 1994. The Beneficial Reuse of Biosolids: How Important is Public Perception? In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation. **#1 NIMBY. Bad management. Lack of trust.** Stresses need to address perception, "do it right" and involve local public. Recommends certification of biosolids managers. Calls for states to provide more public education and information. "Whether we like to admit it or not, public perception is *reality* especially for those groups or individuals emotionally involved with issues or projects that relate to the environment…. It is difficult.…to have an objective dialogue with them, because it is similar to an argument over religion."

Draman, Grace A. 1995. Public Perception is Key to Biosolids Acceptance. *BioCycle*, 36(9), 82-83. **#3: risk perception, acceptance, NIMBY.** The author makes the case that public perception is the key to biosolids recycling, and the basis for action within the industry to fund research into attitudes on environmental risk as it relates to biosolids. Outstanding problems regarding quality and practices must be addressed, and strict adherence to federal Part 503 regulations a necessity. “First, public education and awareness programs that reach all levels must go full steam ahead. Equally important is the performance of everyone involved with beneficial use projects – it must be done right from top to bottom.” “Perception is reality, and it will make the difference as to whether or not a project is successful.”

Durand, Robert. 2000. Supporting Biosolids Recycling, a talk at a biosolids compost application demonstration, Harvard Medical School, Boston, MA, May 3. "Like any new idea, biosolids need to be promoted…. We want … to move away from the use of landfills and incinerators as the disposal method of choice. Basically, we want to eliminate the concept of waste.”

Duroe, M.G. 1993. Multi-county Composting and Recycling Program. In *National Extension Compost Utilization Conference*, Minneapolis, MN: Minnesota Extension Service/ Cooperative Extension System. 149-153. **#2, using extension services to bring forth public education.**

Earth Justice. 2001. Unchecked Incinerator Pollution Underscores Pervasive Problem: Toxic Emissions From Many Categories Remain Uncontrolled. Press Release. Washington, D.C. July 20.

Eckhaus, Mel. 2000. Biosolids--The Farmer's View, an Opinion. Letter to PA House of Representatives by PA Farm Bureau representative reprinted by PA Dept. of Environmental Protection, http://www.dep.state.pa.us/dep. **#3. In support.** "Many public fears of the use of biosolids arise over the potential existence of foreign substances and or harmful concentration of substances in the material….DEP's current regulatory program should be given a fair chance to be implemented, and use of biosolids under the program be judged on its scientific merit."

Egigian-Nichols, C., and C. Lekven. 1998. All New Biosolids Fact Sheets – 26 Flavors from Sacramento. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 535-542. **#2, land application, education program, positive outcome.** The Sacramento Regional County Sanitation District (SRCSD) operates a successful biosolids land application program that includes a continuous, aggressive public education and outreach effort. Part of the education and outreach program includes creation of information tools useful for marketing their biosolids to farmers and to the general public. SRCSD created 26 Fact Sheets covering the full range of typical questions asked about biosolids. These tools are targeted to sell a specific audience on the safe and reliable recycling of SRCSD biosolids. SRCSD developed 3 message points for the Fact Sheets including: 1) Biosolids recycling benefits the environment as a fertilizer and soil enricher. 2) Biosolids recycling is proven, safe, and reliable. 3) SRCSD expertly creates these biosolids using sound science, commitment to quality control, extensive monitoring, and regulatory compliance. The Fact Sheets were developed from a list of over 125 questions. SRCSD established the list of questions, the SRCSD message points were refined and re-refined, scientifically factual information needed to supply answers was researched from the literature, concluding in the writing of the Fact Sheets.

Ehrmann, John R. and Barbara L. Stinson. 1999. Joint Fact-Finding and the Use of Technical Experts. In Lawrence Susskind, Sarah McKearnan, and Jennifer Thomas-Larmer (eds.), *The Consensus Building Handbook: A Comprehensive Guide to Reaching Agreement.* Thousand Oaks, CA: Sage Publications. **#1. Public participation, science.** Guidance on how to do joint fact-finding.

EKO Compost. *Compost: A Short History of the Earth's Original Soil.* Maui, HI.

Englebow, Jill. 1992. Co-composting Controversy: County Recycler Sees Spot on Team For Sludge. *The Maui News.* May 31. **#2. Groundwater. Metals. Landfilling.** Waste diversion efforts mentioned in this article as a primary advantage to using biosolids as a resource.

Environmental Research Foundation. 1997. New U.S. Waste Policy, Pt. 2: Sewage Sludge. *Rachel's Environment & Health Weekly* #561. August. http://www.monitor.net/rachel/r561.html. **#2.**

Environmental Working Group. 1998(a). Dumping Sewage Sludge on Organic Farms? Why USDA Should Just Say No. April 30. http://www.enviroweb.org/issues/sludge.

Environmental Working Group. 1998(b). Toxic Wastes "Recycled" as Fertilizer Threaten U.S. Farms and Food Supply: Dioxin, Lead, Mercury Spread on Crops as States Scramble to Protect Public Health. http://www.ewg.org/pub/home/reports/factoryfarming/fertpress.html **#4. Fertilizer.** Concerns about chemical fertilizers that include industrial by-products.

Enviroweb. 2000. The Sludge Hits the Fan. http://www.enviroweb.org/issues/sludge/sludge.html.

Epstein, George. 2000. *Epstein's the Key*, political advertisement. *Laconia Citizen*, NH. **#4. Politics.**

European Union. 2000. Working Document on Sludge, 3rd Draft. Brussels. April 27.

Evans, Tim. 2002. Summary of Attitudes To Biosolids Recycling. Unpublished manuscript.

Evanylo, Greg. 1998. *Biosolids Land Use Ordinances Gaining Favor.* Virginia Cooperative Extension. January. http://www.ext.vt.edu/news/periodicals/cses/1998-01/1998-01-05.html #**2. Communication, information.** Helpful fact sheet, presented even-handedly.

Evanylo, G.K. 1999. *Agricultural Land Application of Biosolids in Virginia: Risks and Concerns.* Virginia Cooperative Extension. Publication 452-304. Available at http://www.ext.vt.edu/pubs/compost/452-304/452-304.html **#2. Communication, information.** Helpful fact sheet, presented even-handedly.

Fahey, Tom. 2000. Governor Candidates Tackle the Environment. *The Union Leader*. October 11. **Politics.**

Fanfare Communications. Waste Management Specialists and Environmental Engineers are Winning the Battle of Technology, but Losing the War of Public Opinion: Here's What You Can Do To Help Your Projects Win Public Acceptance. Fanfare Communications pamphlet.

Farrell, Molly. 2001. Site Monitoring and Odor Control at Co-composting Facility. *BioCycle.* July.

Finkel, A. M. 1995. Toward less misleading comparisons of uncertain risk: the example of Aflatoxin and Alar. *Environmental Health Perspectives.* 103-4:376.

Fischhoff, B. 1999. Why (Cancer) Risk Communication Can be Hard. *Journal of the National Cancer Institute Monographs*, 25, 7-13. **#1: Personal control, risk communication, risk understanding, science understanding.** Effective risk communication is made more difficult because the communicator must determine what is most worth saying and the receiver must integrate that message using only his or her fragmentary mental models of the processes creating and controlling the risks. One risk communication strategy is to use analytic methods for selecting information based on how critical it is to recipients' decision-making. A second strategy is to adapt messages to the cognitive processes of the recipients.

Fischhoff, M.G.M.B., A. Bostrom, L. Lave, and C.J. Atman. 1992. Communicating Risk to the Public. *Environmental Science and Technology* 26(11):2048-2056. **#2, risk communication.**

Fisher, A. 1991. Risk Communication Challenges. *Risk Analysis*, 11(2), 173-79**. #2: risk communication, risk understanding, public acceptance.** The author compares models of risk communication from two polar perspectives, informing versus empowering, and compares the characteristics of each end of the spectrum and the gradations between them. A gradated matrix of these two perspectives is presented, with descriptions that range from "telling them what has been decided" to "helping them interpret results and to use ways to affect the decisions." The author identifies the areas that need additional research (Note: the specific characteristics cited in this paper have been studied in more detail since 1991).

Fitzcharles, Margaret. 2000. Norco Woman Fights DEP Over Spread of Sewer Sludge. *The Mercury*, PA, September 7. **#3** "'I have sent Secretary (James) Seif at the DEP a very strong letter telling him I am holding him personally responsible not only for the health and lives of my husband and myself but for all of us who will have to breathe in the fumes, possible pathogens, chemical combinations, heavy metals, sulfur or chlorinated combinations that may blow in our direction,' said Mazze."

Fleming, M. 1998. Dairy Cows Dying; Farmers Sue City. *Waste News*. 16. November 30. **#4.**

Fondahl, Lauren. 1999. Biosolids Management in the Western Region. *BioCycle*. July. **#1. Pathogen. Metals. Class A. Class B. Land application. Landfilling. Incineration. Composting. Stockpiling. Local/regional ban or restrictions. Lack of oversight/enforcement. Profit motive. Someone else's biosolids are unacceptable.** Bans have caused POTWs costs to rise for increased composting and/or increased transportation. POTWs choose what is most cost-effective.

Forste, J.B. 1993. Gaining Public Acceptance for Biosolids. *Sewage Sludge: Land Utilization and the Environment*, Bloomington, MN: Soil Science Department and USDA-ARS, University of Minnesota. August 11-13. **#1, land application, gaining public acceptance.** Those of us involved in public acceptance efforts recognize that scientific data and information about risk assessment do not necessarily result in public acceptance for the projects we develop. We are told that: (1) perception equals reality (i.e., a perceived risk is just as real to the person concerned about it as it scientifically derived risk assessment), and (2) in decision-making, perception outweighs reality. We need to remember, however, that perceptions about many subjects can and do change with time and with accurate, credible communication efforts. The beneficial use of biosolids provides a case in point regarding risk perception. A 20-year compilation of extensive, detailed, scientific data has clearly established that the treated solids from municipal wastewater can safely be used on land in a variety of ways. The quality standards for such safe beneficial use are based on protective assumptions about the impact of biosolids on the environment, crops, animals, and humans. Why then does a negative perception about the use of this material persist? Part of the answer lies in lack of understanding – the result of a very common and natural human apprehension. The average citizen knows little or nothing about wastewater treatment, the pretreatment programs which protect the integrity of this process, and the biological and chemical composition of the treated solids. To develop a dialogue with communities where biosolids will be processed or used, it is important to establish the link between our national commitment to clean water and the necessity to manage the solids from wastewater treatment. The environmental issues that relate to municipal wastewater solids and treatment are very different from those involving hazardous wastes; these issues must be clarified to win public confidence and support for beneficial use projects.

Forste, Jane. 1995. Building a Biosolids Program: Elements of Success. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1. Fairness, communications.** "We always need to remember that the questions people ask which arise from genuine concern are valid and demand clearly understandable, open and honest responses."

Forste, Jane. 1997. In for the Long Term: Developing Message for Sustainable Biosolids Recycling. *Illuminating the Future*. Vancouver, WA. Northwest Biosolids Management Association 9th Annual Biosolids Management Conference. #**2.** Discusses message tracks that should be focused upon: environmental, agricultural (other beneficial use) and health and safety.

Forste, J. 2000. Bridging the Communications Gap: The EMS Approach. *14th Annual Residuals And Biosolids Management Conference*, Boston, MA. **#2.**

Forste, Jane and Pete Machno. 1992. Biosolids Management: A New Way of Looking at an Old Resource. *Water Environment* 6(2), Summer.

Forste, J.B., and P.S. Machno. 1994. Public Acceptance of Biosolids--What's In a Name? In *The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective*, Washington, D.C.: Water Environment Federation. 9-45–9-55. **#2, developing public materials to promote biosolids., word "biosolids." Many issues addressed.** A summary of the work of the Water Environment Federation (WEF) Biosolids Public Acceptance Task Force and the Powell-Tate recommendations, including a summary of survey results. "We have to 'sell' a material this is accompanied by a history of negative perception." Identifies obstacles: "embedded beliefs regarding biosolids, health and environmental concerns, the NIMBYism prevailing in many rural and suburban communities," mistrust of government regulations as inadequate, limited resources, possible perception of scientific obsolescence due to scarcity of recent studies, and basic lack of public interest particularly from those not impacted directly." Identifies opportunities to pursue: "biosolids are a resource, power of recycling message can position biosolids as a solution, good sound bites (e.g. 'improving water quality') provide a positive environmental goal to be extended to biosolids recycling, positioning as 'water quality professionals,' safety-related messages have high receptivity and biosolids recycling is a sensible solution, environmental groups' support should be attainable based on the environmentally friendly use of biosolids (understanding that these groups may not totally accept or agree with EPA regulations), the strong scientific support for the safety of biosolids recycling can answer public concerns, strong supporters of biosolids recycling exist among key audiences and can be used to recruit other support." Stresses the need to engage with key opinion makers--gatekeepers--and convey certain messages which are appropriate to their interests. Gatekeepers include academics/agricultural scientists, water quality professionals, public health officials, agricultural groups/farming representatives, environmentalists, regulatory officials, and the media. Messages include an environmental one ("Biosolids recycling benefits the environment."), an agricultural one ("Biosolids recycling on lan helps farmers and benefits crops."), and a health and safety one ("Biosolids have been thoroughly researched by top scientists at leading scientific institutions and found to be safe and beneficial to the environment.") Introduces the phrase "Biosolids Recycling: Beneficial Technology for a Better Environment" and a communication plan.

Foster's Daily Democrat. 1998. Sludge Question Smells Like Politics: Rubens Knows Which Way the Wind Blows. Editorial, February 27, p. 8. **#4. Politics.** "…by homing in on a handful of sludge horror stories and fanning the populist flames of fear, Rubens has created an interesting duality…" attracting liberal environmentalists to go with his conservative Republican background.

Fox, Chuck. 1999. EPA Sludge Standards are Tough. *USA Today*. October 7. #**3.** Rebuttal by USEPA Office of Water assistant administrator of previous *USA Today* story (see *USA Today*, 1999, below). "Thirty years ago, thousands of American cities dumped their raw sewage directly into our nation's rivers, lakes, and bays. What has happened since then is an American success story…." Regarding biosolids recycling: "The EPA sets tough health standards for all disposal options, and backs them up with strong enforcement actions that hold treatment plants accountable….the EPA is obligated to provide the public with educational information, based on the best science, about the safe recycling and disposal of sludge."

Fraser, Patrick. 2000. Deadly Dirt? *WSVN TV News*, FL. November 14. Sunbeam Television Corporation.

Frederick Schnieders Research.1998. Survey results summary presented to the Water Environment Federation. **#1. Public perception.** A short national survey of a small sample that tested knowledge of biosolids and the usefulness of various messages about biosolids recycling. Some of the questions from this survey were retested in the 2002 Biosolids Public Knowledge and Perception Survey discussed in this research report.

Freeman, D. 1995. Controlling Odors: Don't Let Them Get The Drift. *World Wastes* 38(9):40. September. #**3, odors, landfill disposal, best management practices.**

Freudenberg, W.F. 1996. Risky Thinking: Irrational Fears About Risk and Society. *Annals of the American Academy of Political and Social Science*, 545, 44-63. #**1: acceptance, risk**

assessment, risk perception, technology (trust). Public concerns over the risks of new technology have grown dramatically, to the point that they sometimes dominate decision-making and impede installation of beneficial technologies. In the face of declining "real" risks, the simplistic tendency is to blame public ignorance or irrationality, and argue that decisions should be based on quantitative risk assessments, ignoring public concern. Such assertions reflect fundamental misunderstanding of the nature of technological societies, the reasons behind declining scientific credibility, and the actual limits of risk assessment. Scientific risk assessments have practical utility, but proposals for risk-based decision-making could lead not to increased credibility for specific technologies, but self-reinforcing losses of credibility for science and technology as a whole.

Gardner, G. 1997. *Recycling Organic Waste: From Urban Pollutant To Farm Resource.* Worldwatch paper #135. Washington, DC: Worldwatch Institute. **#1. Concerned citizens, enforcement, local soils/climate, best management practices, lack of trust, liability.** A prestigious environmental group lays out the rationale for recycling organic wastes but stresses concerns about current U.S. standards for the recycling of biosolids.

Gardner, G. 1998. Recycling Human Waste: Fertile Ground Or Toxic Legacy? *World Watch* 11(1):28-34. January/February. **#3, land application, 503 worries.**

General Physics Corp. Environmental Services Division. 1991. Data results: Revised bioaerosol monitoring program for the Washington Suburban Sanitary Commission. Montgomery County Regional Composting Facility. Silver Spring, MD.

Gerber, Steve, Aaron Lopresti, and Gary Martin. 1993. *Sludge.* Westlake Village, CA: Malibu Comics Entertainment, Inc.,1(1), October. First edition of the *Sludge* comic book series.

Gigliotti, I. 1991. An Assessment of Attitudes and Beliefs About Sewage Sludge Management Strategies in New York. HDRU Series #91-10. Ithaca, NY: Cornell University Department of Natural Resources. **#2. Public perception.**

Gilbert, Steve and Sue Hennig. 1996. Biosolids Long-Range Planning: Changing the Paradigm. *A Bridge to Sustainability*. Chelan, WA. Northwest Biosolids Management Association's 8th Annual Biosolids Management Conference. #**2.** Discussion of public meetings and how the public attendance at the meeting "may have nothing to do with acceptance or approval."

Global Citizen, The. 1999(a). Environmental Debates Have Science and Emotion on All Sides. http://iisd1.iisd.ca/pcdf/meadows/debates.htm. May 28.

Global Citizen, The. 1999(b). Sludge by Any Other Name Can Still be a Problem. http://iisd1.iisd.ca/pcdf/meadows/sludge.htm. May 28.

Goldfarb, W., U. Krogman, and C. Hopkins. 1999. Unsafe Sewage Sludge or Beneficial Biosolids?: Liability, Planning, and Management Issues Regarding the Land Application of Sewage Treatment Residuals. *Boston College Environmental Affairs Law Review*. 26:687. **#2, Politics, ban.**

Goldsmith, Thomas and Monica Whitaker. 2000. Sludge Facility Ex-workers Questioned. *Tennessean.com*. April 8. http://www.enviroweb.org/issues/sludge/.

Goldstein, N. 1999. Environmental management system initiative. *BioCycle* 40(9):74-75. **#2, environmental management systems, initiatives to increase public acceptance.**

Goldstein, Nora. 2000. National Overview of Biosolids Management. *BioCycle*, December. **#2. Odors, metals, pathogens, urbanization, media, regulatory climate, successful programs.** This annual survey provides the best current summary of biosolids management in the U.S. The survey of state biosolids regulatory program leaders asked about the "top pressures" on biosolids recycling programs: "Hands down, odors are the number one pressure on biosolids recycling programs in the United States….Concern about pathogens was cited as the number two pressure….Suburban sprawl--both in terms of encroaching neighbors and decreasing availability of sites for land application--took third place….Several states mentioned negative media coverage…. Six states noted that costs are a pressure on beneficial use….General public acceptance challenges were listed, as were negative public perception…." See also previous *BioCycle* biosolids management surveys.

Goldstein, Nora. 2001. National Biosolids Partnership EMS Update. *BioCycle:* 42(5): 57-60. May.

Gray, George, Kim Thompson, and Pamela Williams. 2002. Risks of Conventional and Organic Produce: Public and Scientific Perceptions. Harvard Center for Risk Analysis: http://www.hcra.harvard.edu/foodresearch.html#tradeoffs **#3. Risk perception. "**Survey research suggests that the public misperceives the relative risk of different hazards, including those related to food safety. Much of the research on food safety risk perception has focused on qualitative assessments of pesticide risk, with little attention to the magnitude of consumers' risk judgments in the context of multiple food safety risks. Few studies have attempted to characterize consumer's perceived risk reduction achieved through consumption of organic, rather than conventionally grown, produce. This project compares public perceptions about a range of foodborne risks, including those from exposure to pesticide residues, microbial pathogens, and natural toxins, to scientific perceptions of the risks. Consumers risk judgments are from a food safety survey administered to food shoppers in the Boston area while scientific assessments are based on a review of the published literature. Study results indicate that the public significantly overestimates foodborne risks and are misinformed about food safety issues and agricultural practices. Consumers' perceptions that substituting organic for conventionally grown produce may substantially reduce risks are not substantiated by the science. The study suggests the need for consumer education about the range of food safety issues and better data on differences in foodborne risks associated with alternative farming methods."

Greater Vancouver Regional District. 2000. *Issues on Biosolids: Report on Focus Groups and Triads.* December 4. **#1. Public perception**. Interesting focus group results about how people feel about biosolids products. Focus groups included both average public consumers and a selected group of people working in the turf, gardening, and landscaping business.

Greenwood, Gail. 1997. How to Get the News Hounds to Chase you Without Getting Bit. *Illuminating the Future*. Vancouver, WA. Northwest Biosolids Management Association's 9th Annual Biosolids Management Conference. #**2. Media campaign.** Workshop to develop skills in speaking with the media and how to get positive stories airtime.

Gregory, R., J. Flynn, and P. Slovic. 1995. Technological Stigma. *American Scientist*, 83, 220-23. **#1: technology acceptance or change, trust, risk or chemicals or radiation, hazard perception.** The Greek concept of stigma referred to the mark placed on an individual to signify infamy or disgrace, posing a risk to society. Stigma plays out socially in opposition to many technological activities, particularly related to chemicals or radiation, and in the courts. Lawsuits increasingly succeed in preventing siting of controversial facilities or are the basis of compensatory actions against technologies whose attendant risks degrade property value. It is not even necessary to demonstrate a risk is real, but compensation is being awarded on the basis of public perception and fear. Stigma goes beyond conceptions of hazards. Technology is being shunned because it is perceived as overturning a positive condition and, as such, represents an increasingly significant social factor in scientific and technological innovation. Stigma is closely correlated to amplification by the media.

Gregory, R., T.C., Brown, and J.L. Knetsch. 1996. Valuing Risks to the Environment. *Annals of the American Academy of Political and Social Science*, 545, 54-63. **#2: risk management, risk understanding, fairness, trust.** Increasing awareness of exposure to environmental risks has focused attention on measures that would give greater assurance that such risks are effectively managed and that their adverse consequences are mitigated. Such actions are made more difficult by the uncertainties of environmental changes, their oft-delayed impacts, the great importance attached to extremely small risks, and the lack of clear ways to measure the value of environmental losses. Recent behavior studies of people's time preferences, valuations of losses relative to gains, and risk perceptions are providing information that should lead to more effective risk management strategies. Valuation, however, is nearly always a contentious process, leading to claims and counterclaims regarding the motives of agencies and developers and fairness to the affected population.

Grey, Mark. 2000. Scenes From the Front Line: Skirting Bans and Forging Alliances. *Storms on the Horizon*. Ocean Shores, WA. Northwest Biosolids Management Association's 11th Annual Biosolids Management Conference. #**2. Local regional ban. Urbanization.** Discusses the state of biosolids applications in the state of California.

Grier, Chris. 1999. Proposed Plant's Potential Odor a Big Problem, Vice Mayor Says. *The Virginian-Pilot.* April 28.

Griswold, L. 2000. Valley counties fight use of sewage sludge. *The Fresno Bee*. September 4.

Group for the South Fork. 1995. *Composting; What's it to You, Composting & Recycling in East Hampton.* #**4. How the town of East Hampton initiates and starts a composting program.**

Guerra, Sarith and Tim Jones. 1992. Siting Solid Waste Facilities: Seven Case Studies. *MIS Report* 24(10). October.

Gusterson, H. 2000. How Not to Construct A Radioactive Waste Incinerator. *Science, Technology and Human Values*, 25(3), 332-51. **#2: risk perception, NIMBY, public acceptance, risk of nuclear power or radiation, trust of government.** Traces the evolution of risk perceptions in relation to existence of a radioactive incinerator. Analyzes the changes in attitudes toward the incinerator and the agency of activists in shaping those public perceptions. Author traces the evolution of "rhetorical strategies" that undermined official discourse on risk, although in a somewhat cynical manner that appears to dismiss the public's participation in a public process within their community.

Haag, Ed. 1992(a). Just Say No. *Dairy Today.* March, 82-83.

Haag, Ed. 1992(b). Sludge Under Suspicion. *Farm Journal.* 116 (6): 16-19. #**2. Metals, groundwater, sick cows.** One of two articles by Haag in a farming journals (see below). "Ultimately, the buck stops at the farmer's door….'I have no confidence in the current system of policing the stuff,' says Darrell Turner, who co-authored a 100-page manual on sludge application to farmland for Washington State's Department of Ecology."

Hadeed, Sam. 1999. Developing An Effective & Sustainable NBP Communications Strategy, presentation to *Reinvesting in Success*, a meeting of biosolids stakeholders and regional associations, Charlotte, NC. #**3. Communications.** Outlines potential communication tools and public acceptance strategies.

Hadeed, Sam. 2002(a). Guidance for Implementing Public Participation in EMS Planning (Part 9 in a Continuing Series). Washington, DC: National Biosolids Partnership (NBP). http://www.biosolids.org. **#1. Best management practices, public participation.** Overview of the recommendations for public outreach and participation provided in the NBP Environmental Management System (EMS) program guidance manuals.

Hadeed, Sam. 2002(b) Engaging the Public in EMS Planning (part 10 in a Continuing Series). Washington, DC: National Biosolids Partnership (NBP). http://biosolids.policy.net/proactive/newsroom/release.vtml?id=26521 **#1. Public participation.** Overview of the recommendations for public outreach and participation provided in the NBP Environmental Management System (EMS) program guidance manuals.

Haenel, Bob. 2002. The Public Pay Toilet: Concern About Sludge Dumping is Hitting the Fan Around the State. *The Herald-Coaster.* October 8, p. 2. Outrage at Synagro's litigious approach.

Hahn, A.J. 1993. Elements of an Extension Public Policy Education Program. In *National Extension Compost Utilization Conference*, Minneapolis, MN: Minnesota Extension Service/Cooperative Extension System. 119-124. **#3, public education.**

Hale, Robert. 2001. *Nature*. 412:140-141. **#3. Chemicals, Land application.** Report on measurements of brominated di-phenyl ethers (BDEs) in biosolids and fish; no cause and effect relationship is claimed by the author, but he implies a relationship, which triggered a defensive response from biosolids industry.

Hammit, James K. 2000. Evaluating Risk Communication: In Search of a Gold Standard. In: Cottam, Harvey, Pape, and Tait (eds.). *Foresight and Precaution*. Rotterdam: pp. 15-19.

Hammit, James K. and Pamela Williams. 2002. Risk Perceptions of Organic versus Conventional Foods and Willingness-to-Pay for Risk Reduction. Harvard Center for Risk Analysis: http://www.hcra.harvard.edu/foodresearch.html#tradeoffs. **#3. Risk perception.** "Research shows that consumers are very concerned about pesticide residues on food and are willing to pay a significant premium to purchase food they perceive to be less risky. However, data are limited on the magnitude of public risk perceptions and valuation for the range of food safety concerns. This study uses a survey of Boston food shoppers to explore consumers' perceived risks and willingness-to-pay for specific risk reductions associated with conventionally and organically grown produce. Survey results reveal that consumers perceive the consumption of fresh produce to be quite risky, especially when compared to other public health hazards. The public also believes that organically grown produce poses significantly less risk than conventionally grown. Survey respondents were willing to pay a price premium to reduce both consumer and nonconsumer risks, suggesting important altruistic values. Multiple regression analyses indicate a subset of factors that are predictive of high or low perceived risk and willingness to pay, including questions of trust, attitudes toward science and technology, sources of food safety information, and specific lifestyle characteristics and behaviors."

Hance, B.J., C. Chess, and P. Sandman. 1991. *Improving Dialogue with Communities*. Division of Science and Research, New Jersey Department of Environmental Protection and Energy.

Hance, B.J., C. Chess, and P. Sandman. 1990. *Industry Risk Communication Manual: Improving Dialogue with Communities*. Florida: Lewis Publishers.

Hanifin, Linda. 1992. Effective Communication Skills Fundamental to Total Quality Management. Presentation at WEF Human Resource Management Conference. September 19.

Hansen, Brian. Students, feds clash over EPA clean-up: Documents Suggest Conflict of Interest in Lowry Case. *Colorado Daily*, Boulder, CO. November 16.

Hansen, Renee. 1995. Hitting the Fan. *Snoqualmie Valley Reporter*. January 18. **#2. Pathogens. Metals. Nitrogen. Surface water. Ground water. Land application. Class B. NIMBY. Remote site.** Sold land that was too close to outraged citizens and bought land for I-90 restoration project.

Harding, Earle C. 2001. Laymanization: An Engineer's Guide to Public Relations. *Water Environment and Technology*. P. 45-48. April.

Harman, Alan. 1998. Applying effluent to land could be harmful alternative. *The Western Producer.* October 29. **#2. Groundwater. Surface water. Nitrogen. Land application. Best management practices.** Concerns stated in regards to biosolids use in Canberra, Australia.

Harrison, E. Z., M.B. McBride and D. R. Bouldin. 1999. Land Application of Sewage Sludges: An Appraisal of the U.S. Regulations. *International Journal of Environment and Pollution.* Vol. 11(1), 1 -36.

Harrison, E.Z., and T.L. Richard. 1992. Municipal Solid Waste Composting: Policy And Regulation. *Biomass & Bioenergy* 3(3-4):127-143. **#4, composting, contaminant standards.**

Harrison, Ellen Z. 2000. Desired Outcomes of Hearing, Comments to the U.S. House Committee on Science, March 22. **#3. Concerned, lack of trust, testing, chemicals, Part 503.** Recommendations on what could be done to improve biosolids programs and oversight in the U.S.

Harrison, Ellen Z., Murray McBride and David Bouldin. 1997 and 1999. *The Case for Caution: Recommendations for Land Application of Sewage Sludges and an Appraisal of the U.S. EPA's Part 503 Sludge Rules*. Cornell Waste Management Institute: August 1997 and February 1999. Available at http://www.cfe.cornell.edu/wmi/PDFS/LandApp.pdf. **#1.** The most thorough and comprehensive critique of current U.S. biosolids recycling policy. Cited widely by concerned citizens. "Current US federal regulations governing the land application of sewage sludges do not appear adequately protective of human health, agricultural productivity or ecological health. The risk assessment conducted by United States Environmental Protection Agency (US EPA) contains many gaps and non-conservative assumptions in establishing contaminant levels which are far less protective than those of many other nations. Current New York State (NYS) regulations are more protective than those of US EPA, but not as stringent as the recommendations of the authors. The potential for widespread use of sludge on agricultural and residential land, the persistence of many of the pollutants which may remain in soils for a very long time, and the difficulty of remediation call for a more cautious approach. In addition, reassessment of standards based on ecotoxicological impacts will need to be undertaken shortly when the US EPA-sponsored study being performed by Oak Ridge National Laboratory is completed. Soil, water and crop characteristics in NYS and other areas of the northeastern US raise particular concerns. Shallow acid soils, abundant precipitation and crops sensitive to phytotoxic metal inputs increase the need for caution. Federal regulations are the same for all soils, areas and uses, which is an unrealistic simplification. Based on their analyses, the authors do not suggest a prohibition of land application; but rather significantly more restrictive use. Recommendations are made for farmers and home gardeners electing to use sewage sludges and suggestions are made for policies and regulations which incorporate the more conservative assumptions expected to be more protective of human health and agricultural productivity. Limiting cumulative additions of pollutants to prevent soils from exceeding recommended maximum contaminant levels can be achieved by application of clean sludges or by application of lesser quantities of less high quality sludges. Additional testing of sludges is recommended. Caution is advised in application to pasture and forage as well as on home grounds where vegetables are grown or children have access. Further investigation is needed to assess risks to ground and surface water and to establish standards for additional contaminants." A section titled "Is Land Application Safe?" discusses the differences in perspectives and philosophies of various stakeholders involved or impacted by biosolids recycling programs.

Hartley, Troy W. 2001. *Public Perception & Participation in Water Reuse*. Alexandria, VA: Water Environment Research Foundation, National Water Research Institute (NWRI), American Water Works Association Research Foundation (AWWARF), WateReuse Foundation. August. **#1. Public participation, fairness, communications.** This project, parallel to the public perception and participation project on biosolids, came up with similar, independent findings regarding stakeholder involvement, fairness, respect, communications, need for information, and the need for motivation and commitment to these on the part of organizations.

Hartman, Charlotte. The National Sludge Alliance Calls on Congress to Halt the Land Disposal of Sewage Sludge. Letter to Congress. http://www.riles.org/NSA.htm, retrieved May 21, 2002.

Hassell, Leroy R., Sr. 2001. Virginia Supreme Court Opinion January 12. Reuben L. Blanton, et al. v. Amelia County, et al. Record No. 000277, from the Circuit Court of Amelia County. **#3. Local bans. Legal.** VA Supreme Court strikes down local county ban on biosolids recycling.

Hawaii Environment & Health News.1998. Paradise Sludged: Act Now!1(1), September http://www.hookele.com/hehn/98-09/actnow.html.

Hazen & Sawyer. 1995. Task 15.6 Final Public Participation Report, Volume 1. Concerning the New York biosolids management planning process.

Hegedus, Mike. 2000. The Marketing of Nature: The Nature of Marketing**.** Cleveland, OH: U.S. Composting Council's 10th Annual Conference. #**3. Methods of marketing compost (biosolids).**

Hellfach, Alwynne. 2000. Just Wash Your Hands and Don't Eat It. Letter to editor, *Argus-Champion,* NH. September 6. **Politics**.

Hellstrom, Thomas. 1994. Swedish Experience in Gaining Acceptance for the Use of Biosolids in Agriculture. Paper presented at the 1994 WEF Specialty Conference, *Biosolids Public Acceptance Digest,* Water Environment Federation, 1996. **#1. Metals. Politics.** Discusses "environmental worry" and how relative risk of "environmentally hazardous substances" is perceived by the public over time and after absorbing technical information. Worry increases as people receive initial information and then will decline if and when more information is absorbed. Discusses the self-perpetuating cycle of environmental worry in which the public loses and the politicians, researchers, product manufacturers, and the media gain. Critiques the Swedish Environmental Protection Board use of best available technology (BAT) regulation: "The official justification for applying BAT is that environmental control has to be carried out in accordance with the principle of caution (read: the principle of worry)." Recommends careful evaluation of risks and comparison to risks presented by other common practices.

Hench, David. 1998. Westbrook Group Fighting Sludge. *Portland Press Herald.* February 17.

Hendren, Lee. 1988(a). Sludge Plan Support Unanimous. *The Enquirer-Journal.* March 3.

Hendren, Lee. 1988(b). Waste Disposal Worries Mayors. *The Enquirer-Journal.* February 26.

Hennig, Sue. 1995. Biosolids Compost: A Collaborative Solution for Biosolids Public-Acceptance. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1. Education.** Discusses the importance of collaboration among local sponsors in getting projects started to educate public of biosolids recycling.

Henry, Charles. 1996. The New Book of Biosolids Management: Roles for Sustainability. *A Bridge to Sustainability*. Chelan, WA. Northwest Biosolids Management Association 8th Annual Biosolids Management Conference. #**2.** Discusses the changing climate biosolids is in.

Henry, Tom. 2002. Skeptics critical of use of sludge on farmlands. *Toledo Blade.* Toledo, OH. November 25. **Health impacts, public concerns.** Well-done article discussing the various perspectives on biosolids, including quotes from NViro and reference to the National Research Council report of July 2002.

Herkert, J.R. 1994. Ethical Risk Assessment: Valuing Public Perceptions. *IEEE Technology and Society Magazine*, 79, 4-10. **#1: environmental risk, public acceptance, technology acceptance, trust.** The ethical responsibilities of engineers and the need for workable solutions to technological controversies dictate that engineers be able to openly discuss technological risk with the public, which is at odds with the prevailing engineering culture. Engineers and other “experts” need substantive attitude changes with respect to acknowledging and explaining risk. These are both moral and practical issues. There are differing views of risk between the engineering community (risk is a quantitative component) and the public (risk is qualitative). The two views must be integrated, but it is not clear how effective the author’s “transformation” of the engineering culture will be.

Hirshorn, Susan. 1992. Human Fertilizer Goes Out To Pasture. *Canadian Living.* February. **#2. Chemicals. Groundwater. Nitrogen. Nutrients. Odors. Pathogens. Phosphorus. Land application. Local bans. Profit motive/lower cost.** Reporting on how biosolids fertilization saves money. "Quebec forbids sludge use on land growing crops."

Hirst, E. 1984. Household Energy Conservation: A Review of the Federal Residential Conservation Service. *Public Administration Review,* 44, 421-430. **#3: acceptance, behavior, technology change.** The author reviews the Federal program to encourage energy conservation in homes, finding that the expenditure of tens of millions of dollars achieved little in the way of energy savings when compared to the potential for such savings. This was an important effort in recognizing that public agencies and others interested in advancing environmental protection through changes in public behaviors did not know much about what motivates people and what would create changes in behavior.

Hodson, C.O. 1996. Biosolids Management: Beneficial Use Comes of Age. *Pollution Engineering* 28(13):38-41. December. **#2, metals, pathogens, groundwater contamination, odors, composting, land application, urbanization, local/state delegation, public perception.** The most important issues facing the biosolids management industry today are costs, odors, and public perception. Of these, public perception has the biggest effect on the industry. Officially, “sludge” is a term affixed to the product that comes out of sewage treatment plants, and “biosolids” is what the processed end product is called. Still called sludge by some environmental professionals in the water and wastewater industries, biosolids is the official term for the sludge being marketed to the public. As the public grows more comfortable with biosolids and the practice of beneficial use and more states move toward delegation of the new regulations, the stigma originally carried with "sludge" gives way to a new age, a new name, and a new century.

Hodson, S. 1998. City Wants To Exclude Lawyers In Farm Lawsuit. www.augustachronicle.com November. #**4.**

Hoffman, Ian. 1988. Sludge: Friday Date for First Application. *The Enquirer-Journal.* May 15.

Horan, Jack. 1989. Sludge Shoveling a Niche as Fertilizer. *The Charlotte Observer.* July 24.

http://www.cfe.cornell.edu/wmi/Sludge/Beneficial.pdf

http://www.cfe.cornell.edu/wmi/Sludge/Characteristics.pdf

Hull, D. 1998. Parsons Farm owner wins round against County. *The Washington Post,* Prince William Extra section, p. V01. May 23.

Hunley, Jonathan. 2002. What's That SMELL? Fredericksburg: *The Free Lance-Star*. April 23.

Hunt, Patricia, and David W. Oerke. 1994. Institutions, Attitudes, and Opinions Impacting Acceptance of Biosolids Land Application Programs in Northeastern Colorado. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation, 1996. **#1. Land application. Urban/rural conflict. Importance of local supporters. Politics. Liability (bank concerns).** "About 85% of Colorado's biosolids (treated wastewater residuals are recycled by applying them to agricultural land. In years past, land application has not posed a significant public acceptance problem. But recent experiences by some wastewater treatment plants indicate a possible public opinion shift that may damage the efforts of responsible wastewater treatment plant operators to continue beneficial recycling land application programs. This paper describes the efforts of the Metro (Denver) Wastewater Reclamation District to assess the severity of the public acceptance problem. A central element of the paper is highlights from a public opinion study conducted in November 1993 to determine baseline conditions for acceptance of biosolids land application in northeastern Colorado."

Hyde, James. 2002. Communicating About Risk During Chaos Events. Presentation to the New England Water Environment Annual Conference. January 28. **#2. Risk communication.** Useful perspective on risk communications.

Inlow, Shawn K. 2000. George, Tackett Assail Use of Sludge. *The Progress,* July 17. **#3. Lack of trust, politics, profit motive, pathogens, concerned citizens.** Fall-out from the death of Tony Behun, Rush Township, PA. "'Sludge is not safe,' said Dr. Tackett….'It has never been proved to be safe. But there is a small group of people with the EPA that insist it is safe, and the sludge industry supports them because the sludge industry makes a lot of money by spreading it on the land.'"

International Association for Public Participation. 2000. *IAP2 Public Participation Toolbox.* From the Internet site http://www.iap2.org. **#1. Communications, public participation.** An excellent resource available online and in the WEF *Survival Guide* (see Wantland, 2002). Other useful information available from this website and organization.

Irvine, Lori and Anne Bonelli. 2000. Beneficial use of biosolids. *American City & County*. October 17. **#2. Public perception.** "Ultimately, the public perception of the safety and value of biosolids recycling will have a major impact on a community's ability to market biosolids usage and products."

Iskandar, Alex. 2000. Sludge--We All Make It, So It Has to Go Somewhere. Letter to the *Argus-Champion,* NH, August 2. **#4. Politics.**

Jefferson County, AL. 2000. Beltona Land Application Program. Videotape.

Johnson, B.B., and P. Slovic. 1995. Presenting Uncertainty in Health Risk Assessment: Initial Studies of its Effects on Risk Perception and Trust. *Risk Analysis*, 15(4), 485-94. **#1: risk perception, risk communication, risk assessment, trust**. It is unclear if discussing uncertainties in health risk assessments reduces citizens' perceptions of risk and increases their respect for the risk assessing agencies. Three studies tested between 180-272 focus grouped subjects with words and graphics to obtain a detailed response to these scenarios. The results, suggested that (1) people are unfamiliar with uncertainty in risk assessments and in science generally; (2) people may recognize uncertainty when it is presented simply; (3) graphics may help people recognize uncertainty; (4) reactions to the environmental problems in the stories seemed affected less by presentation of uncertainty than by general attitudes and perceptions toward risk, government, and authority; (5) agency discussions of uncertainty in risk estimates may signal both agency honesty (66%) and agency incompetence (34%) for some people; and (6) people seem to see lower risk estimates as less credible, perhaps because of a generalized distrust of government.

Johnson, Dawn. 1997. Golf club expansion begins. *The Similkameen Spotlight.* July 23. **#3. Dust. Trucking. Stockpile. Land application. Education.** Transportation to the golf course was an added bonus since it is right off of the highway from Vancouver.

Johnson, William E. 2002. Jurors express concern over sludge dumping. *Daily World.* St. Landry Parish, LA. November 24. **Public outrage.** News article noting public outrage over discovery that a site has been used for "sludge dumping" for 20 years. A clear example of the inevitable public upset created by keeping quiet about biosolids management programs.

Joiner, Lawrence. 2000. Nutrifor Provides Ultimate Recycling. *The Ashcroft Journal.* August 29. **#2. Nitrogen. Odor. Nutrients. Land application. Successful program. Private sector.** Joiner sharing his experiences with biosolids on his ranch - in support of biosolids.

Jolma, Dena Jones. 1994. *Attitudes Towards the Environment*. McFarland and Company, Jefferson, North Carolina. **#2: environmental attitudes, understanding.** This book compiles abstracts from a wide range of sources on public attitudes about the natural environment.

Jones, Robert E., and Riley E. Dunlap. 1992. The Social Bases of Environmental Concern: Have They Changed Over Time? *Rural Sociology*, 57(2), 28-47. **#1: environmental attitudes, public acceptance, trust of science.** Data from a series of national opinion surveys that track changes in environmental concern over an 18 year period by the National Opinion Research Center was analyzed to determine whether support for environmental issues had broadened to include a wider cross-section of Americans. Demographic variables included age, political ideology, education, residence at 16, current residence, political party, industrial sector, family income, gender, race, and occupational prestige. Analysis revealed that support for environmental spending remained stable despite fluctuations in economic, political, and environmental conditions. The highest support was found among young adults, the well educated, liberals, Democrats, those raised and living in urban areas, and those employed outside of industry. Provides background information on public attitudes towards the environment.

Joss, Glen. 2000. Nothing to do with the landfill. *The Ashcroft Journal.* August 22. **#2. Pathogens. Landfilling. Private Sector. Worker safety. Education.** Joss submitting response as an employee from Arrow Transportation. Defending the quality of biosolids.

Kamrin, Michael; Dolores J. Katz; and Martha L. Walter. 1995. *Reporting on Risk: A Journalist's Handbook on Environmental Risk Assessment*. Ann Arbor, MI: Michigan Sea Grant Program and the Foundation for American Communications. A shorter version of this handbook (posted in 2000) is available from FACSNET at http://www.facsnet.org/tools/ref_tutor/risk/index.php3. **#1. Risk communication, media.** A superb primer for reporters and others regarding how best to present risk information.

Kaufman, Susan and Douglas Haith. 1986. Probabilistic Analysis of Sludge Land Application. *Journal of Environmental Engineering*, December,112(6)1041-1053.

Kaufman, Susan S. and Douglas A. Haith, M. Date unknown. Probabilistic Analysis Of Sludge Land Application. National Science Foundation.

Kays, Jonathon, Gary Felton, and Eric Flamino. 1999. Claiming Victory From Spoils. *Water Environment & Technology*, May, pp. 42-48.

Kearney, R.J. 1997. California Biosolids Management, Will Opponents End Beneficial Use? In *Water Residuals and Biosolids Management Approaching the Year 2000,* Philadelphia, PA: WEF/AWWA Joint Conference. 16-35–16-39. #**3, opposition to land application with less restrictive waste discharge regulations based on many issues.**

Kelley, Bronwyn, Alan B. Cooper, and Larry J. Karnes. 1994. Direct Public Involvement to Develop a Residuals Management Plan in Sydney (Australia): North Head Sewage Treatment Plant Case History. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation, 1996. **#2. School educational programs. Community advisory groups.** "In 1991, thirty percent of all wastewater from the Sydney Water Board's service area (i.e. 315 ML per day) was treated at the North Head Sewage Treatment Plant. Twenty five tonnes of solids (30 percent of the influent load) were captured daily. Biosolids were incinerated with screenings, grit, and scum. Due to negative local perceptions of incineration, a decision was made in mid-1991 to evaluate other stabilisation alternatives. The Board was underway with long term strategic planning for residuals management, with implementation about year 2000. An interim residuals management plan was identified to evaluate chemical stabilisation. Public acceptance was the key to a successful interim plan. The proposal recommended initial chemical stabilization followed by a thermal drying facility. A full scale trial of chemical stabilization of biosolids and other residuals began in 1992 identifying the impacts on the public and defining concerns. Public input and the findings of various surveys allowed chemical stabilisation to be accepted as a short-term management practice provided that the Board actively move to implement thermal drying of biosolids as a medium term solution with long term solutions also to follow as part of the overall strategic plan."

Kelly, Brian. 1999. The Biosolids Boogeyman. *Snoqualmie Valley Record*. May 27. **#2. Rural. Concerned citizen involvement.** Discusses use of biosolids in rural town. "Gravel pit opponents claim that use of biosolids on the Grouse Ridge site will make North Bend residents 'test rats in a mad scientist's experiment.'"

Kelowna, City of. *Biosolids Recycling: Beneficial technology for a better environment.* **#3**.

Kelsey, T.W., and L. Singletary. 1996. When Composting Meets Suburbia. *BioCycle* 37(7):66-67. #**3, odors, noise, composting, urbanization.**

Kenny, Catherine. 1995. Ready to blow the biosolids. *The Issaquah Press*. September 13. **#4.**

Keremeos Review, The. 1999(a). Biosolids Answers Needed. February 25. **#3. Groundwater. Surface water. Land application. Lack of public information. Education.**

Keremeos Review, The. 1999(b). Pollution Would Be Hard To Prove. February 11.#**2. Groundwater. Surface water. Land application. Class A. NIMBY. Possible ticking bomb.** Significant opposition to these land applications in Cawston, BC.

Keremeos Review, The. 2000. Permit Given in '99. October 12. **#2. Groundwater. Land application. Successful program. Education.** Concerned individuals were sent copies of the permits and no appeals were submitted. Farmer states support for beneficial and environmentally sound use of biosolids fertilization rather than using chemical fertilizer.

Kern County Biosolids Ordinance Adoption Process. www.co.kern.ca.us/rma/bsurgenc.htm.

Kim, W. Chan and Renee Mauborgne. 2003. Fair Process: Managing in the Knowledge Environment. *Motivating People*, January, pp. 127 -136.

Kimantas, John. 2000. *Waste Not, Want Not*. September 11. **#2. Odor. Nutrients. Land application. Profit motive/lower costs. Regulatory climate. Politics.**

King 5 Investigation: Grounds for Concern. 2000. Seattle: KING-TV. November 20. http://king5.com/detailtopstory.html?StoryID=9137.

King County Department of Natural Resources. 1996. *Green Valley Project Update.* **#3**

King County, Washington. 2000. Biosolids recyling program. http://dnr.metrokc.gov/WTD/biosolids/BMP1.html. **#3.** Descriptions of one of the nation's leading and most successful biosolids recycling programs, retrieved November 27, 2000.

King5.com. 2000. King5 Investigation: Grounds for Concern. wysiwyg://206/http://www.king5.com/detailtopstory.html?StoryID=9137. November 20.

Kirk, Ken and Albert Gray. 2000. Letter to Marilyn Fingerhut, Ph.D., Chief of Staff, National Institute for Occupational Safety and Health (NIOSH), October 31. American Metropolitan Sewerage Agencies and Water Environment Federation response to NIOSH HID #10 regarding Class B biosolids workers.

Kliewer, T. 1999. Firm's Bid To Spread Treated Sludge On Farm Worries Waller County. *The Houston Chronicle, Star Edition*. 13. May 17. #**2, land application, lack of public information, groundwater, odors, perceived appearance.**

Koenig, Rich, Dean Miner, and Kerry Goodrich. *Land Application of Biosolids: A Guide for Farmers.* Utah State University Extension. http://extension.usu.edu/publica/agpubs/biosolids.htm.

Kohn, S., and D. Lewis. 1999. Note on the AP Wire Concerning a Press Conference at the National Press Club on March 23. March 19.

Krauss, G.D., and A.L. Page. 1997. Wastewater, Sludge and Food Crops. *BioCycle*. 38(2):74-82. February. #**1, public perception, 503, concerns, perceived/real risks, need for community risk.** Key summary article on the results of the National Research Council (NRC) review of the federal biosolids management regulatory program (see National Research Council, below) by two of the participants on the NRC review panel. "After 17 months of study that included several field visits and a workshop on land application, the NRC released a report in March 1996 ("Use of Reclaimed Water and Sludge in Food Crop Production") that confirmed properly treated and managed municipal wastewater effluents and sludge can be safely and effectively used in food crop production…. The committee found no documented reports of outbreaks of infectious disease associated with exposure to adequately treated and properly distributed reclaimed water or sludge applied to agricultural land. Still, the committee concluded that general acceptance of using sludge on cropland will depend on the ability of municipal authorities and private contractors not only to comply with government regulations but also to provide well managed and reliable waste treatment and beneficial use programs that are responsive to community concerns."

Krogmann, Uta and Ellen Z. Harrison. 1998. Understanding the difference: Why European and U.S. sludge standards differ. Paper presented at AAAS Conference, February, 1998, Philadelphia. http://www.cfe.cornell.edu/wmi/Sludge/AAAS/Overview.html). **#2 Risk assessment versus precautionary principle.** "For all contaminants except lead, the US EPA standards for land application of sewage sludges are significantly less stringent than standards in northern and central European countries. The cumulative pollutant loading allowed under EPA rules would result in contaminant levels approximately an order of magnitude higher than those allowed under rules in northern and central Europe. A significant fraction of European sludges are able to meet the standards and are thus being applied to land. Regulations in the US versus countries such as Denmark, Germany, the Netherlands. Sweden and Switzerland are based on different philosophies. The US regulations are based on a risk assessment which evaluates the potential risk to humans, other animals, and plants from selected pollutants in sewage sludge (14 pathways). The standard for a contaminant is set at the limit generated by the pathway resulting in the lowest concentration that represented an acceptable risk according to the assessment. Many European regulations are based on precautionary limits in which in the long-run a net balance between the input and output of pollutants in the soil is sought. Recognizing the persistence of inorganic contaminants, the goal is to prevent the accumulation of inorganic contaminants above levels in uncontaminated agricultural soils. Even when a similar risk assessment approach is taken (e.g. Netherlands soil intervention values), much lower pollutant limits result from different assumptions and policy choices. In the long-run these different approaches could result in much higher pollutant concentrations in US agricultural soils than in European soils."

Krogmann, Uta, William Goldfarb, Virginia Gibson, and Lisa S. Boyles. 2001. Land Application: An Extension Perspective. Water Environment Federation.

Kuchenrither, Dick. 1992. Draft Responses Received to Date to NRDC/EDF Questions. November 9.

Kunkle, Fredrick. 2001. Sludge-Spreading Raising Concern Over Health Fears. *The Washington Post.* August 23.

Land Recycling and Resource Management. 2000. New Jersey Biosolids Recycling Programs. http://www.lrrm.com/library/nj.html. **#4** Land application company promotes biosolids recycling.

Land Resource Recycling Management. 1997. Biosolids Fact Sheet: Beneficial Use of Biosolids in New Jersey. http://www.lrrm.com/library/nj.html.

Land Resource Recycling Management, Inc. 2000. Biosolids Fact Sheet: Beneficial Uses of Biosolids in New Jersey. http://www.lrrm.com/library/nj.html. November 27.

Lang, Mark E. 1993. Public Education of Biosolids Management in Vermont. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation. **#2. Educational materials.** Overview of a cooperative effort to develop educational materials, regulatory review, and public outreach to address the declining rate of biosolids recycling in this small northeastern state.

Lang, M. 2000. The Biosolids Message. In *Proceedings from 14th Annual Residuals and Biosolids Management Conference*, Boston, MA: Water Environment Federation. February 27-29. **#2.** Since passage of the Clean Water Act in 1972, we have made significant advances in wastewater treatment that have dramatically impacted the quality of our Nation's water. These wastewater treatment improvements, which include the implementation of pretreatment programs, have allowed our water reclamation facilities to not only enhance water quality but to produce biosolids. Biosolids can be used in a number of programs to provide nutrients and organics to our soils. To be successful in using biosolids, we need to educate the public regarding the benefits of the material and address any concerns they may have. "The Biosolids Message" has been developed to serve as a base in developing information for use with the public. The message summarizes our advances in wastewater treatment from prior to the Clean Water Act through the 1990s. It describes the trend in biosolids characteristics and highlights the positive impacts that pretreatment programs have had on our ability to produce a beneficial product. The message summarizes the land application risk assessment that was performed in the development of the 40 CFR Part 503 Regulations and compares the US EPA's regulations to the Canadian fertilizer standards. The message provides information regarding the use of biosolids on a national and regional basis. The message also summarizes the value of biosolids to the agricultural community.

Lang, M.E., and R.A. Jager. 1996. The Impacts of the Public's Perception on Land Application Programs Implemented Under the 503 Regulations. In *10th Annual Residuals and Biosolids Management Conference: 10 Years of Progress and a Look Toward the Future*, Denver, CO. 4-31–4-35. August. **#2, health, environmental/site mismanagement, perceptions, land application, lack of oversight, trust.** Following promulgation of the 40 CFR Part 503 Regulations, the State of New Hampshire decided not to regulate wastewater solids and have programs regulated directly by US EPA Region I. The State of New Hampshire eliminated regulatory oversight of biosolids management programs, maintaining that such oversight would be unnecessary since the responsibility has been transferred to Region I. The New Hampshire Department of Environmental Services (DES) continued their effort to promote beneficial use by providing public outreach programs regarding biosolids issues and permitting septage land application sites that remain under State jurisdiction. This approach had a negative impact on the public's perception of land application programs. A number of communities placed a moratorium on biosolids use within their boundaries. In addition, a number of complaints were filed with DES and members of the State legislature. The public's perception resulted in the State adopting emergency rules on November 12, 1995 and final rules on March 19, 1996. The rules relate primarily to the management practices associated with biosolids and septage use.

Lang, Mark E., Carolyn A. Jenkins, and W. Dale Albert. 1995. Biosolids Regulations in the Northeastern United States, unpublished paper. **#4**

Lawson, Lisa. 1998. Cawston opposes biosolids. *The Similkameen Spotlight.* October 6. **#2. Groundwater. Land application. Local soils/climate/natural conditions. Education.** Concerned citizen involvement. Concerns regarding application of biosolids to area that is prone to flooding.

Laylo, Bob. 2000. *Lehigh Coal Pulls Request to Spread Sludge*. PA:*Lehigh Valley News*. October 25.

Laylo, Bob. 2000. Lehigh Coal Pulls Request to Spread Sludge: Company's Plan to Reclaim Mine Land With Waste Drew Protests. *Lehigh Valley News.* October 25.

Leach, John D., Steve Hoss, and Craig Gautreaux. 1990. Good Management Practices in Sludge Land Application. City of Lafayette, LA.

League of Women Voters Education Fund. 1976. *Municipal Sludge: What Shall We Do With It?* Publication No. 627. #**2, land application, composting, many possibilities.**

Leany, Kathryn, and Alan Cooper. 1992. A Public Involvement Program to Turn Around Negative Public Opinion of the Sydney (Australia) Water Board. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation. **#3.** "This paper summarizes the public involvement processes required by legislation in New South Wales, and describes the Water Board's recent experience intrying to turn around negative public opinion of the Board."

Leavitt, Terry. 1998. Symposium Discusses the Pros and Cons of Sludge Use. *Carroll County Independent*. September 2. New Hampshire.

Leeder, Jessica. 2002. Human Fertilizer Poses Cancer Risk: Study. *National Post.* July 31. Report on David Lewis's work in major Canadian publication.

Leege, P.B. 1993. Composting Infrastructure in the United States. In *Science and Engineering of Composting: Design, Environmental, Microbiological, and Utilization Aspects*. Wooster, OH: Ohio State University, H.A.J. Hoitink and H.M. Kenner (eds.). Also In *Proceedings of an International Composting Research Symposium*, Columbus, OH. March 1992. #**2, increasing public information, education with composting, products.**

Lees, P.S.J., and M.S. Tockman. 1987. Evaluation of possible public health impact of WSSC Site II sewage sludge composting operations. Johns Hopkins University School of Hygiene and Public Health, Baltimore, MD.

Lenhart, Jennifer. 2002. Waste Not, Says Maker of New Fertilizer. *The Washington Post*. March 17.

Lennon, J. Mark. 1998. New Hampshire's Approaching Solid Waste Crisis. Presentation to NEBRA First Annual Meeting & Conference, May 1998. **#4 Landfilling**. Discusses the limits of landfill space in NH.

Leonard, Peggy, Doug Schindler, Roberta King and Ken Konigsmark. 2000. Restoring Mountain Slopes and Forests with Biosolids in the Washington Cascades. Golden, CO: Mining, Forest & Land Restoration Symposium/ Workshop. #**3**.

Lester, James P. and Ann O'M. Bowman, eds. 1983. *The Politics of Hazardous Waste Management.* Duke University Press, Durham, North Carolina. **#3: hazards, risk management, NIMBY, government trust.** An early work that describes the deterioration of public trust generally and, more specifically, surrounding famous hazardous waste spills and processing facilities.

Lewis, David L. 2000(a). Letter regarding trace gaseous organic amines from biosolids land application. **#4. Chemicals, aerosols.**

Lewis, David L. 2000(b). Political Science at its Worst: The 503 Sludge Rule: Why EPA Regulations Have Everything to do with Elections and Nothing to do with Protecting Public Health and the Environment. http://www.whistleblowers.org/statements.htm#state2. **#2. Lack of trust.**

Lewis, D.L., S. Shepherd, D.K. Gattie, S. Sanchez, and M. Novak. 2000. Enhanced Susceptibility to Infection from Exposure to Gases Emitted by Sewage Sludge: A Case Study. In *Biosolids Management in the 21st Century Conference*, College Park, MD. 152-159. Available at http://members.aol.com/LewisDaveL/Proceedings.htm. #**2, land application, Class B, pathogens/chemicals allegedly caused sickness in New Hampshire.**

Published on the Internet regarding a possible cause of the death of Shayne Conner, Greenland, NH. Response by Wheelabrator, below. For response, see Wheelabrator (below).

Lewis, David and David Gattie. 2002. Pathogen Risks from Applying Sewage Sludge to Land. *Environmental Science and Technology*, July 1, pp. 287-293.

Lewis, David, David Gattie, Marc Novak, Susan Sanchez, and Charles Pumphrey. 2002. Interactions of Pathogens and Irritant Chemicals in Land-Applied Sewage Sludges (Biosolids). *BMC Public Health* 2:11, June 28. **#1. Pathogens**, **Class B, chemicals.** Describes potential health impacts amongst neighbors to Class B biosolids land application sites and hypothesizes how health impacts may be caused by air emissions from biosolids. A significant and controversial paper.

Libby, John. 1995. Brain Viruses on the Prairie! A Biosolids Siting Tragicomedy. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1. Concerned citizen involvement. Education. Lack of trust.** A Health Inspector' s perspective on dealing with public concerns. "It is important that the county take a role in risk communication with its citizens. Misinformation can quickly spread and cause a maelstrom for county regulators and politicians."

Lieberman, Adam J. and Simona Kwon. 1997. 3rd edition, revised June 1998. *Facts Versus Fears: a Review of the Greatest Unfounded Health Scares of Recent Times*. New York: American Council on Science and Health, Inc.

Lindsay, B.E., H. Zhou, and J.M. Halstead. 2000. Factors Influencing Resident Attitudes Regarding The Land Application Of Biosolids. *American Journal of Alternative Agriculture* 15(2):88-95. #**1, media accuracy, socioeconomics do not play into issues, dissemination of accurate information is key.** Residential household owners were surveyed in two different New Hampshire communities that varied in terms of population size, degree of rurality, and per capita income, each with no activities in land application of biosolids. Logit models were developed and logistic regression analyses were carried out for each community. The empirical results suggest that the perception by residents of the potential economic benefits and negative impacts from land application of biosolids can be very influential in achieving public acceptance. From a policymaker’s viewpoint, this suggests the need for sound educational programs that explicitly describe the economic benefits, negative impacts, and potential risks that typically occur with land application of biosolids. Supportive studies are needed to complement the educational programs. These measures will allow residents to weigh the relative benefits and costs to determine their positions on this approach to management of biosolids and to discount emotional judgements and misinformation. The media seeks to ensure that newspaper, magazine, and television reports are accurate and taken from reliable sources. Survey results suggest that the less volume of information presented by the media, the more supportive residents are of land application. Therefore, with such sensitivity by respondents to quantity of information, it is imperative that media outlets place high priority on the quality and accuracy of materials presented. Socioeconomic characteristics of the respondents did not influence attitudes toward acceptance or rejection of biosolids application, thus eliminating the difficulty that social stratification could cause in achieving acceptance.

Lindstrom, Carl. 2K Interview with Carl Lindstrom, http://safesoil.com/iview.htm, retrieved December 5, 2000.

Living on Earth. 2000. News: National Organic Standard. Boston:World Media Foundation. March 24.

Living on Earth. 2000. Transcript of radio show, broadcast March 24. http://www.loe.org/archives/000324.htm.

Lloyd, Jillian. 1998. Special Report: A Trooper, A Dump, and a Tale of Doubt. *The Christian Science Monitor.* June 10. About plans for the Denver Metro wastewater facility to accept treated groundwater from the Lowry Landfill and concerns that it may contain radioactive waste.

Lloyd, Jillian. 2000. USA in Fight Over Toxic Landfill, Round 1 Goes to Citizens. *The Christian Science Monitor.* May 8. http://www.csmonitor.com/durable/2000/05/08/fp2s2-csm.shtml. **#2. Citizen concern, risk.** About Lowry Landfill, Denver area, relates to Denver biosolids recycling program.

Logan, T.J. 1995. Gaining Public Acceptance for Beneficial Use of Biosolids. *BioCycle*. 36(12): 61-64. #**1, history, metals, pathogens, risk, education, successful program, Class B, lack of public information/data.** Article cites successful projects, progression of biosolids development and recommendations. Use of research as public acceptance mechanism. “Fear is highest when the public only has enough information to know that a risk exists but not enough to understand the extent of that risk, or that management controls are in place to limit them.”

Logan, T.J. 1997. Balancing Benefits and Risks In Biosolids. *BioCycle* 38(11):52-57. **#2, metals, chemicals, odor, vectors, land application, poor oversight, NIMBY, lack of public information.**

Logan, T.J., C.L. Henry, J.L. Schnoor, M. Overcash, and D.C. McAvoy. 1999. An Assessment Of Health and Environmental Risks of Trace Elements and Toxic Organics in Land-Applied Municipal Solid Waste Compost. *Compost Science & Utilization* 7(3):38-53. #**4, land application, compost, municipal solid waste, heavy metals, scientific research.** This study applied the risk assessment methodology developed by USEPA for establishing regulatory contaminant limits and loading rates for municipal biosolids to MSW compost. Literature data on trace element and organics composition of MSW compost were evaluated relative to levels of the same compounds in biosolids. In addition, data from several laboratory, greenhouse, and field studies with MSW compost were used to determine parameter values for MSW compost for the 503 risk assessment algorithms.

Logsdon, Gene. 1987. Cultural Attitudes and Waste Disposal. *BioCycle*, March. **#2.** Early interview with researcher Terry Logan of Ohio State University. "As for landspreading sludge in the U.S., it will no doubt increase. It is no longer a controversial issue in the newspapers which is a good sign people are accepting it. The lesson for us who believe in it as the better way to dispose of sludge is that selling the public is a continuous process. You have to maintain high standards."

Logsdon, G. 1992. How Does Society Learn About Sludge Safety? *BioCycle* 33(5):68-70. May. **#1, educational issues about building public acceptance.** "Much philosophizing took place in the biosolids fraternity after *Farm Journal* magazine published an article in its April, 1992 issue which was decidedly negative about the application of sludge to farm land….Most scientists who have spent their lives studying sludge are convinced that the…article was, to put it mildly, not researched well enough, and that many of its claims were unsubstantiated if not downright erroneous….But rather than being angry, sludge scientists seem to feel a bit helpless and more than a little dejected….There is no doubt among sludge scientists in general that their long and arduous efforts to convince society of the safety of sludge has been set back a few years….says John Walker, soil scientist at EPA headquarters in

Washington, "This kind of journalism is quite common now and the trouble is that when a particular news story is disproved by scientific data, that data doesn't get equal play in the press. We all remember when headlined stories reported that football players were getting arthritis because of playing on fields fertilized with composted sludge. When a blue-ribbon team of scientists disproved the story, their report got very little coverage'…. But how do you go about teaching a subject of great complexity (i.e. the impossibility of zero risk) to a public culturally brainwashed into believing that excrement disappears when the toilet is flushed; who is ecologically illiterate…. Looming over this challenge is another formidable drawback. The scientists who understand the problem are either not particularly adept at communicating to lay people or do not usually get the opportunity to do so….." Suggestions: "Quit using the word 'sludge….' In life there is no such thing as zero risk….'Presence does not equal hazard….' In interpreting research, the public and particularly the journalist must understand the researcher's goals and parameters in any particular study, point out Naylor who claims: 'A toxicological study growing lettuce on pure sludge is valid for toxicological purposes, but will give results that do not apply to what happens in an approved, real life field application.' The public needs to understand that what we are dealing with is a natural biological process, say Jane Forste…Contaminated, the treatment process would crash of its own accord. Stress the overwhelming benefits of sludge to soils and the environment rather than dwelling on scientific minutiae of one in a billion chances of contamination….Don't assume that only 'the man in the street' is 'ignorant.' …due to the history of the way regulations in waste handling have come into being, in many states, permitting for sludge application is handled in the same regulatory way (and in fact by the same people) as for hazardous waste sites and landfills. This obviously leads to a negative attitude about sludge…. Basic to all the suggestions above is the necessity to correct what John Walker and others refer to as a cultural problem in our society: that human excrement is vile and dirty stuff."

Logsdon, G. 1993. Beneficial Biosolids. *BioCycle*. 43(2):42-44. #**2, trace metals, N, P, S, organic matter.** Washington man who speaks to citizens about his personal successes with biosolids application on his land. He never uses the word “sludge.” Spends much of his time familiarizing municipal officials with farmers’ attitudes and how to make a biosolids program to suit the farmers’ needs. His biggest accomplishment is allaying the concerns of officials over whether applying biosolids to farmland really works.

Logsdon, G. 1995(?) *The Contrary Farmer.* CA: Real Goods. **#3. Metals.** "Unfortunately, organic farming organizations, after much debate, have disapproved the use of pre-treated, composted sludge on certified organic farms. To me this was a stupid move which I think springs from our silly fear of our own excrement. For ten years I have followed this debate and as a writer have worked closely with the leading sludge scientists. True, in earlier times, PCB-contaminated sludge was a remote possibility (though even then, ton upon ton of sludge was applied to Ohio farmlands with no problems), but with modern pretreatment and constant monitoring, sludge is, as USDA Scientist Dr. Rufus Chaney says, as safe as any soil amendment or fertilizer can be….Of course the Chinese would smile at this debate. They have been using human excrement on their garden-farms for forty centuries" (p. 41-42).

Loken, Lorraine. 1994. A National Strategy for Public Acceptance of Biosolids. *Conveying the Message.* Chelan, WA. Northwest Biosolids Management Association's 6th Annual Biosolids Management Conference. **#1. Media campaign.** Mentions how the product is played down and process is primary focus. It also discusses seven biosolids communicators whom the general public relies on.

Long, Kimberly. 2002. Tour Group Finds City of Brotherly Love Loves to Promote Sewage-Sludge Recycling. *The News Item.* September 3. **#1. Communication, public outreach.** Enthusiastic news coverage of Philadelphia's biosolids composting operation generated by having a public tour (the value of a tour).

Lono, Maile. 2000. Sustainable Resource Display. *Biosolids Bulletin*. Northwest Biosolids Management Association. June. #**2. Class A. Education.** Discusses the creation of a display regarding the beneficial and practical applications of various recyclable materials.

Lopez, Elizabeth. 1995. Discovery Park Sludge Treatment To Help Restore Native Plant Life. *The Seattle Times*. August 4. **#2. Pathogens. Land application. Class B.** Educating public of beneficial use and safety.

Lovell, Barbara, Mike Toombs, Murray Blackie, and John Schliehauf. 1996. Factsheet: *Land Application of Sewage Biosolids for Crop Production*. Ontario, Canada: Ministry of Agriculture, Food and Rural Affairs. April.

Lubchenko, Jane. 1998. Entering the Century of the Environment: A New Socila Contract for Science. *Science,* 279, pp. 491-497.

Lucey, Anne. 2001. Kerry Council to Query Use of Sludge from Plant. *The Irish Times*. December 18.

Lue-Hing, Cecil. 2001. Risks From Toxicants and Pathogens in Biosolids Fertilizers. Comments to the National Research Council, Public Meeting, March 14.

Lyman, Rick. 1998. For Some, Texas Town Is Too Popular as Waste Disposal Site. *New York Times*, September 2, 1998. **#3.** Sierra Blanca.

Machno, Pete. 1990. Sludge Name Change. Memo to AMSA Sludge Management Committee. July 11.

Machno, P.S. 1996. Biosolids 2000: Are We Letting Our Guard Down on Public Acceptance? In *10th Annual Residuals and Biosolids Management Conference: 10 Years of Progress and a Look Toward the Future*, Denver, CO. 4-21–4-27. August. **#2, public acceptance.**

Machno, Peter. 2000. National Biosolids Partnership Environmental Management System Overview. *14th Annual Residuals and Biosolids Management Conference,* Boston, MA. Alexadria, VA: Water Environment Federation.

Machno, Peter, Bob O'Dette, Jane Forste, et al. 1996. "Recycling and Acceptance." Water Environment & Technology 8 (2):40-43. **#2.**

Machno, P.S., and J. Forste. 1997(a). Biosolids 2000, Public Acceptance of Biosolids Recycling. In *Water Residuals and Biosolids Management Approaching the Year 2000*, Philadelphia, PA: WEF/AWWA Joint Conference. 4-1–4-9. **#2, public acceptance, NIMBY, odors, public education.** Public acceptance of biosolids recycling is a significant issue facing biosolids managers in the 1990s. With the cessation of ocean disposal in the United States, Australia, and the European community, a major cost-effective alternative is land application. Land application often involves working in communities other than those where biosolids originate. Interaction with neighbors requires biosolids managers to adopt new communications skills. In 1990, the Water Environment Federation adopted "biosolids" as the new term to describe treated solids from a wastewater treatment facility that can be recycled beneficially. Biosolids is a much more accurate term than "sewage sludge" to describe a product that has been treated, is regulated, and can be used as a fertilizer. Biosolids managers and organizations worldwide recognize that public acceptance is essential for any successful biosolids recycling program. The Biosolids 2000 Program was developed to articulate the goal of making biosolids recycling publicly acceptable throughout the globe by the year 2000.

Machno, Peter S. and Jane Forste. 1997(b). Biosolids 2000: Public Acceptance of Biosolids Recycling. *Keystone Water Quality Manager.* Pennsylvania Water Environment Association. September- October.

Maddocks, Susan. 1995. Fear's Scent Remains Over Sludge. *Portsmouth Herald,* NH. December. **#4. Concerned citizens.** Discusses Shayne Conner death in Greenland, NH.

Mahin, Tom, Richard Pope, and Charles McGinley. 2000, When Is Smell a Nuisance? An Overview of Different Approaches Taken Around the World In Setting Odor-Control Measures. *Water Environment and Technology,* May. Alexandria, VA: Water Environment Federation.

Mahr, Joe. 2000. Cash-Strapped Farmers Leery of Sludge Warnings. *The Blade,* Toledo, OH. www.toledoblade.com. **#3. Pathogens, Class B, land application, best management practices, concerned citizens.** Discusses the NIOSH HID #10 (see below),

Main, F., and T. Randall. 2000. Farms Linked To Disease. www.suntimes.com/output/news/sludg18.html. January 18.

Maine Waste Water Control Association. 1999. Biosolids Position Paper. Submitted at the NEWEA Congressional Briefing, March.

Mann, A. 1999. Environment: Fight Over Sludge Starts To Get Dirty. *Time* 154(13):26. September 27. **#3.** One of the first mentions of biosolids controversy in a national general interest news magazine.

Mann, A. 1999. Follow-up: More Sludge Slinging: How Safe is That Dump? *Time* 154(14):36. October 4.

Manty, Dale. 2002. Public Outreach and Co-Learning. Presentation to the WEFTEC 2002 conference, Chicago, IL, September 29. **#2. Public participation.** Details years of experience (291 outreach projects) with working with communities "co-learning" (learning together) about management of hazardous substances or wastes around superfund or other hazardous materials sites. "Co-learning allows academics [project managers and other technical experts] to learn from communities [and] communities to learn from academics." More information at http://www.toscprogram.org or http://www.hsrc.org.

Marchione, Marilynn. 1997. Human Waste May be Crypto Culprit; Study Suggests Source of Outbreak Wasn't Cattle. *Milwaukee Journal Sentinel*. October 18. http://www.jsonline.com/news/dec98/1204crypt.asp.

Martin, Lucy L. 2002. Sludge Piles in Whitefield to be Hauled Away. *Lincoln (ME) County News.* 127: 36, September 5. **#2. Concerned citizens, odor.** An example of a negotiated agreement amongst stakeholders, created through extensive interaction.

Maryland Department of the Environment. 1998. *Sewage Sludge Utilization in Maryland*, fact sheet.

Maschal, Richard. 1992. 'Sludge Queen' Hailed for Not Wasting Waste. *The Charlotte Observer.* September 21.

Mason, Eleanor. 1997. Fisherman's Farm Gets Green Light to Spread Sludge! *New England Country Folks*. June 23.

Massachusetts Water Resources Authority. 1998. *Facts About Sludge Processing.* Boston: MWRA.

Massachusetts Water Resources Authority. 1998?. *Down the Drain.* Boston: MWRA. #4. Education. A grade school curriculum on wastewater treatment, including a unit on use of fertilizer, especially Bay State heat-dried pellets produced by MWRA.

Massachusetts Water Resources Authority. 1999. *Bay State Fertilizer*. Brochure.

Massad, Jason. 2002. Growing Question: Are Biosolids Safe? Sludge Concern Spreads. *Vacaville Reporter.* California. August 24.

Matthews, Peter. 1997. Transatlantic Comparison of Biosolids Practices. Anglian Water Services, UK. **#2. Public perception, trust, perception of science, risk.** Compares European and American standards for biosolids recycling and discusses the precautionary principle versus risk assessment and attempts to define sustainability in biosolids management. "One quite normal response from the public is that if, in a debate about risk management, one scientist says level 5 and another says levels 10, the perceived third party view is that they do not know what they are talking about, so let us restrict the activities to level 1 until agreement can be reached. The problem is that even if the right answer proves to be level 10 in due course, it is usually very hard to relax legislation. So the precautionary principle is looking for practices which will lead not to controlled acceptable effect, but to no observed effect. The activity must be harmless…. The biggest immediate threat to the sustainability of operations in both the US and EU is public acceptance, so problems like bad smells can be more threatening than some of the concepts relating to metals…. It may be that quality assurance systems such as ISO 9000 and environmental management systems such as ISO 14000 will not only sustain public confidence but assist managers in maintaining sustainable operations. The elements of sustainable policy for agricultural use are proposed as: Set soil quality criteria which ensure safe use in perpetuity…, ensure that these criteria are achieved in a period of more than 50 years of biosolids application, the biosolids application is safe in health terms, the practice is acceptable to the public and customers, the operation should be affordable, and it should score highly on eco audit systems.

Maui News, *The.* 1998. EPA Gives Thumbs Up to Co-Composting Facility, Calls Product Exceptional. November 2. **#3.** Reports EKO Compost's product as "exceptional quality" with support from the mayor.

Mayer, Roger. 1999. Mayer Defends Biosolids. *The Keremeos Review.* February 18. **#2. Groundwater. Nutrients. Land application. Lack of trust. University involvement. Regulatory climate. Education.** Farmer states his case on why he chose biosolids as the beneficial resource he believes it is.

Mazmanian, Daniel and David Morell. The NIMBY Syndrome: Facility Siting and the Failure of Democratic Discourse. In Norman Vig and Michael Draft, eds., *Environmental Policy in the 90s*. CQ Press, Washington, D.C. **#2: NIMBY, trust, technology, public acceptance.** One in a series of articles that examines instances of siting public and private facilities, some of which present environmental risks. The siting issues in most instances, be they for landfills, mental institutions, prisons, or other facilities, follow a familiar trajectory which most often fails as the result of agency reluctance to share information, pre-existing public sensitivity, or media interference. The failure of traditional democratic discourse is, some authors argue, a direct result of declining trust in government.

McAvoy, Gregory E. 1999. *Controlling Technocracy: Citizen Rationality and the NIMBY Syndrome.* Georgetown University Press, Washington, D.C. **#2: NIMBY, trust of science and government, technology change, personal control.** Over the past fifty years we have witnessed a dramatic development in the state's administrative capacity and a commitment to use that capacity to solve social problems. At the same time, opportunities for citizens to express their policy preferences through elections, public hearings, open meeting laws, referenda, and public opinion polls have increased, setting the states and citizens on a collision course. This book tracks the NIMBY syndrome along a solid waste landfill development in Minnesota, and concludes with a discussion of research that supports the author's analysis of the Minnesota example. He concludes that resistance to new technology or to facilities is not the result of disagreements over technology itself, but that resistance to technological change is more a response to loss of control, respect, or justice or to incomplete or inept communication.

McBride, M. B. 1995. Toxic Metal Accumulation from Agricultural Use of Sludge: Are USEPA Regulations Protective? *Journal of Environmental Quality*, 24:5-18. **#3. Metals, land application, Class B.** A significant paper by a Cornell soil scientist that is widely cited by those concerned about the allowable levels of trace metals in U.S. biosolids.

McCance, M. 1998. Board Bans Sludge Use In County. *Richmond Suburban Newspapers*. June 20-26.

McConnell, D. Hew. 1994. GVRD takes issue with comments on Delta sewage plant. *South Delta Today*. December 11. **#2. Metals. Water Reuse. Concerned citizen involvement. Education.** McConnell submitted the article as public outreach and invitation to contact GVRD for more information.

McDaniels, T.L., L.J. Axelrod, N.S., Cavanagh, and P. Slovic. 1997. Perception of Ecological Risk to Water Environments. *Risk Analysis*, 17(3), 341-51. **#1: environmental risk, risk perception, water resources, trust of experts, personal control.** There are significant differences between expert and lay perceptions of risk. The characteristic perceptions of human health risks are expressed in a psychometric paradigm expressed through surveys. There are several key areas in which experts and lay populations differ in their risk perceptions, offering key issues in ecological risk management efforts for water resources. Underlying factors include ecological impact, human benefits, controllability, and knowledge.

McDougall, Ruth, Michael D. Van Ham, and Mary Jane Douglas. 2002. *Best Management Practices Guidelines for the Land Application of Managed Organic Matter in British Columbia*. **#3. Best management practices.** These thorough guidelines supplement new provincial regulations in British Columbia.

McKenna, Brian. The Scoop on Lansing's Poop. http://lansing.com/health/index.html, retrieved September 12, 2001.

McKenzie-Mohr, Doug. 1996. *Promoting a Sustainable Future: An Introduction to Community-Based Social Marketing*. National Round Table on the Environment and the Economy, Ontario (CN) Ministry of Environment and Energy. **#1: acceptance, behavior, trust, technology acceptance.** This booklet gives a layman's tour of the literature concerning behavior change as it relates to environmental practices. It identifies specific behavior change tools and works as a companion to a web site that displays examples of how these tools can be applied. As a guide to understanding the tools of behavior change, it is very easy to read and extrapolate to environmental issues other than recycling. (McKenzie-Mohr, Doug and William Smith. 1999. *Fostering Sustainable Behavior*. British Columbia: New Society Publishers. expands upon these themes.)

McKinney, D.E., T. Immerso, S. Fangmann, and C. Koch. 1990. NIMBY and the Ocean Dumping Ban Act of 1988. In *The Water Pollution Control Federation Specialty Conference*

Series, The Status of Municipal Sludge Management for the 1990's. New Orleans, LA: The Water Pollution Control Federation. 90-92. #**3, various applications, public concern over amount of time and input.**

McNaughton, Samuel J. 1999. What is Good Science? *Natural Resources Journal*, Spring. American Bar Association. "Good science can be identified readily by applying four tests, each of which can be unequivocally answered by a single yes or no. Those tests deal with procedure, performance, duplication, and peer scrutiny."

Meadows, Donella. 1997. In the Great Sludge War, Spreading Comes Out Ahead: Done Well, It Makes Ecological Sense. *Concord Monitor.* February.

Mendenhall, Trille C. 1990(a). From NIMBY to YIMBY: Public Acceptance Strategies for Sludge Utilization. *BioCycle.* October.

Mendenhall, Trille C. 1990(b). Public Information Concerns & Management. Charlotte, NC: Charlotte-Mecklenburg Utility Department.

Mendenhall, Trille C. 1990(c). Public Acceptance Strategies for Sludge Utilization. *BioCycle*. 31(10): 34-37. October.

Mendenhall, Trille C. 1991(a). A Municipal Perspective. *National Association of Professional Environmental Communicators* 2(4). December.

Mendenhall, Trille C. 1991(b). Strategic Planning for Residuals (Sludge) Management. Presentation at BioCycle Southeast Conference, Raleigh, NC. November 20.

Mendenhall, T.C. 1991(c). Environmental Communication: Strategy and Tactics. *AWWA/WPCF Joint Residuals Management Conference "Residuals Management After 1991."* Durham, NC: American Water Works Association and Water Pollution Control Federation. August 11-14. **#2, educating public is primary priority**, **environmental communication**. What is environmental communication? Why is it important? Public opinion is more important than ever before and the impact of environmentalism has been significant. I am sure most people believe they are environmentalists and certainly professionals in the wastewater industry are protectors of the environment. (An environmentalist is defined as a person who seeks to protect the natural environment, as from air and water pollution, wasteful use of resources, and excessive human encroachments.) Just doing a good job in protecting the environment is not enough. You may know you are doing a great job but how can the public know? To increase public confidence, we must continually tell them what we do and how we do it.

Mendenhall, Trille. 1992. Public Acceptance of Biosolids--Biosolids Managers' Perspective. In *Biosolids Public Acceptance-Digest*, Alexandria, VA: Water Environment Federation. **#2.** Communications. "Public opinion is more important than ever before and the impact of environmentalism has been significant. Generally, most people believe they are environmentalists…. To increase public acceptance and confidence, we must continually tell then what we do and how do it….Communication should be receiver-centered, not send-centered."

Mendenhall, Trille C. 1993. Gaining Acceptance for Beneficial Use. Presentation at the USEPA/AMSA Public Workshop on New Federal Sewage Sludge Regulations, Atlanta, GA. June 18.

Mendenhall, Trille C. 1995. How to Get and Maintain Public Acceptance of a Biosolids Utilization Program. Presentation at "The Effective Use of Lime for the Treatment and Disposal of Municipal Bio-Residuals" Conference, Baltimore, MD. December 12.

Merrimack, NH. 2000. *Merrimack: The Town and the River.* Videotape. 38 minutes. **#3. Education, best management practices.**

Merriman, Ed. 1991. Farmers, Public Warned of Sludge Danger. *The Capital Press,* WA. July 19:1. **#3. Metals, groundwater.** One of several news articles following the claims by the Ray and Linda Zander of harm to their cows from biosolids applied to a neighboring farm in northern Washington state.

Merritte, Marc. 1998. Linda Lingle: No Friend of the Environment. *Hawaii Environment & Health News*, 1(1), September http://www.hookele.com/hehn/98-09/nofriend.htm.

Metropolitan Denver Sewage Disposal District. Late 1990s. Metrogro: A Product of the Metropolitan Denver Sewage Disposal District. **#4.** Product description.

Metropolitan Water Reclamation District of Greater Chicago, 1995. Website description of biosolids program. http://www.mwrdgc.dst.il.us

Metropolitan Water Reclamation District of Greater Chicago. 1999(a). Land Application of Sewage Sludge: Papers and Publications by the R&D Department, and Research Funded by the District - A Bibliography, 1968 -1998, Rpt. #99-11.

Metropolitan Water Reclamation District of Greater Chicago. 1999(b). Improvements in the Quality of Sewage Sludge at the Metropolitan Water Reclamation District of Greater Chicago, Rpt. #99-20.

Metropolitan Water Reclamation District of Greater Chicago. 1999(c). Effect of Time After Cessation of Biosolids Applications on the Concentration of Cadmium, Copper, Nickel, and Zinc in Soil, Leaves and Grain of Corn, Rpt. #99-23.

Metropolitan Water Reclamation District of Greater Chicago. 1999(d). Environmental Protection System Report for Fulton County, Illinois, May 1999, Rpt #99-18.

Michigan Water Environment Association. 1997. Biosolids: Nutrient-Rich Organic Product of Wastewater Treatment. Folder and fact sheets distributed by the state environmental agency.

Miller, Dale. 1996. A Potential Disaster. Reader's Forum Column. *Coos County Democrat—Lancaster, NH.* 1-A. November 13.

Miller, G.M., B.A. Janonis, and J.A. Billica. 1996. Soft Engineering: Management of Public Concerns in a Potentially Controversial Biosolids Project. In *10th Annual Residuals and Biosolids Management Conference: 10 Years of Progress and a Look Toward the Future,* Denver, CO. 4-15–4-20. August. **#1, groundwater, overgrazing the land, land application, methods to achieve public consent.** Any large public works project can raise concerns from the citizens it serves. Biosolids projects in particular tend to evoke strong emotions and even opposition from the public. Fort Collins, Colorado set out to purchase and use rangeland for the beneficial use of biosolids, knowing that the land purchase and subsequent activities could be controversial. Fort Collins developed and implemented a systematic approach to obtain public consent for the project. This approach involved identifying the potentially affected individuals, forming a citizens' advisory board, performing research studies in response to citizen concerns, and maintaining a commitment to be responsive to the citizens. The result has been an ever-growing support for the project, increased credibility for the City, and a stronger bond between the City and the agricultural community. This paper outlines the underlying philosophy of the Fort Collins approach, gives an overview of the biosolids project and the public input process, and provides real-life examples of its successes and failures.

Milwaukee Metropolitan Sewerage District (MMSD), 1995. Website: http://www.milorganite.com

Minnich, Jerry, Marjorie Hunt, and the Editors of Organic Gardening Magazine.1979. *The Rodale Guide to Composting.* Emmaus, PA: Rodale Press. **#2 Organic. Compost. Land application. Concerned citizens.** "The recent history of sludge seems to be one of missed opportunities….There are two reasons you should be informed about the health and safety of using sludge. The first is that as a gardener, homesteader, or farmer, you may want to use some of this valuable soil builder and fertilizer on your garden, in your fields, or in your compost pile….The second reason we should be informed is that a public battle is shaping up over sludge use, a battle which carries over into all compost practice. As composters, we will have to have informed answers for those who try to scare us back to chemical fertilizers by using public health arguments…."

Missouri Extension. 1996. Safety and Benefits of Biosolids. http://muextension.missouri.edu/xplor/waterq/wq0427.htm. **#3. Pathogens, metals, chemicals, land application, education.**

Mittelstaedt, Martin. 1999(a). Guidelines Would Likely Increase. *The Globe and Mail.* January 20. **#3. Metals. Pathogens. Land application. Regulatory climate. Politics.**

Mittelstaedt, Martin. 1999(b). Sewage Sludge Gaining Acceptance As Farm Fertilizer. *The Globe and Mail.* January 20. #**2. Surface water. Nutrients. Metals. Pathogens. Phosphorus. Land application. Profit motive/lower costs.** Outlines major concerns with biosolids, but also mentions environmental and economic benefits.

Montague, P. 1999. Excrement Happens. *The Ecologist* 29(4):267-269. July. **#3, concerned citizens.**

Moore, Michael. 1994(?) New York City Sludge Train. *TV Nation*.

Moore, Michael D. and Karen Ingrid Strearns.2001. Developing an Environmental Management System. *BioCycle.* 42(5): 61-66. May.

Moote, Nancy. 1998. Construction Aggregates Honored for Environmental Initiatives. *Coast Independent* 4(23). June 8.

Moran, Tim. 1996. Atwater Cited for Poisoned Hay: 13 Cows Poisoned by Hay Fertilized with Sewage Sludge. *Modesto Bee Online*, CA. **#3. Nitrate.** News report on claim of dead cows due to high nitrate in hay grown with biosolids in Modesto, CA.

Motavalli, Jim. 1999. The 20/20 Vision Thing: The Green Group for Busy People. *E Magazine.* March-April. **#3. Concerned citizens. Organic rule.** About the group 20/20 Vision: "Erika Chan, the group's director of special projects, points to a series of success stories for the group…. Certainly, 20/20's letters were a significant percentage of the 200,000 Agriculture Secretary Dan Glickman received in opposition to his agency's proposed organic standards, which were tainted with genetically-engineered products, sewage sludge and irradiation."

Mulvihill, Keith. 2001. Long-Lasting Pollutant Found in Fertilizer, Fish. *Reuters.,* July 11. News story about Robert Hale's work on BDEs (see Hale, 2001).

Muse, J.K., C.C. Mitchell, Jr., and G.L. Mullins. 1991. Land Application of Sludge. Environmental Education Series. Extension Environmental Education, Auburn University, Alabama. February.

Musselman, Ned, Lawrence Welling, Sandy Newman and David Sharp. 1980. *I*nformation Programs Affect Atttitudes Toward Sewage Sludge Use in Agriculture. U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory. July.

National Biosolids Partnership. 1999(a). Code of Good Practice. *1999-2000 Annual Report.* Alexandria, VA: National Biosolids Partnership. **#2.** "The Code of Good Practice is a broad framework of goals and commitments to guide the production, management, transportation, storage, and use or disposal of biosolids. Code subscribers and EMS participants pledge to uphold the following principles of conduct: Comply with all Applicable Regulatory Requirements, Provide a Quality Biosolids Product, Develop an EMS for Biosolids, Provide Quality Monitoring. Require Good Housekeeping Practices, Develop Contingency and Emergency Response Plans, Commit to Sustainable Management Practices and Operations, Prepare and Implement Preventive Maintenance Plans, Seek Continual Improvement of all aspects of Biosolids Management."

National Biosolids Partnership and Regional Associations. 1999(b). Communications System for the National Biosolids Partnership and Regional/Local Biosolids Groups. Suggestions from the "Re-Investing in Success" Workshop , Charlotte, NC. August 20.

National Biosolids Partnership. 1999(c). *Improving Biosolids Management Programs and Increasing Public Support through an Environmental Management System*. #**1, environmental management systems, good practice with biosolids, increasing public support.**

National Biosolids Partnership. 2000(a). *1999 – 2000 Annual Report*. **#2, EMS process.**

National Biosolids Partnership. 2000(b). *National Manual of Good Practice for Biosolids.* Alexandria, VA. **#1. Land application, composting, heat drying, odors, public participation.** This manual provides guidance for developing an Environmental Management System (EMS) for biosolids and was developed as part of the National Biosolids Partnership EMS program. The first substantive chapter is "Public Acceptance," indicating the importance placed on this topic. "Building in the infrastructure to gain and maintain public acceptance is just as crucial as having all the screens, dewatering presses, field equipment and other mechanical components necessary to treat wastewater and manage solids. Too often, however, public acceptance doesn't enter the picture until there is a problem with the biosolids management program…. First and foremost is a well run operation." Goes on to encourage careful tracking and record-keeping, proactive odor management planning, and careful development of communication and public input. Also outlines the environmental and community benefits that should be stressed.

National Biosolids Partnership. 2001. *2000-2001 Annual Report.* Alexandria, VA: National Biosolids Partnership. www.biosolids.org.

National Biosolids Partnership. 2002(a). *Third Party Verification Auditor Guidance*. April, 2002. **#2. Public participation, communications.** Includes some good discussion about what robust proactive public outreach and participation should be within the EMS program.

National Biosolids Partnership. 2002(b). *Elements of an Environmental Management System (EMS) for Biosolids*, final interim draft, May 1, 2002. **#2.** One of the NBP EMS core documents.

National Coalition for Dialogue & Deliberation. http://thataway.org/ncdd/index.htm "The National Coalition for Dialogue & Deliberation is a Coalition of Organizations and Individuals who are committed to strengthening and uniting the growing dialogue and deliberation community."

National Institute for Occupational Safety and Health (NIOSH). 2000. *Workers Exposed to Class B Biosolids*. Hazard ID #10. Morgantown, WV: NIOSH. This "hazard ID" was rather critical of biosolids recycling and was criticized for ignoring literature on the health of wastewater treatment workers and biosolids. It was subsequently replaced by the following publication.

National Institute for Occupational Safety and Health (NIOSH). 2002. *Guidance For Controlling Potential Risks To Workers Exposed to Class B Biosolids.* Replaced the NIOSH Hazard ID #10 (see above). **#1. Health, risk.** A useful analysis of potential risks of working with Class B biosolids that may contain viable pathogens. Includes recommendations for reducing risks.

National Research Council. 1989. *Improving Risk Communication*. Washington, DC: National Academy Press.

National Research Council, 1993. *Issues in Risk Assessment*. Washington, DC: National Academy of Sciences.

National Research Council, 1996. *Understanding Risk: Informing Decisions in a Democratic Society*. Washington, DC: National Academy of Sciences**. #1. Risk, public participation.** "Risk characterization should be a decision-driven activity, directed toward informing choices and solving problems….Coping with a risk situation requires a broad understanding of the relevant losses, harms, or consequences to the interested and affected parties….Risk characterization is the outcome of an analytic-deliberative process. Its success depends critically on systematic analysis that is appropriate to the problem, responds to the needs of the interested and affected parties, and treats uncertainties of importance to the decision problem in a comprehensible way. Success also depends on deliberations that formulate the decision problem, guide analysis to improve decision participants' understanding, seek the meaning of analytic findings and uncertainties, and improve the ability of interested and affected parties to participate effectively in the risk decision process. The process must have an appropriately diverse participation of representation of the spectrum of interested and affected parties, of decision makers, and of specialists in risk analysis, at each step….The analytic-deliberative process leading to a risk characterization should include early and explicit attention to problem formulation; representation of the spectrum of interested and affected parties at this early stage is imperative. The analytic-deliberative process should be mutual and recursive. Analysis and deliberation are complementary and must be integrated throughout the process leading to risk characterization: deliberation frames analysis, analysis informs deliberation, and the process benefits from feedback between the two…. Structuring an effective analytic-deliberative process for informing a risk decision is not a matter for a recipe. Every step involves judgement, and the right choices are situation dependent. Still, it is possible to identify objectives that also serve as criteria for judging success: getting the science right,…getting the right science,…getting the right participation,…getting the participation right,…developing an accurate, balanced, and informative synthesis…. Those responsible for a risk characterization should begin by developing a provisional diagnosis of the decision situation so that they can better match the analytic-deliberative process leading to the characterization to the needs of the decision, particularly in terms of level and intensity of effort and representation of parties…. Each organization responsible for making risk decisions should work to build organizational capability to conform to the principles of sound risk characterization. At a minimum, it should pay attention to organizational changes and staff training efforts that might be required, to ways of improving practice by learning from experience, and to both costs and benefits in terms of the organization's mission and budget…."

National Research Council. 2001. Study of Public Participation in Environmental Assessment and Decision Making. Summary Notes from Planning Meeting. July 20.

National Research Council. 2002. *Biosolids Applied to Land: Advancing Standards and Practice*. Washington, DC: National Academy Press. Prepublication Copy, July. **#1. Pathogens, Class B, air emissions, health effects.** This second major review by the National Academy of Sciences of the federal EPA biosolids program created considerable debate as it found no documented failure of the Part 503 protecting public health and the environment, but did suggest the rule's science needed updating and studies of potential health effects are necessary.

National Research Council.1996. *Use of Reclaimed Water and Sludge in Food Crop Production,* Washington DC: National Academy Press. **#1. Metals, pathogens, chemicals, nutrients, odors, enforcement, lack of trust.** Extensive peer review of the U.S. EPA 40 CFR Part 503 biosolids rule and risk assessment. "Public concerns fall into several categories. One category consists of 'nuisance' risks to community quality of life and property values, such as odors, traffic, and the attraction of vermin to sludge application sites. Another category of concern has to do with protection of nearby natural resources of high value, such as wellwater, other water supplies, and fish….The POTW and cognizant officials must provide the public with assurances that meet such concerns. Studies have shown the importance of bringing the public into the decision-making process at an early stage for this purpose….The operators of municipal wastewater treatment facilities and the parties using sludge and wastewater should implement visible, stringent management and self-regulation measures, including monitoring and reliable reporting by farmers, and should support vigilant enforcement of appropriate regulations by local or state agencies… The municipal utility should carry out demonstration programs for public education, and to verify the effectiveness of management and self-regulatory systems. In addition, the utility should be prepared to indemnify farmers against potential liabilities when farmers' financing by banks or other lenders may hinge on this assurance…..Program credibility may be improved and public concern reduced if federal, state, and municipal regulators clearly assign authority to local governments for responding to any reports of adverse consequences related to beneficial use of sludge…. The public should be aware that state and local units of government have the necessary regulatory authority to take corrective actions against parties who have violated rules and guidance."

National Sludge Alliance. 1997(a). NSA Fact Sheet 104: EPA's Reckless Endangerment of Public Health. February 10. http://www.enviroweb.org/issues/sludge/nsa/nsa104.html.

National Sludge Alliance. 1997(b). NSA Fact Sheet 107: The Sludge Gets Deeper. March 10. http://www.enviroweb.org/issues/sludge/

National Sludge Alliance. 1997(c). Public Facts 113: Is it Toxic Sludge or Cow Manure Poisoning Our Food Supply. May 7. http://www.enviroweb.org/issues/sludge/.

National Sludge Alliance. 1997(d). Caution: EPA Scientist at Work. NSA Fact Sheet 111. April 16. #**3, land application adjacent to Zander farm, opposition.** There are many such fact sheets.

National Sludge Alliance. 1997(e). EPA's Reckless Endangerment of Public Health. February 10. http://www.enviroweb.org/issues/sludge/nsa/nsa104.html.

National Sludge Alliance. 1997(f). Is It Toxic Sludge or Cow Manure Poisoning Our Food Supply? May 7. http://www.enviroweb.org/issues/sludge.

National Sludge Alliance. 1997(g). The Sludge Gets Deeper. March 10 http://www.enviroweb.org/issues/sludge.

National Sludge Alliance. 2000(a). NSA Fact Sheet 122: Catch 22 – The Plight of the Farmer Who Accepts Sludge. http://www.enviroweb.org/issues/sludge/nsa/nsa122.html.

National Sludge Alliance. 2000(b). NSA Public Fact Sheet 123: The Terrible Truth. http://www.enviroweb.org/issues/sludge/nsa/nsa123.html.

National Sludge Alliance. 2000(c). Catch 22-The Plight of the Farmer Who Accepts Sludge. http://www.enviroweb.org/issues/sludge/nsa/nsa122.html. Retrieved December 5.

National Small Flows Clearinghouse. 1998. Managing Biosolids in Small Communities. *Pipeline.* Vol 9, No. 4, Fall 1998. **#2. Education.** Provides basic background information on biosolids management options. Recommends more education on the topic.

National Whistleblower Center. 2002. Scientific Freedom Under Attack: An Analysis of the Synagro Technologies, Inc. "White Paper" Regarding Dr. David Lewis. January 24. (Available at: http://www.whistleblowers.org/sludgereplyfinal.htm) **#2. Concerned citizen, science.** Part of a strong debate on the theories of Dr. David Lewis and the responses from EPA and industry.

National Wilderness Institute. 1999. EPA Decisions Driven by Politics: Agency Responsible for Any Harmful Health Effects of Sludge Says NWI. http://www.nwi.org/PressReleases/23March99.html. March 23.

National Wind Coordinating Committee. 2002. *Permitting of Wind Energy Facilities, A Handbook*. National Wind Coordinating Committee: http://www.nationalwind.org . August. **#1. Public participation. NIMBY.** An example of a public participation approach in another environmental field that includes the need to site facilities (wind farms) in rural communities. More information: RESOLVE, 1255 23rd Street NW, Suite 275,Washington, DC 20037; phone (888) 764-WIND, (202) 944-2300; fax (202) 338-1264; e-mail: nwcc@resolv.org.

National Wilderness Institute. 1999. News Release: EPA Decisions Driven by Politics: Agency Responsible for any armful Health Effects of Sludge Says NWI. March 23.

Natural Life. 2000. Sludge on Your Supper Table. http://enviroweb.org/issues/sludge, retrieved December 5.

Nature's Blend Organic Fertilizers. 2000. Advertising brochure. Warren, OH.

Naylor, L.M. 2000. Survival and Success Strategies at In-Vessel Facilities. *BioCycle* 41(8):62-65. #**3, education tool, composting.**

Nelson, Arlyn. 1993. Community Decision Making: Deciding on an Option. National Extension Compost Utilization Conference, Minneapolis, MN**. #3: risk understanding, public acceptance, public perception, public relations.** Case study of county decision-making process surrounding a solid waste landfill; traces the erosion of political support and funding for a limited solution to a municipal solid waste (MSW) disposal problem.

Nesmith, Jeff. 1996. Turmoil at EPA. *The Atlanta Journal-Constitution, Saturday Reader.* July 27. **#3. Lack of trust, chemicals.** David Lewis criticism of EPA science, including accusations of "sludge magic" in the development of the 40 CFR Part 503 rule.

Neville, Angela. 2000. Fertile ground. *Environmental Protection.* September. #**2.** Provides an overall look at biosolids recycling (process, dioxins, regulations, EMS, bans, etc.).

New England Biosolids and Residuals Association (NEBRA). 1999(a). Questions and Answers. http://www.nebiosolids.org

New England Biosolids and Residuals Association. 1999(b). Communications System for the National Biosolids Partnership and Regional/Local Groups: Suggestions from the

Reinvesting in Success Workshop, Charlotte, NC. **#3. Education. Communication.** Provides recommendations to the National Biosolids Partnership on stakeholder needs and potential tools and projects, such as a national website, for addressing those needs.

New England Biosolids and Residuals Association (NEBRA). 2001. Were Biosolids Involved in the Death of a Greenland, New Hampshire Man? Information Update. Available at http://www.nebiosolids.org/scienceof.html.

New England Biosolids and Residuals Association. 2000. News story. www.nebiosolids.org.

New England Fertilizer Company. 1999. *Complete Biosolids Management Services.* Brochure.

New England Interstate Water Pollution Control Commission. 1994. Sludge, a.k.a. Biosolids! *Water Connection*, 11(2), Fall. **#2. Education, liability, odors.** A collection of articles from New England biosolids management experts. John Donovan regarding public concerns: "Successful public acceptance programs generally have a few things in common: they promote early public involvement; they freely provide scientific information and testimony from independent sources; they provide opportunities for exchange of views and questions; and they explain safeguards, standards, and benefits of the proposed programs." USEPA's John Walker and Farm Credit Bank's Roger Allbee on liability: "Although there has been significant research on the beneficial use of biosolids, and history has demonstrated in the United States and other regions of the world that high quality residuals can be a beneficial soil additive and plant nutrient when properly applied, concerns still exist. One reason for this, of course, is the origin of biosolids. Another reason is a general lack of understanding on the part of the public about advancements in biosolids technologies and the resulting better quality materials that are safer and more suitable for land application. In addition, some people are concerned that the acceptable environmental standards of today might change in the future, subjecting property owners to either increased cleanup costs or property devaluation." Andrew Carpenter on public education: "Talk about history, discuss the issues, be a good neighbor, sort out myth and reality."

New England Interstate Water Pollution Control Commission. 1995. *Land Application of Biosolids*. Fact Sheet prepared by NEIWPCC's Residuals Workgroup. October. #**2, biosolids, adherence to 503s, public outreach/education.** "The New England states, New York, NEIWPCC, and EPA believe that when managed and applied properly, biosolids can be valuable resources….Many communities have discovered viable, safe, and environmentally sound options for the beneficial use of their biosolids….In choosing an option, communities must consider cost, odor control, and siting issues."

New England Interstate Water Pollution Control Commission. 1995. *Sludge or Biosolids*. Fact Sheet prepared by NEIWPCC's Residuals Workgroup. October. **#2, gets information to the public in a concise and technical manner.**

New England Interstate Water Pollution Control. 1995. *Sewage Sludge Incineration* (brochure). October.

New Hampshire Comparative Risk Project. 1997. Report of Ranked Environmental Risks in New Hampshire, Concord, NH. **#4. Concerned citizens, risk communication.** 50+ NH environment and public health stakeholders evaluated and ranked perceived risks in order of actual risk; "sludge management" was close to last on the list (considered relatively low risk).

New Hampshire Greens. 1997. Position Statement: Stop the Sludge. August 18. http://home.earthlink.net/~rhenderson/grsludge.html

New Hampshire Water Supply and Pollution Control Commission. 1978. Land Application of Wastewater Sludge at Somersworth, NH. November. "Generally, reception towards land application of wastewater sludge at the site in Somersworth was favorable…. Municipal agencies received only a few complaints about mild odor from nearby residents, and the problems lasted less than a week. Residents are often requesting sludge for their gardens and lawns, although all such use of fresh sludge is presently not allowed…for bacteriological reasons. When other interests were approached with proposals for land application of sludge, an attitude of skepticism was common."

New Hampshire, University of. 1998. Landspreading of Sludge in New Hampshire, Report of the UNH Sludge Task Force. **#3. Metals, concerned citizens, pathogens, chemicals, groundwater.** This is an evaluation of biosolids recycling by a variety of scientists with a variety of experience and knowledge.

New U.S. Waste Strategy, Pt. 2: Sewage Sludge. 1997. *Rachel's Environment & Health Weekly* #561. August 28, 1997. http://www.monitor.net/rachel/r561.html

New Waves. 1992. TWC Proposes Tough New Rules to Deal with West Texas Sludge Project. 5(3), October. http://twri.tamu.edu/twripubs/NewWaves/v5n3/news-5.html

New York City Department of Environmental Protection, Biosolids Citizen Advisory Committee. 1998-2000. Minutes of Meetings.

New York City Department of Environmental Protection. 2003. Tips for Preparing a Public Participation Plan Pursuant to the New York State Department of Environmental Conservation Commissioner Policy-29, Environmental Justice and Permitting.. Issued December 4. **#3. Public participation.** Some helpful very basic guidelines on developing public participation programs around environmental programs.

New York State Department of Environmental Conservation.1997. *A Technical Review of 'The Case for Caution,'* document finalized and made available as part of rulemaking process in 2002. **#2.**

Newton, C. 1995. Public Acceptance: The Key to Surviving the Coming Backlash. In *4th Annual Joint WEF & AWWA Conference, Biosolids and Residuals Management,* Kansas City, MO. 5-5–5-6. July. #**1, land application, beneficial use, public acceptance.** "The 1994 election was not only a message from Americans to their elected representatives, it signaled the onset of a long overdue period of introspective examination of citizens' social compact with their government. With environmental do's and don'ts intruding on virtually every minute of a person's daily activities, it is no wonder that people are re-examining their commitment to a pollution-free world. And while many continue to label themselves as environmentalists, skepticism and questioning of this commitment is growing as the need for personal sacrifice mounts. This yin and yang – a desire for a better environment tempered by reluctance to personally pay for it – defines a generation."

Nichols, Alan B. Cartoon Series Dramatizes Environmental Challenge. About *Captain Planet* cartoon, which included a critical slant on "sludge."

Nichols, Alan B. 1992. How to Get the Best from Your Public Education Program: Getting the Public Involved in Utility Projects. *Water Environment & Technology.* August.

Norman, Roni. 1995. Reader objects to Nutrifor Treatments. *The Similkameen Spotlight*. September 13. **#2. Odor/vector attrn. Land application. Local ban. Media campaign. Lack of public information. Lack of trust.** Concern already has roots in poor perception of GVRD. Resident encourages other concerned individuals to respond to regulatory officials and to stop further applications.

Northwest Biosolids Management Association (NBMA). 1998(a). *Biosolids Recycling: Recognizing a Resource.* Fact Sheets, video. **#2.** Excellent video and fact sheets providing introduction to biosolids recycling in the Northwest U.S. Video also discusses importance of NBMA.

Northwest Biosolids Management Association and U.S. Environmental Protection Agency. 1998(b). *Final Report: Cooperative Agreement.* **#1.** Discusses different aspects of biosolids program development. Discusses specific roadblocks and aids in creating a successful biosolids project.

Northwest Biosolids Management Association. 1997-1998. *Literature Reviews***. #4. Nutrients, metals, chemicals.** Literature reviews developed at the University of Washington, for NBMA, of technical papers regarding biosolids and incineration, metals, microbes, nitrogen, organics, poplars, runoff, soil physical properties, and wildlife.

Northwest Biosolids Management Association. 1999. *The Results of the Marketing Assessment for Biosolids.* April. #**1.** Uncovers some key elements to making a biosolids project a success as well as outlining some obstacles.

NViro. *Today's Biosolids and Residuals Technologies.* Videotape.

O'Dette, R.G. 1994. The Beneficial Use of Biosolids: We're Getting There! In *The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective*, Washington, D.C.: Water Environment Federation. 9-1–9-12. #**3, metals, dioxin, Round 2 of 503 regulations.**

O'Dette, R.G., and G.A. Draman. 1998. Success Stories in Biosolids Recycling. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 549-553. #**3, land application, composting, liability, Class A.**

Oerke, D.W., J.H. Rickermann, F. Bebler, and P. Heppler. 1998. What Happened When Neighbors Moved Next Door – A Successful Approach to Public Involvement in Biosolids Management Decisions in Boulder, Colorado. In *12th Annual Residuals and Biosolids Management Conference,* Bellevue, WA: Water Environment Federation. 555-561. #**1, toxicity, general siting issues, land application, citizen outcry and mechanism to work out a plan for the City.** The City of Boulder, Colorado has been land applying Class B biosolids within 10 miles of their wastewater treatment plant (WWTP) since 1980. Their land application program has received many awards for their management of biosolids over the past several years. In their inventory of application sites was a very large tract of dryland wheat acreage within 4 miles of the WWTP. The City was transporting and applying approximately 75% of the City's annual production of biosolids to this site since 1985 without concern or complaints from the public. In 1990, the City reviewed the land application program in light of increasing development pressure in Boulder County for suitable agricultural land for biosolids application. The conclusion of the study showed that the City should purchase agricultural land for long-term application of biosolids. The City determined that the substantial tract of dryland wheat 4 miles from the WWTP was the most cost-effective alternative for the long-term future. The first parcel available to purchase was an 80-acre tract in 1991. This purchase was completed with little to no interest from the community at any public meetings held by the City regarding the Class B land application program. Several land parcels became procurable in late 1994. During the first public meeting presenting the plan to make these additional land purchases for the existing Class B program, staff was only able to introduce the first seven minutes of the planned addenda before the community became outraged – 15 people attended. One week later, the City scheduled another public meeting to further discuss the planned purchase. More than 300 people attended this meeting with the same upheaval and anger as the first meeting. Two weeks later, the City staff again attempted to explain the process and land application of biosolids to more than 550 citizens with only "mob rule" mentality. The media had a field day at the City's expense. A small group of citizens, which moved to Boulder from a different region of the Country, mobilized and became very organized with both funding and resources to oppose and demand that the City of Boulder's Class B land application program be stopped in the controversial area. The City staff voluntarily halted land application within the County and moved the biosolids land application program 60 miles away to another county in eastern Colorado. The City developed a new plan to evaluate the long-term final use of biosolids, with participation from a citizen study review group (SRG) consisting of representatives from the community, City of Boulder staff, and the consultant. The group evaluated the fiscal and community impacts, environmental compatibility, reliability, flexibility, site requirements and end-use market potential for Class A and Class B biosolids management alternatives. This paper focused on lessons learned from these public acceptance problems and the right way to include citizens and city staff in a positive "team approach" to build a consensus on the selection of a biosolids management plan. Special attention was given to how the citizens group was formed, the goals that were established for the group, how meetings were facilitated, and how input from all group members was solicited to ensure consensus and "buy-in" to the study conclusions.

Ohio Farm Bureau Development Corporation, Ohio State University, and USEPA. 1985. *Demonstration of Acceptable Systems for Land Disposal of Sewage Sludge.* Cinncinatti: USEPA Water Engineering Research Laboratory. **#3. Land application, pathogens, metals.** The Ohio farm study comparing the health of residents of 47 farms that received sludge compared with residents of 46 farms that did not receive sludge.

Okun, Melva. 1999. Human Health Issues Associated with the Hog Industry. Environmental Resource Program, School of Public Health, the University of North Carolina at Chapel Hill January. http://checc.sph.unc.edu/rooms/library/docs/hogs/hogs_hhealth.html.

Olson, Robert. 1995. Sustainability as a Social Vision. *Journal of Social Sciences*: 51(4), 15-36. **#3: environmental attitudes, science, trust.** The author states that there is evidence that traditional images of the future are becoming less believable and that, as a society, we are becoming less hopeful about the future. He cites influences that shaped modern societies and discusses ways to explore the requirements for reaching a sustainable future, assumptions about the prospects for growth, and alternative scenarios of a sustainable future. Reflecting upon the available scenarios for the future, he concludes that societies in the North will have to consume far fewer resources and use them more efficiently or suffer an ecological holocaust.

Operations Forum. 1994. Beneficial Use of Biosolids. November, pp.8-12. The EPA biosolids awards were established to encourage development of cost-effective and environmentally safe biosolids management practices that recycle nutrients and improve soil conditions. This year's awards were presented to large and small operating projects, research activities, and three specially recognized programs.

Oppel, Richard et al. 1992. Congratulations to CMUD. Editorial in *The Charlotte Observer.* September 24.

Organic Consumers Association. Drugs Are Accumulating in Sewage Sludge, Surface Waters and Drinking Waters. http://purefood.org/toxic/drugsinwater.cfm, retrieved December 5, 2000.

Orlando, L. 1997. The Sewage Scam – Should Sludge Fertilize Your Vegetables? *Dollars and Sense* 211:34-37. May/June. http://www.riles.org/paper2.htm. #**2. Concerned citizens, lack of trust.**

Orlando, Laura. 1999(a). Something Stinks in the EPA. ReSource Institute for Low Entropy Systems http://www.riles.org/musings23.htm. September 24.

Orlando, Laura. 1999(b). Toxic Avengers: The EPA is Pushing Hazardous Sludge as Fertilizer. The Locals are Fighting Back. *In These Times*. February 21. http://www.riles.org/library.htm.

Ott, P.E. and R. Randy. 2000. Six Years and Still Going, Onondaga County's 10 Year Biosolids Privatization Program. In *14th Annual Residuals and Biosolids Management Conference.* Water Environment Federation. February/March.

Outwater, Alice. 1996. *Water, A Natural History.* New York: Basic Books. **#3. Chemicals, metals.** The perspective of a water quality engineer who worked at Boston's biosolids management program: "As soon as a city starts recycling its sludge, the industrial-discharge permit system tightens up….With municipal-sludge quality reports from around the country piled on my desk, I began to realize that industries themselves are no longer directly dumping much down the sewers….Sludge doesn't lie. And most city sludge is remarkably clean."

Ozawa, Connie P. and Lawrence E. Susskind. 1984. Mediating Science-Intensive Public Policy Disputes. Presented at the annual meeting of the Association for Public Policy Analysis and Management, October 18-20.

Page, A. L. and A. C. Chang. 1994. Overview of the Past 25 Years: Technical Perspective, in Clapp, C. E., W. E. Larson, and R. H. Dowdy (eds.): *Sewage Sludge: Land Utilization and the Environment.* Madison, WI: Soil Science Society of America Miscellaneous Publication.

Palazzo, A.J., and I.K. Iskandar. 1993. Use of Sewage Sludge on Park and Recreational Lands. *Sewage Sludge: Land Utilization and the Environment*, Bloomington, MN: Soil Science Department and USDA-ARS, University of Minnesota. August 11-13. **#4, land application on public lands.**

Palmer, D.W., and C.G. Shimp. 1995. New Jersey Wastewater Authority Buys Farmland For Biosolids Disposal. *Water Engineering & Management* 142(7):37. July. #**4, on-site disposal, biosolids as fertilizer, land application, groundwater not an issue, best management practices.**

Passi, Peter. 2000. Companies to Manage Wood Resources on Minnesota Land. *Duluth News-Tribune.* http://www.penweb.org/issues/sludge/tailingspoplars.html.

Passi, Peter. Companies to Manage Wood Resources on Minnesota Land. *Duluth News-Tribune*. http://www.penweb.org/ssues/sludge/tailingspoplars.html, retrieved December 5.

Pavey, R. 1998(a). Dairy Farmers Suffering. www.augustachronicle.com/stories/111598/met_cows2.Shtml. November 15.

Pavey, R. 1998(b). Sludge Raising a Stink. www.augustachronicle.com/stories/111598/met_cows1.Shtml. November 15.

Pavey, R. 1998(c). Dairy Farms File Lawsuits Against County. www.augustachronicle.com. November. #**3, land application to grow grazing material for cattle, negative media story, led to further investigations, lack of enforcement, bad management.**

Pavey, R. 1998(d). State to Audit Wastewater Plant In Toxin Case. www.augustachronicle.com. November.

Pavey, R. 1998(e). Wastewater Plant In Disrepair. www.augustachronicle.com.. November.

Pearce, Robert. 1997. www.nosludge.org. Palmdale, CA. **#3. Opposed. Urban/rural conflict.** "Tell the city of Los Angeles to keep their sewage to themselves."

Pearlman, Stephen and Steve Frank. 2001. Winning Trust Through Open, Honest Communication Helps Reduce Neighbors' Fears of Biosolids. *15th Annual Residuals and Biosolids Management Conference, San Diego, CA.* Water Environment Federation conference. **#1. Independent monitoring, third-party review, outrage, public concern, addressing technical issues.** Describes the application of public participation and communications concepts, including those of Peter Sandman, to a difficult biosolids recycling public acceptance problem, including public concern over the acceptance by Denver Metro of Lowry Landfill treated groundwater about which there have been concerns about radioactivity.

Pearlman, Stephen, Duane E. Humble, and Stephan D. Frank. 2000. Independent Biosolids Monitoring Plan Paves the Way for Cooperation Between Skeptical Neighbors and Wastewater Agency. *14th Annual Residuals and Biosolids Management Conference, Boston, MA.* Water Environment Federation conference. **#2. Independent monitoring, third-party review.**

Pellow, D.N. 1999. Framing Emerging Environmental Movement Tactics: Mobilizing Consensus, Demobilizing Conflict. *Sociological Forum*, 14(4), 659-683. **#2: Personal control, acceptance, framing, environmental justice, trust of government or corporation.** A study of an emerging environmental decision-making model of social movements that moves beyond traditional adversarial approaches toward "consensus building." The model advocated by the author allows activists equal power with industrialists and state actors in environmental policy making. There are instances when challengers actually engage in collaborative framing with their adversaries. Literature on frame analysis is growing, and does not presume that activists reject oppositional framing altogether, but may draw on a mixture of confrontation and negotiation in this form of collective action that places them in a decision making role. The author points to four frames: (1) political economic [a diagnostic frame used by environmentalists to identify the source of their problems]; (2) environmental justice [activists articulate their demands]; (3) collaborative [in which activists engage and jointly struggle with their opponents]; and (4) tactical [consensus building decision making, or "CBDM"]. The author suggests that environmentalists are becoming more sophisticated in their efforts to protect local communities and natural resources and that CBDM is becoming, more often, a tool for both sides to utilize.

PENnet. Assorted messages on web site www.penweb.org/pennet.html. **#3. Concerned citizens.**

Pennsylvania Department of Environmental Protection. 1999. *Land Application of Biosolids Workbook.* Commonwealth of Pennsylvania Department of Environmental Protection Bureau of Water Quality Protection. September. **#3. Training. Land application.** Includes tips for involving the public and addressing public concerns during each step of a land application program.

Pennsylvania Department of Environmental Protection. 1999. *Teaching About Biosolids*. **#2. Education, risk perception.** "A curricular supplement designed to assist educators and middle school students in meeting several of the newly proposed state standards in Environment and Ecology and in understanding biosolids and their use."

Pennsylvania Department of Environmental Protection. 2000. Regulation and Beneficial Use of Biosolids. Internet website: http://www.dep.state.pa.us/dep/biosolids/toc.htm. **#2. Education.** Good presentation of information.

Pennsylvania Environmental Network. 1999?. The Power to Protect! Flyer encouraging local ordinances for additional testing and bonding of biosolids land application programs in PA. http://www.penweb.org.

Pennsylvania Environmental Network. 2001. Why We Are Opposed to the Land Application of Sewage Sludge. Received via email. July. Reprinted in Appendix B.

Pennsylvania State University. 1985. NEC-28. *Criteria and Recommendations for Land Application of Sludges in the Northeast.* Bulletin 851. **#4. Metals, pathogens, nutrients.** "This bulletin informs public officials and private citizens about the benefits and hazards of land spreading of sludges in the Northeast."

Pennsylvania State University. 1999. Land Application of Sewage Sludge in Pennsylvania: Use of Biosolids in Crop Production. Cooperative Extension fact sheet. **#2. Communications, information.**

Penticton Herald, The. 1992. Princeton Picks Sludge Over Contaminated Soil. October 21. #**3. Trucking. Land application. Politics.** Lost government funding to study mine tailings since town rejected contaminated Expo soil.

People Against Power's Sludge (PAPS). 1999. Letter to local citizens regarding land application of biosolids permitting in Rush Township, PA. **#4. Concerned citizens.** "Let us be heard loud and clear. We say no to sludge!"

Peot, Chris and Dan Thompson. 1996. Compost use in wetland restoration. *BioCycle*. January. **#1. Wildlife impacts.** City staff went out and met with neighborhood leaders and created a citizen support group for the project. Neighbors unanimously voted for the biosolids project.

Perciasepe, Robert, Assistant Administrator, USEPA.1997. Letter to Ellen Z. Harrison, Cornell Waste Management Institute, October, 1997.

Perkes, C. 1999. Tractor Company Sues to Block Composting Firm; It's the Second Legal Action Filed by Pacific Tractor in an Effort to Halt Expansion of Inland Empire Composting in Colton. *The Press-Enterprise*, Local section, p. B03. March 30. Riverside,CA.

Peters, R.G., V.T. Covello, and D.B. McCallum. 1997. The Determinants of Trust and Credibility in Environmental Risk Communication: An Empirical Study. *Risk Analysis*, 17(1), 43-54. **#1: trust, credibility, risk communication, risk perception.** This article identifies the specific characteristics that are necessary for public acceptance – it should be more widely read. Several theories have been postulated regarding how the public develops perceptions of trust and credibility in environmental risk communications. There is strong evidence to show that trust and credibility are key components of environmental risk communication. The development of trust and credibility depends on three factors: perceptions of knowledge and expertise; perceptions of openness and honesty; and perceptions of concern and care. Researchers found the following: (1) for industry, increases in public perceptions of concern and care will increase their sense of trust and credibility; (2) for government, increased public perceptions of commitment will increase perceptions of trust and credibility; (3) for citizen groups, an increase in public perceptions of knowledge and expertise results in increased perceptions of trust and credibility. In summary, defying a negative stereotype is one key to improving perceptions of trust and credibility.

Peterson, Niels. 1994. Human Waste Mixed For Park. *The Western Press.* March 16. **#2. Odor. Pathogens. Nutrients. Land application. Regulatory climate. Profit motive/lower cost.** Council member says, "It may be perceived positively, but God help you if it smells."

Physicians for Social Responsibility. 1994. Putting the Lid on Dioxin: A National Policy on Dioxin. http://www.psrus.org/diox6.htm.

Pick, C. 1996. Bouncing Back From a Public Nuisance Setback. *BioCycle* 37(9):58-61. **#1, odor, public health, composting, NIMBY, concerned citizen.** The topic of public health as it relates to composting is complex and involves a multitude of concepts, including politics, science, emotion, perception, composting methodology, regulation, fear, and more. The apparent contradictions between these themes are what make the public health issue so challenging to manage. However, it is imperative that composting site operators, both private and public, and the industry in general be prepared to face this issue and manage it productively.

Pilisuk, M. and C. Acredolo. 1988. Fear of Technological Hazards: One Concern or Many? *Social Behavior*, 3, 17-24. **#2: technology trust, hazards, environmental justice.** A survey of three Northern California communities assessed levels of concern about ten potential dangers of technology. A factor analysis showed a single underlying dimension accounting for at least half of the variance among the diverse concerns. This overall level of concern, while high across all groups, was raised among women, minorities and less educated and poorer income people more highly than among others. Concern was also higher among liberals and those indicating a greater involvement in religion. Level of concern did not vary, however, as a function of having children in the home, exposure to television and radio news, or participation in political action. (Note: subsequent studies have displayed significantly elevated levels of concern among women with small children in the home).

Pokorny B., R. Prabhu, C. McDougall, R. Bauch. 2004. Local Stakeholders' Participation in Developing Criteria and Indicators for Sustainable Forest Management. *Journal of Forestry*, 102 (1), 35-40. Abstract: Criteria and indicators (C&I) for sustainable forest management are important tools to improve the quality of forest management. In most cases they have been developed by experts, but the participation of stakeholders is essential if the C&I are to be locally relevant and practicable. We asked four stakeholder groups to apply a set of C&I to a forest management unit in the eastern Amazon basin. The study confirmed the importance of involving stakeholders and demonstrated that effective efforts begin with well-defined and clearly understandable C&I. Stakeholders were better able to apply and adapt measurable verifiers than the more abstract indicators and criteria. Intensive communication about personal experiences and subjective interpretations is necessary to prevent misunderstandings and misinterpretations. Our study also confirmed the general practical applicability of C&I and revealed their potential as instruments of communication and learning.

Pollan, Michael. 2001. The Year in Ideas: - An Encyclopedia of Innovations, Conceptual Leaps, Harebrained Schemes, Cultural Tremors & Windsight Reckonings That Made the Difference in 2001: The Precautionary Principle. *New York Times Magazine.* December 9**. #2.** Good summation of this principle.

Pooley, Julie Ann and Moira O’Connor. 2000. Environmental Education and Attitudes: Emotions and Beliefs Are What is Needed. *Environment and Behavior*, 32(5), 711-724. **#1: environmental education, behavior, public acceptance.** The main focus of environmental education programs has been to change environmental behavior through increasing environmental knowledge. Because many environmental studies have failed to successfully apply attitude theory in researching environmental attitudes, the present study investigated the cognitive and affective bases of environmental attitudes to indicate that it is what people feel and believe about the environment that determines their attitudes toward it. The findings suggest that, environmental educators interested in changing environmental attitudes need to target emotions and beliefs, rather than knowledge, as sources of information on which to base their environmental programs (*Ed. note*: this analysis is consistent with research summarized by McKenzie-Mohr).

Portland, City of (Maine). 2000. *Invitation to Tour of Madison Farms.* April 20. #4

Portland, OR, City of. 1999. Media Guide: Biosolids Media Training. City of Portland and OR Department of Environmental Quality. **#2. Media campaign.** Example of efforts by utilities and biosolids managers to manage media stories.

Powell, Douglas. 1996. An Introduction to Risk Communication and the Perception of Risk. Unpublished manuscript, University of Guelph, Ontario, Canada. **#1. Risk, communication.** An excellent primer.

Powell, T. 1998. Officials Silent on Future of Wetlands. www.augustachronicle.com. November.

Powell-Tate. 1993. *Communications Plan on Biosolids.* Prepared for the Water Environment Federation. **#1.** Includes identification and surveys of gatekeepers, recommendations for positive biosolids messages.

PR Watch.1995. A R.O.S.E. by Any Other Name… *PR Watch*, 3rd Quarter. **#3. The word 'biosolids.'**

PR Watch. 1999(a). Flack Attack. www.prwatch.org **#3.** An advocacy group challenges American Council on Science and Health for being "right wing" and industry funded, thus producing tainted science. ACSH responds.

PR Watch. 1999(b). Sandman's Cagey Tactics (letter to PR Watch) www.prwatch.org. **#3.** PR Watch and readers attack Peter Sandman's model of public outrage; "outrage can be good; hold on to it."

Priesnitz, Wendy. 1997. The Real Dirt on Sewage Sludge. *Natural Life Magazine* #58. http://www.life.ca/nl/58/sludge.html, retrieved December 5, 2000.

Providence Journal. 2002. Internal Review Faults EPA Over Safety of Recycled Sewage. February 7.

Pure Food Campaign. 1997(a). Federal Sludge-Labeling Bill. April 22. http://www.purefood.org/sludge.html.

Pure Food Campaign. 1997(b). Toxic Sludge as Fertilizer. *The Seattle Times.* November 23. http://www.purefood.org/Toxic/toxicSludge.html.

Pure Food Campaign. 2000(a). Drugs Are Accumulating in Sewage Sludge, Surface Waters, and Drinking Water. http://www.purefood.org/toxic/drugsinwater.cfm.

Pure Food Campaign. 2000(b). Toxic Wastes 'Recycled' as Fertilizer Threaten U.S. Farms and Food Supply. http://www.purefood.org/Sludge/toxicFert.htm. Retrieved December 5,2000.

Quirk, Mark. 1997. So What's all the Stink About? *Foster's Daily Democrat*. June 10. New Hampshire.

Race, Michael. 1997(a). Debate Rages Over Sludge as a Fertilizer. Lebanon County, PA: *Lebanon Daily News*. December 14.

Race, Michael. 1997(b). Sludge Issues, Lebanon County, PA. *The Lebanon Daily News.* December 14.

Racey, P.K. 1991. Plain Talk – Putting the Risks of Land Application Into Perspective for the Public. *AWWA/WPCF Joint Residuals Management Conference "Residuals Management After 1991."* Durham, NC: American Water Works Association and Water Pollution Control

Federation. August 11-14. #**2, public acceptance, land application, community sensitivities.** Early discussion of BioGro's approach to public acceptance of land application, which was characterized by: (1) participation in the wastewater treatment industry and (2) concern for the sensitivities of the communities where projects are located. As a result of the community acceptance and outreach efforts described in this paper, BioGro received a 1990 U.S. EPA Special Award for the beneficial use of sludge.

Rachel's Environment & Health Weekly. 1997. Sewage Sludge, A New U.S. Waste Policy Emerges, Parts 1 and 2, August 21 and 28. **#1. Metals, chemicals, pathogens, many issues.** Significant critique of federal biosolids recycling policy.

Rachel's Environment & Health Weekly. 2000. June 22. Quotes from C. Daughton and C. Ternes: Pharmaceuticals and Personal Care Products [PPCPs] in the Environment: Agents of Subtle Change, in Environmental Health Perspectives, 107: 6, December 1999, 907-938. #**3. Chemicals.** Raises the issue of consumer product chemicals impacting the environment: "…almost nothing is known about their movement in the environment….The primary source for terrestrial exposure is probably from disposal of biosolids (sludge)….Theoretically, is sewage sludge applied to crop lands could be taken up by plants."

Rainey, M. 1998. Working Out Approval Of Biosolids Land Application. *BioCycle* 39(5):66-69. **#1, land application, odors, lack of public information, lack of trust in regulators, septage.** A thoughtful discussion of how local town leaders and citizens can be constructively involved in learning about, helping plan, and implementing biosolids land application programs. "Many people believe ownership of a septic system removes them from involvement in the biosolids controversy, but, if their septage goes to a POTW, they are contributors."

Rampton, S. 1998. Let Them Eat Nutri-cake: Merriam-Webster Thinks Our "Biosolids" Don't Stink. *Harper's Magazine* 297(1782):48. November. **#2. The words biosolids v. sludge.**

Randall, Tom. 2000. A Death in the Night, Yet EPA Maintains Breathing Dried Human Waste is Safe. *Environment News.* June. #**3. Concerned citizens, pathogens.** Shayne Conner, Greenland, NH death case.

Raver, Anne. 2001. A Land Rush for Compost in the City. *The New York Times*. June 17.

Raymond, Lyle, Ken Cobb and Clifford Scherer. (1993) Winning When You Have Lost: Cutting Your Losses with Host Community Benefits. Cornell University Waste Management Institute Fact Sheet #5. Reprinted in NYSBA Law Studies, Vol. XVIII, No. 2, Special Edition.

Ready, Carol and Dan Sturgill. 1993. Beyond a Public Meeting, the Evolution of the Boulder Park Project. *Entering a New Era*. Alderbrook, WA. Northwest Biosolids Management Association Annual Biosolids Management Conference. 18. #**1.** Discusses how the process of educating the farmers on biosolids applications was a great way for the public to see local sponsorship and support of these biosolids applications.

Reardon, David J. and Joseph G. Haworth. 1999. How to Give a Really Lousy Presentation: Part 2. Water Environment Federation: 72nd Annual Technical Conference and Exposition. **#1. Communications**. Recommendations for effective public speaking presentations by water quality professionals.

Reardon, Kate. 1998. Public Works Scientist Instrumental In Getting Word Into Dictionary. *The Herald*. July 25. #**2.** "Words imply different values. This (biosolids) is a totally different product (than sludge) that has gone through a natural process."

Reed, Chris. 2000. Kern Tiring of O.C. Sludge. *The Orange County Register, Sunday*. July 16. **#3. Liability.** History and development of Kern County biosolids ban. Discussing the estimated increase in cost of $3.20 per customer that would occur if Orange County, CA biosolids had to be trucked to Arizona or Nevada, a Kern farmer says 'We're billions of dollars at risk,…we don't think [$3.20 a year] is exorbitant.'"

Rembert, T.C. 1998. Strategic Retreat on Organics. *E Magazine: The Environmental Magazine* 9(4):27. July/August. #**4, organic foods market, land application, biosolids.**

Renn, Ortwin, Thomas Webler, and Branden B. Johnson, Summer 1991, "Public Participation in Hazard Management: The Use of Citizen Panels in the U.S." *RISK -- Issues in Health & Safety*, 197-226. **#1. Public participation.** Explains the citizen panel process and its theoretical underpinnings. The analytical methods of the case study are not clear, although it draws some interesting conclusions that are consistent with this line of risk communication. The panel design did not resolve conflicts about values or lead to citizen acceptance, although it did increase mutual understanding among government, stakeholders, citizens, and technical experts. Suggests that the issues of greatest concern to the citizens around the New Jersey site were less about health consequences or odor and most about the long term impact that sludge application would have on the viability of farming and the rural landscape of the town. The authors argue that, for citizen panels to work, they need variability of feasible options; an equitable burden-sharing arrangement; randomly selected citizens (in stark contrast to the use of representatives from interest groups perspective); citizens with personal experiences that lead to feeling confident about learning and discussing the issues; and an openness of the sponsoring agency to seriously consider the panel's recommendations.

Renn, Ortwin, Thomas Webler, and Peter Wiedemann. 1995. *Fairness and Competence in Citizen Participation: Evaluating Models for Environmental Discourse.* Boston: Kluwer Academic Publishers. **#1. Public participation, communication.** A comprehensive evaluation of a variety of currently-used models for involving the public in environmental public policy decision-making, including citizen advisory committees, planning cells, citizens juries, the Varresbecker Bach participatory process, regulatory negotiation, mediation, compensation and voluntary siting of noxious facilities, and Dutch study groups. Each model is discussed by an advocate and a critic. Based on a 1992 workshop in Morschach, Germany that addressed the questions "How can environmental policies be designed in a way that achieves both effective protection of nature and an adequate representation of public values? In other words, how can we make the environmental decision process competent and fair?"

ReSource Institute for Low Entropy Systems. 1998(a). Email correspondence about sludge between Jim Chisholm, chair of the Environmental Committee of the Canadian Union of Public Employees Loc. 79 and Laura Orlando, director of the ReSource Institute. April 1. http://www.riles.org/musings5.htm.

ReSource Institute for Low Entropy Systems, The. 1998(b). The EPA's Slight of Hand: Laundering Radioactive Sludge in Denver. August 28. http://www.enviroweb.org/issues/sludge/.

Resource Recycling Systems, Inc. 2000. *Biosolids Composting Overview*. One-page fact sheet.

Rich, Richard C., Michael Edelstein, William K. Hallman, and Abraham H. Wandersman, 1995, Citizen Participation and Empowerment: The Case of Local Environmental Hazards. *American Journal of Community Psychology*, 23(5):657-. **#2. Personal control, empowerment.** Environmental hazards carry threats of physical and financial harm, disruption of social networks, and loss of personal control, which in turn can fundamentally disempower individuals and communities since established mechanisms for collective action (local government, civic groups, etc.) are often unable to respond effectively to the threat. Empowerment is a mechanism by which people, organizations, and communities gain mastery over their affairs. Empowerment at the individual level (psychological empowerment) has three dimensions: 1) intrapersonal - perceived personal capacity to influence social and political systems; 2) interactional - knowledge and skills to master social and political systems; and 3) behavioral - actions that influence social and political systems. An empowered community is one that initiates efforts to improve the community, responds to threats to quality of life, and provides opportunities for citizen participation. An empowering organization facilitates confidence and competencies of individual members and empowered organizations influence their environment. Participating in decision making can be empowering or disempowering, depending on the nature and outcome of the experience. If governments fail to respond to citizens' concerns or use technical experts to discredit those concerns, citizens may feel abandoned by the one institution that was supposed to be under their control and protecting their interests. Paradoxically, all the conditions of disempowerment can be the seeds of empowerment, promoting an "enabling response." As a result of people's isolation from others in the community and the inability to rely on traditional institutions, they may develop a sense of common purpose among themselves and create new institutions specifically to meet the challenges. The communities response to local hazards is shaped by interaction of two broad factors: 1) community's capacity for responding to the problem, as determined by a combination of individual characteristics and social institutions; and 2) capacity of formal institutions for responding to citizens and involving them in decision making. Individuals and communities may be empowered or disempowered by the experience, regardless of whether or not the hazard is removed. Reactive empowerment (capacity acquired in response to a threat) is different from proactive empowerment that facilitates the pursuit of chosen and desired activities. There are four forms of empowerment; it is possible to achieve some forms without achieving the others and because different forms have very different implications for actual power relationships. All four forms are necessary for community empowerment. Formal empowerment is created when institutions (governments, businesses) provide mechanisms for the public to influence decisions which interact with the characteristics of the affected citizens and their social institutions in such a way as to create real opportunities for citizens to be involved in decision making. Intrapersonal empowerment is a feeling of personal competence in a given situation. Instrumental empowerment refers to the individual's actual capacity for participating in and influencing a decision making process, as determined by the interaction of such factors as relevant knowledge, material resources, and persuasive ability with formal opportunities and legal standing to participate. Substantive empowerment refers to the ability to reach decisions that solve problems or produce desired outcomes, and it requires that citizens and formal institutions work together to reach decisions.

Richardson, Carolyn. 2001. How To Build Strategic Collaborations, With the Residuals Issue As A Case Study. *WEF/AWWA/CWEA Joint Residuals and Biosolids Management Conference*. February 21.

Richert, E. 1999. Taking the Offensive Against Sprawl. *BioCycle* 40(11):66-67. #**3, urban sprawl, odors, land application.**

Riviere, Peter. 1997. Sludge Spreading Goes Well With No Odors. *The Caledonian-Record*. June 2. New Hampshire.

Robb, D.J. 1998(a). Compost shutdown awaits December 2, Richfield Township gets order for closure. *The Plain Dealer*, Metro section, p. 1B. November 5. Ohio.

Robb, D.J. 1998(b). Richfield Compost Firm Bids To Reopen. *The Plain Dealer,* Metro section, p. 1B. December 5. Ohio.

Rockefeller, Abby A. 1999. Civilization & Sludge: Notes on the History of the Management of Human Excreta. *Current World Leaders*, Vol. 39, No. 6. Also available at www.riles.org/paper1a.htm. **#2**. **Chemicals, metals, nutrients, risk, lack of trust. "**Some of the major environmental organizations--including the Environmental Defense Fund (EDF) and the National Resources Defense Council (NRDC)--struck a deal with the EPA, which agreed to shut down ocean dumping if they would join in promoting land application as the long-term solution to the disposition of sludge. Both EDF and NRDC were among the signers of the "consent decree," the legal document mandating land application in place of ocean dumping. To many in these organizations, this must have seemed a very good arrangement: in one fell swoop it ended a poisonous process (ocean dumping) and, it seemed, began a very good one. Wasn't this a promise to "recycle"? Wasn't it "sewage farming" at last? ….The claim that "biosolids" are beneficial is based on the presence in the sewage sludge of nutrients deriving from human excreta. But the benefit of this content compared to the dangers of the toxic matter in it is a key point in the debate about land application of sludge. It is the view of this writer that the menace of toxic and otherwise non-life-compatible substances that can be found in sludge so greatly outweigh the potential nutrient benefit as to make that potential benefit an irrelevance…. The real significance of all this--of the names and numbers, of the long list of "anecdotes" about human illness, about cows and horses dying after eating hay grown on sludge and of people who live next to agricultural lands to which sludge has been applied developing strange illnesses--lies in the unknowability of it all: what goes down the drains is unpredictable; what goes into the sewer--from hour to hour, from week to week, from month to month--is unpredictable; what is extracted from the wastewater can neither be predicted nor monitored to an extent even remotely adequate. And no system of regulations can be either designed or enforced in such a way as to protect life chains from the potential of devastation by the constituents of sludge."

Rocky Mountain Water Environment Association. *Recycling Completes the Cycle.* Videotape.

Rocky Mountain Water Environment Association. 1995. *Guide to Dealing With the Media.* **#1. Media, public participation, trust.** "The central question in any public policy debate is whether the public debate is maturing in a positive way and moving toward your position….Public policy is like concrete. It is very pliable as it is poured from the concrete truck into the form. Once it is in the form, it is still pliable within the walls of the form. Once it starts to set up, however, it is very difficult to move. After it has hardened, it is impossible to destroy except with a jackhammer, piece by piece. In many cases, a better solution is to pour new concrete on top of the old to correct a deficiency. Therefore, in many public policy debate in which you intend to influence the outcome, it is important to commit adequate resources in the early stages of the debate, for this is where the outcome is most flexible and can be most influenced. In some cases, the debate will continue for years (as in the case of biosolids public acceptance)…. Although you do not have complete control of the public debate, you do have control over the messages that are delivered and how they are delivered. The effective delivery of these messages is the primary topic of this training."

Rocky Mountain Water Environment Association. 1996. Biosolids Factsheets. RMWEA Biosolids Committee.Topics: Biosolids Benefits to Farmers, Rangeland Application, Soil Compaction Issues, Conservation Compliance, Agricultural Site Restrictions, Public Access

Restrictions, Liability Issues, Surface Water Contamination, pH Changes and Salinity Concerns, Using Biosolids Compost in a Home Environment, Will Biosolids Cause AIDS?, Biosolids versus Septage.

Rodgers, S. 1994. The Role of Local Government in Land Application of Biosolids Programs. In *The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective*, Washington, D.C.: Water Environment Federation. 9-73–9-80. #**2, land application, local government, achieving public acceptance.**

Rodriguez, L. and J.W. Peterson. 1996. Sludge Under Suspicion: Explaining Perceptions of Risks from Relatively "Unknown" Technology. *Journal of Applied Communication*, 80: 12-25. **#1. Public perception, risk perception, risk communication.** A good example of a survey looking at many of the same interests and concepts as the survey conducted for this project, with similar findings. "Factors such as knowledge about the technology and trust in technology-generating institutions influenced people's decisions about the acceptability of applying treated sludge on Iowa's agricultural lands. Responding to a questionnaire mailed statewide, 700 respondents answered questions about three dimensions of acceptability of this practice: potential for individual use, potential for family use, and attitude toward a ban. Risk message characteristics, respondent's background, knowledge, and attitudes were tested as predictor variables through multiple regression. The findings provided support for normative/value types of decision making when it comes to less controversial, poorly understood risk topics such as sludge application in farms. Although knowledge of the topic correlated with support for the technology, trust factors were more powerful predictors. These results suggested that effective risk communication may be more a problem of ensuring trust than it is an issue of explaining risk/benefit analysis in lay terms. History of safe use and industry/regulator integrity were likely to impress the nonexpert far more than improved technical presentations."

Ropeik, David and George Gray. 2002. Risk. Harvard Center for Risk Analysis. **#3. Risk perception, risk management**. Presents statistical and scientific risk analysis of commonly perceived risks.

Rosenbaum, Walter. 1983. The Politics of Public Participation in Hazardous Waste Management. *The Politics of Hazardous Waste Management*, Duke University Press, Durham, NC. **#3: risk perception, risk management, public acceptance, public participation.** Citizen groups have increasingly gained access to the public decision making process around hazardous waste management issues, often by utilizing funds provided by USEPA's "Toxic Substances Control Act." Funding direct public participation was considered a reasonable manner of giving "equal time" to arguments made by citizen groups that were outspent and ostensibly overrun by technical arguments. The author traces the evolution of hazardous waste policies in light of increased citizen involvement. He observes that the venue for conflict and direct participation is now moving toward the state level, with the possibility that state agencies may be frozen and immobilized by the onslaught of an aroused and possibly ignorant public that demands government action inconsistent with sound technical handling of hazardous waste issues. The author advocates creation of many different opportunities for citizen participation in crucial phases in hazardous waste policy formulation.

Rosenfeld, Paul. 2000. The Answer is Blowing in the Wind: Options for Odor Control. *Storms on the Horizon*. Ocean Shores, WA. Northwest Biosolids Management Association 11th Annual Biosolids Management Conference. #**2. Odor.** "Perception very often defines public acceptance and for biosolids, perception is often directly related to what we smell instead of what we read or see or hear."

Ross & Associates Environmental Consulting. 2000. *Recommendation to the National Biosolids Partnership on a Biosolids EMS Third Party Verification Program*. Alexandria, VA: National Biosolids Partnership.

Rowe, G. and L.J. Frewer. 2000. Public Participation Methods: A Framework for Evaluation. *Science, Technology & Human Values*, 25(1), 3-29. **#1: risk evaluation, public acceptance, risk understanding.** There are a variety of public participation models that aim to consult and involve the public, ranging from the public hearing to the consensus conference. Because of the lack of appropriate benchmarks for evaluation, there is a general lack of empirical data on the quality of these methods. Authors suggest a number of theoretical evaluation criteria essential for effective public participation. They are of two types: acceptance criteria (representativeness, independence, early involvement, influence, transparency), which concern features of a method that make it acceptable to the wider public, and process criteria (resource accessibility, task definition, structured decision making, cost-effectiveness), which concern features of the process that are liable to ensure that it takes place in an effective manner. Authors express need for more research into these criteria and their applicability to the public participation models, the effectiveness of which are significantly influenced by contextual and environmental factors.

Rubens, Jim. 2000. NH Sludge Regulations Are Lax. *Valley News,* August 16. **#4 Class A, class B, groundwater, opposed.**

Rubin, Dr. Alan B. 1998. Statement before the Kern County Biosolids Ordinance Advisory Committee in Bakersfield California. December 1. #**2. Lack of trust. Urbanization.**

Rynk, R., M. van de Kamp, G.B. Willson, M.E. Singley, T.L. Richard, J.J. Kolega, F.R. Gouin, L. Laliberty, Jr., D. Kay, D.W. Murphy, H.A.J. Hoitink, and W.F. Brinton. 1992. *On-farm Composting Handbook*. Ithaca, NY: Northeast Regional Agricultural Engineering Service. **#3, composting issues (nutrient management, odor control), benefits.**

Rynk, Robert. 2000. Fires At Composting Facilities: Cause and Conditions, Part 1. *BioCycle*. 41(1): 54-58. January.

Sacramento Regional Wastewater Treatment Plant - Biosolids Program. *Biosolids Kids News.* **#2.** Creating a fun way of teaching kids about biosolids with games and language they can relate to.

Sacramento Regional Wastewater Treatment Plant - Biosolids Program. 1999. Biosolids Fact Sheets. #**1.** Likely the most thorough set of informational fact sheets covering various concerns/issues with biosolids (26 fact sheets).

Sacramento Superior Court. 2001. Sacramento Superior Court WRIT: Central Delta Water Agency, et. al. vs. State Water Resources Control Board. July 20.

Safesoil.com. 2000(a). 2K Interview with Carl Lindstrom. http://www.safesoil.com/iview.htm.

Safesoil.com. 2000(b). Sludge on Farmland Case Studies. http://safesoil.com/case.htm.

Safesoil.com. 2000(c). Threats to Sustainable Agriculture Through Agro-sludging. http://safesoil.com/.

Sahagun, Louis. 2001. Plan Would Bury Sewage Deep Below L.A. Harbor. *Los Angelos Times*. September 12.

Sala, Luis; Carlos Nieto; Francesca Camps, and; Joseph Maria Pages. 1998. Building biosolids acceptance. *BioCycle*, Vol. 39, Issue 6, p. 80.

Sandman, P. M. 1987(a). Communicating Risks: Some Basics. *Health and Environment Digest,* Vol. 1, No. 11, 3-4.

Sandman, P. M. 1987(b). Risk Communication: Facing Public Outrage. *EPA Journal*, Vol. 13, No. 9, 21-22.

Sandman, P.M., P.M. Miller, B.B. Johnson, and N.D. Weinstein. 1993. Agency Communication, Community Outrage, and Perception of Risk: Three Simulation Experiments. *Risk Analysis*, 13(6), 585-97**. #1: risk communication, risk perception, public acceptance, hazards, outrage.** Three studies were conducted with hypothetical news stories to compare the effects on reader risk perceptions of two situations: when agency communication behavior was reported to be responsive to citizens' risk concerns versus when the agency was reported to be unresponsive. In the first two experiments, news stories of public meetings filled with distrust and controversy led to a greater perceived risk than news stories reporting no distrust or controversy, even though the risk information was held constant. This effect appeared clearly when the differences in meeting tone were extreme and subjects made their rating on the basis of recall, but it was much weaker when the differences were more moderate and subjects were able to go back over the news stories to separate risk information from conflict information. In a third experiment, news stories about the cleanup of a spill varied the seriousness of the spill, the amount of technical information in the story, and the agency behavior and resulting community outrage. The outrage manipulation significantly affected both affective and cognitive components of perceived risk, but not hypothetical behavioral intentions. Seriousness and technical detail had very little effect on the perception of risk.

Sandman, P. M. 2000. Dealing With Outrage: A Key Communication Tool for Biosolids Professionals, Handbook. Workshop at *14th Annual Residuals and Biosolids Management Specialty Conference.* Water Environment Federation.

Sandman, Peter M.: www.psandman.com

Sarber, K. 1994. How to Strategize for Successful Project Development. *BioCycle* 35(4):32-35. **#1, land application, facility siting, public education, environmental campaign.** The strategies used for influencing voter support in political campaigns are increasingly being adapted by specialized professionals in developing environmental projects. Environmental campaign professionals approach project development with the same sensitivities to the media, the public, and the political dynamics as do their political consultant counterparts. Political campaign techniques that can be used for developing biosolids or recycling projects include public polling and tracking information, demographic identification, direct mail and video outreach, media imaging and shaping, grassroots coalition building, press crisis management, and a cadre of other activities. Specialized environmental campaigns are characterized by these types of proactive positioning tactics and are meant to create positive momentum for a project. These types of campaigns can overcome predictable obstacles to project sitings as seen in the recent successes of out-of-state biosolids land application programs and the siting of a pelletization facility in an urban setting.

Sasser, Larry. 1993. Exceptional Quality Biosolids: The Key to Public Acceptance. *Entering a New Era*. Alderbrook, WA. Northwest Biosolids Management Association Annual Biosolids Management Conference. 12. **#1. Biosolids quality.** This paper discusses shifting to Exceptional Quality for biosolids acceptance. "If the practice of beneficial use of biosolids by land application is to find sufficient public and elected official acceptance to allow siting in some difficult situations, it may be necessary to change the character of the material being applied."

Scharp, Michael. 2000. Why Colorado Farmers Want New York City Biosolids. *BioCycle.* July, 71-80. **#1.** "Ultimately, it's the performance of the biosolids that builds the end user demand….Getting to that point requires a high quality product delivered by a program that covers all the bases."

Scharp, Michael. 2001. The Nuts and Bolts of a Successful Land Application Project: NYC Biosolids in Colorado. WEF Joint Residuals and Biosolids Management Conference, San Diego, CA.

Schecter, M.T.; Spitzer, W.O. and Hutcheon, M.E. 1989. Cancer Downwind From Sour Gas Refineries: The Perception and the Reality. *Environmental Health Perspectives*, 79: 283-290.

Scherer, Clifford W. and Napoleon K. Juanillo Jr. (1990). Public Opinion About Proposed Host Community Benefits. Presented at the First United States Conference on Municipal Solid Waste Management; Solutions for the 90s sponsored by the U.S. Environmental Protection Agency, Washington, D.C., June 13-16.

Scherer, Clifford, W. 1991. Groundwater and Public Policy: Communicating Water Quality Risk Issues to the Public. A PA Soil and Water Conservation Society, Groundwater and Public Policy Series leaflet. http://hermes.ecn.purdue.edu/cgi/convwqtest?wq-17.pa.ascii. Follows the principles of Sandman, discussing levels of public outrage with regard to different imaginary events with potential impacts on groundwater quality. Notes the impact of public participation in decision-making and degree and quality of information shared. . "The best evidence we have does suggest the direction for long-term success: An open, informed, democratic process of decision-making, while more cumbersome than closed, expert decision-making, will be most likely to succeed inn designing effective policies that citizens will support to meet the emerging problems of groundwater protection."

Scherer, Clifford W. 1992(a). Communicating Water Quality Risk Issues to the Public. No. 17 Groundwater and Public Policy Series, Groundwater Policy Education Project funded by W.K. Kellogg Foundation in cooperation with the Farm Foundation; Cooperative Extension, Soil and Water Conservation Society and the Freshwater Foundation. **#3. Communications.**

Scherer, Clifford W. 1992(b). The Proposed Van Buren Landfill: A study of public concern and opinion. Final Report, Department of Communication, Cornell University, Ithaca, New York.

Scherer, Clifford W. 1993(a). Communication, Scientific Risk and Public Decision-Making. Proceedings from the National Extension Compost Utilization Conference, Minneapolis, Minnesota.

Scherer, Clifford W. 1993(b). *Public Participation: Risk and Waste Management*. National Extension Compost Utilization Conference, Minneapolis, MN**. #2: risk perception, public acceptance, risk understanding.** Despite generalized public acceptance of recycling MSW and composting of organic wastes, there is significant site-specific opposition to landfilling and composting facilities. Decision-making strategies include: 1. Technically-based processes, 2. Public relations approaches, 3. Community participation approaches. The author argues for a broader basis of community participation in the analysis and resolution of siting issues, with direct public participation from the outset.

Scherer, Clifford W. 1998. Communication, Scientific Information and Risk Management--A Case Study. Cornell University, Community and Rural Development (CaRDI). As described in the CaRDI newsletter, Fall 1998, see http://www.cardi.cornell.edu/news/newsletter/1998fall.cfm): "Clifford Scherer, Associate Professor in the Department of Communication at Cornell, examined how elected leaders received information on which to base their decisions, and the extent to which this information relied on science. Scherer found that there was only limited misinformation about the technical issues. Rather than misinformation, the problem was more one of the community's limited access to multiple perspectives. Although elected leaders perceived that there was a high volume of science-based information, that volume represented a recycling of limited information from a limited number of sources. Communities facing environmental risk situations, Scherer concludes, clearly need to concentrate on bringing quality scientific and technical information into the public information arena. This will help communities avoid, or have a satisfactory resolution of, controversies."

Scherer, Clifford. 1999. Communication, Scientific Information and Risk Management: A Case Study. From Community Development Reports, Cornell Community and Rural Development Institute, 6(3), Winter.

Schiffman, Susan S., J.M. Walker, P. Dalton, T. S. Long, J. H. Raymer, D. Schusterman, and C. M. Williams. 2000. Potential Health Effects of Odor from Animal Operations, Wastewater Treatment, and Recycling of Byproducts. *Journal of Agromedicine,* 7 (1). **#3. Odors, health effects.** A paper that touched off considerable discussion due to its implication that malodors may cause health effects.

Scholler, D.C., and T. Battenfield. 1999. Public Acceptance a Key Part of a Successful Biosolids Reuse Program. In *WEF/AWWA Joint Residuals and Biosolids Management Conference: Strategic Networking for the 21st Century Conference Proceedings*, Charlotte, NC: WEF/AWWA. January 27-30. #**1, application of end product, educating public/become aware of product.** Public opinion and public acceptance can limit the success of a biosolids reuse program. The public must understand the value of biosolids and feel comfortable with the reuse of biosolids. The City of Houston operates a uniquely challenging biosolids management program due to the size and magnitude of its utility system. The City owns and operates 50 wastewater treatment facilities located throughout the City in a large geographical area. The service area contains over 105,221 hectares (260,000 acres) that includes a customer base of over 1.7 million citizens. The City's treatment plants together treat an average of 946,000 cubic meters per day (250 million gallons per day) of wastewater. From this flow, an average of 163 dry metric tons per day (180 dry tons per day) of biosolids are produced. Based on this complex and dispersed network of treatment plants, the City of Houston has developed an effective, award-winning, regional approach to processing and beneficial reuse of biosolids. Building on this regional framework, the City has developed a beneficial use program that features two alternate disposal pathways – distribution and marketing of heat-dried material and land application of lime stabilized or aerobically digested material. The City of Houston beneficially reuses almost 99 percent of the biosolids that are produced, and public acceptance plays a key role in the success of its program. The City has actively worked to promote biosolids and to improve public acceptance. Its efforts have included a utility bill insert, a public service informational video, a public service announcement for radio broadcast, a public service announcement for television broadcast, and participation in local lawn and garden trade shows. The City also has produced an informational video for presentation to civic associations, schools, garden clubs, etc. This proactive effort by the City of Houston has contributed to the success of its biosolids reuse program. "A number of key pathways to successful marketing in Texas have been identified. Critical elements include education of the end user, focus on biosolids as a recycled product, technical knowledge of market needs, consistent product quality, and organizational flexibility. Farmers are generally not aware of the benefits of using biosolids, but are very familiar and accept chemical fertilizers as a part of their operations."

Science and Health Network. 1998 "The Precautionary Principle--A Common Sense Way to Protect Public Health and the Environment," Windsor, ND. **#2. Philosophical difference. Politics.** This principle represents an important conceptual framework within which many environmental groups are working; it places the burden of proof for the safety and benefit of any human action on the proponent of the action. This principle is cited as part of the underlying philosophy for lower biosolids trace metals limits within the European Community.

Scruton, D. 1991. Memorandum to George Dunsmore, Commissioner of Agriculture regarding "Ruane Farm, No. Clarendon, VT." Vermont Department of Agriculture. June 27.

Seattle Times. 1997. Here Are Answers About Practice of Recycling Wastes. *The Seattle Times.* July 20.

Seif, James M. (DEP Secretary). 2000. Report on the Investigation into the Application of Biosolids at the Al Hamilton Mountain Top Mine Site and the Death of Tony Behun, Bureau of Investigations, Pennsylvania Department of Environmental Protection. Available on the PA DEP web site.

Sellew, Paul and Lorrie Loder. 2001. Composting and Public Acceptance. Water Environment Federation, Specialty Conference Paper.

Sewage Sludge Homepage. 2000. Sludge on Your Supper Table. http://www.enviroweb.org/issues/sludge/ **#3. Concerned citizens, metals.** Concern about Toronto biosolids recycling program.

Shaheen, Jeanne. 2000. A Proclamation: Biosolids Recycling Day, May 16, 2000. Concord, NH.

Shields, Helane. 1997. Shields Urges Voters to Petition for Articles to Ban the Use of Sludge to be Placed on Town Warrants. *Granite State News*, January 22. **#3. Concerned citizens, metals, land application.** Many claims about problems with "sludge." Effort for local bans.

Shields, Helane. 1998. Sludge on Farmland Case Studies. www.websida.com/danger/case.htm. January. **#3, silage from land-applied biosolids on farms, concerned citizen.**

Shimp, Gary F., Blake Childress, Mike Sweeney, Saeed Assef, and Derel Guthrie. 2002. A Solid Finish. *Water Environment & Technology*, February, pp. 40-48.

Shiralipour, A., and J. Zachary. 1993. *Compost Market Development: A Literature Review*. Prepared for the Santa Barbara County Solid Waste Management Division and the California Integrated Waste Management Board. October. #**4, composting, marketability.**

Sierra Club, Hawaii Chapter. 2000. Sewage Sludge Policy Statement. http://www.sierraclub.org/chapters/hi/info/policy/sludge.htm #**2. Concerned citizens.** "It shall be the policy of the Sierra Club, Hawaii Chapter, to seek an end to the disposal of toxic substances into sewage systems. Until that time, we oppose sewage sludge composting and the use of sewage sludge products as fertilizers and soil amendments."

Sierra Club, New Hampshire Chapter. 1999. Sewage Sludge in New Hampshire: Questions and Answers. Concord, NH: NH Sierra Club. **#3. Chemicals, pathogens, lack of enforcement/oversight, concerned citizens.** A two-page sheet that outlines the concerns in NH. "There are hundreds of sludge victims nationwide. People and livestock have been harmed, drinking water has been contaminated, land rendered unusable. Most of these cases are not 'documented' because of out of court settlements, because federal and state agencies often ignore complaints, or because complaints are not investigated adequately."

Sierra Club, New Hampshire Chapter. 2000. *Policy Driven Water Pollution: The Dangers of Using Sludge to Reclaim Gravel Pits in New Hampshire.* Concord, NH: Sierra Club/NH. **#3.**

Groundwater, opposed, nitrates, metals, chemicals, pathogens. "Cases are beginning to be documented of polluted wells, contaminated soil, damage and death to livestock, illness among wastewater treatment plant workers, and illness among people who have been exposed to sludge. There have been at least two deaths that have been linked to sludge spreading" (references Cherry, above). ""Federal sludge regulations are not scientifically defensible….Sierra Club vs. NEBRA on gravel pit sludging….Using sewage sludge and industrial paper mill sludge to reclaim New Hampshire gravel pits can not be defended on scientific grounds."

Sierra Club, Pennsylvania Chapter. 2000(a). Sewage Sludge Hits the Fan in Centre County, A Public Letter from Len Martin and PAPS: People Against Power Sludge. http://pennsylvania.sierraclub.org/ moshannon/fctryfrm.htm. 2000. **#2**. **Concerned citizens. Metals, chemicals, pathogens.** A long and thorough list of concerns about sludge use.

Sierra Club, Pennsylvania Chapter. 2000(b). Statement regarding *E. coli* contamination from manure at Walkerton, Ontario. http://pennsylvania.sierraclub.org/moshannon/fctryfrm.htm. **#4. Manure, bad management.** Biosolids were initially targeted for blame for these unfortunate deaths.

Sierra Club. 2001. EPA Sewage Sludge Rules Do Not Protect Health and the Environment- How Can You Learn More and Help? Sierra Club. March.

Sierra Club. 2002(a). National Sewage Sludge Guidance. Circulated by email delivery; copy available from NEBRA or at http://www.sierraclub.org

Sierra Club. 2002(b). News Release: Sierra Club Asks EPA to Protect Communities From Toxic Sewage Sludge. July 3.

Similkameen Spotlight, The. 1992. Novel Use of Treated Wastewater Sludge Proposed To Help Reclaim Nearby Mine Sites And Promote Plant Growth On Rangeland. September 9. #**2. Nutrients. Land application. Education. University involvement.** Research findings from the University of B.C. were utilized in communicating benefits of biosolids.

Similkameen Spotlight, The. 1997. Green Grass Attracts Cattle. June 11. **#3. Appearance. Wildlife impacts. Land application. Education.** Biosolids not mentioned in article, but is referring to the development in Princeton. Ironic that they now have a cattle issue.

Similkameen Spotlight, The. 1998(a). GVRD Reports Progress on Mine Reclamations. April 22. **#2. Dust. Nitrogen. Nutrients. Land application. Education. Media campaign.** *Similkameen Spotlight, The.* 1998(b). Symposium Showcased Princeton Project. September 22. **#2. Dust. Land application. Politics. Regulatory Climate.** Former regulatory inspector expressed his pleasure in the results of the project and all attendees at the Mine Reclamation Symposium were equally impressed.

Similkameen Spotlight, The. 1998(b). Mine reclamation projects on display as part of symposium. September 23. **#3. Dust. Land application. Education. Media campaign.** Media and demonstration areas were used as way to spread the news about the beneficial use of biosolids recycling.

Similkameen Spotlight, The. 2000. Mayer Inspects GVRD Project. October 17. **#3. Odor. Dust. Appearance. Land application. Education.** Discusses concerns about odor, but project managers made one-on-one efforts to address concerns (even delivered roses to local residents).

Simpson, T. W., S. M. Nagle, and G. D. McCart. 1984. Agricultural Use of Sewage Sludge: Questions & Answers. Virginia Tech pamphlet.

Singer, Eleanor and Phyllis M. Endreny. 2000? (retrieved from website 2003). Reporting on Risk: How the Mass Media Portray Accidents, Diseases, Disasters, and Other Hazards. Available at http://www.fplc.edu/risk/vol5/summer/singer.htm **#2. Media, risk perception.**

Singer, Raymond. 1999. Neurotoxicity from Municipal Sewage Sludge. http://members.aol.com/neurosite/sewage.htm.

Singer, Raymond. 2000?. Neurotoxicity from Municipal Sewage Sludge. An unusual article by a doctor that is cited by some opposed to biosolids.

Sjoberg, L. 2000) Factors in Risk Perception. *Risk Analysis*, 20(1), 1-11. **#2: risk perception, public acceptance, cultural theory, psychometric analysis.** Researchers have generated a number of models to explain public perception of risk, particularly as they relate to perceived risks of nuclear power, but none has taken hold as authoritative. There are, however, some generalized observations that can be made regarding public risk perception. Technical risk estimates are sometimes a factor in accounting for perceived risk, but in many important applications it is not. Heuristics (representativeness, availability, and anchoring) and biases account for only a minor portion of risk perception, and the influence of media are apparently not as significant in risk perception as had been believed. The psychometric model is widely supported, but explains only about 20% of variance in the data. Cultural theory (i.e. risk perception relates to generalized ideology) explains only 5-10% of the variance of perceived risk, and other value scales have also failed to explain the variance. The author proposes a model in which attitude, risk sensitivity, and specific fear are the variables, and which account for 30-40% of the variance. This model offers a different approach to the relationship between attitude and perceived risk.

Slovic, Paul; Baruch Fischhoff; and Sarah Lictenstein. 1980. Facts and Fears: Understanding Perceived Risk. In Richard C. Schwing and Walter A. Albbers Jr. (eds.) *Societal Risk Assessment: How Safe is Safe Enough?* New York: Plenum, 181-216.

Slovic, P., B. Fischhoff and S. Lichtenstein. 1990. Rating the Risks. *Environment*, 31, 5-20, 36-40.

Slovic, P. and Layman, M. 1991. Risk Perception , Trust and Nuclear Waste: Lessons from Yucca Mountain, *Environment*, 33(3), 6-9. **#1: risk perception, trust, nuclear waste, radiation, siting.** Reports that public fear of nuclear power has become a major obstacle to the US government's search for a suitable site for storing radioactive waste. Describes how the results of four recent surveys of public perceptions of the risks from nuclear waste storage may help industry officials understand and resolve the current impasse. The author states that industrialists, scientists, politicians, and the public are united only in their anger and frustration over the ways that environmental risks are currently managed. He then posits a generalized notion that nuclear power advocates can overcome public resistance only when they overcome public mistrust of technology, without stating how that may be accomplished. Without much data to support this notion, the author recommends “aggressive and competent government regulation, coupled with increased public involvement in the decision making process”.

Slovic, P. 1993. Perceived Risk, Trust, and Democracy: A Systems Perspective. *Risk Analysis*, 13, 675-682. **#2: risk perception, trust, environmental justice, fairness.** People are generally disturbed by uncertainty, and there is a tendency for non-technical individuals to perceive science and technology as fixed and certain. Therefore, the suggestion that risk assessment does not identify a fixed and immutable numerical expression of risk is very unsettling to the public. Descriptions of uncertainty in risk estimates may undercut any illusion of safety and may confuse people or even cause outrage.

Slovic, P. 1999. Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis*, Vol. 19, #4. **#1. Risk perception, risk assessment, risk communication.** An important critique of the limitations of risk assessment and the need for stakeholder involvement in the risk assessment process.

Sludge on Farmland Case Studies. http://www.safesoil.com/case.htm, retrieved December 5, 2000.

Sludge. 1995. Washington Coalition Uses Education to Achieve Approval for Reuse Project. Vol. 20 Number 13. June 20. #**2. Safety. Land application. Concerned citizen involvement. Facility siting.** "The county worked through private citizens to introduce biosolids in eastern Washington. Instead of a group of governmental officials trying to convince the public of biosolids safety, individuals and firms from within communities explained the projects."

Sludge. 2000(a). California OKs Land Application Rules that are More Time and Cost Efficient. 25(18):175. **#3, land application, health effects, lower property values.** California's State Water Resources Control Board (SWRCB) adopted requirements August 17th for biosolid land application that will be more time- and cost-efficient and more environmentally restrictive than federal regulations, according to board staff.

Sludge. 2000(b). New Jersey Company Gets Approval to Apply Biosolids in Pennsylvania. 25(21):210. **#3, land application, suspicious citizens, contact list, heavy metals, odors.** A New Jersey business that spreads sludge onto farmland is hoping to fulfill its plans to apply its biosolids in Pennsylvania later this month. But many citizens and community leaders in western Pennsylvania are trying to prevent the application in the long term or at least regulate it more stringently.

Sludge. 2000(c). Judge Allows California County Ban On Application of Biosolids on Farms. 25(25), 242. Business Publishers, Inc. **#3.** Kern County.

Sludge. 2000(d). The Internet is Fueling the Debate. 25(8), 171. Business Publishers, Inc. **#3. Media, communications.** "While the ADA says there shouldn't be any dispute about flouridation, those opposing flouridation have been using the Web to put out their views."

Sludge. 2001(a). EPA Supports Management Programs to Help Meet Biosolids Regulations. Silver Spring, MD: Business Publisher's, Inc., 26(13):122, June 25.

Sludge. 2001(b). The Good and the Bad. Silver Spring, MD: Business Publisher's, Inc., 26(13):121. June 25.

Sludge. 2001(c). California Decisions Causing Changes to Biosolids' Generators, Haulers. Silver Spring, MD: Business Publisher's, Inc., 26(14):132. July 9.

Sludge. 2002. EPA Inspector Report Does Little to Settle Biosolids Disputes. Silver Spring, MD: Business Publisher's, Inc., 40(7):68. April 8.

Smith, Bill. 1991. Indians Threaten Blockade To Stop Sludge Dumping. *Victoria Times Colonist.* February 20. **#2. Odor. Land application. Local ban. Lack of trust. Education.** Native Indians felt betrayed that land application of biosolids made in their territory. "Another example of the white man putting his smelly burden on land housing native Indians."

Smith, C.T. and J.M. Carnus. 1997. Biosolids: Planning and Design. *The Forest Alternative.* Seattle, WA. Northwest Biosolids Management Association, University of Washington

College of Forest Resources, United States Environmental Protection Agency, and Georgia Department of Natural Resources. #**3. Urbanization.**

Smith, Gail. 1991. Sludge Seeks More Savory Image. *The Charlotte Observer.* April 17.

Smith-Heavenrich, Sue. 1998. Effects of Sludge on Crops and Livestock. *New England Country Folks,* February 23. **#3. Metals, pathogens,**

Smyth, J.R. 1994. Operation of a Privatized Solids Drying Facility at a Sensitive Site. In *Proceedings of the Water Environment Federation 67th Annual Conference & Exposition, WEFTEC '94,* Chicago, IL: Water Environment Federation. October 15-19. 609-620. #**2, odor, dust, affected neighbors.** The King County Department of Metropolitan Services (Metro) has entered into two contracts with a private vendor (PCL/SMI) for the construction and operation of municipal wastewater solids drying facilities. The first of these facilities has been successfully processing digested solids using indirect dryers at an off-site location since May 1993. The facility is currently drying and beneficially reusing an average of 18 to 23 dry metric tons (20 to 25 dry short tons) of digested solids per day. This paper discusses lessons learned from startup and operation of the off-site solids processing facility with a focus on mechanical and operational modifications implemented to minimize or eliminate impacts on the surrounding community. The facility suffered through an extended startup period characterized by equipment failures, odor production, and concerns regarding air emissions. However, by working with the community, developing a new contract that enabled the contractor to operate at a reduced capacity, and persistent effort and capital investment by the private contractor, the problems were effectively addressed. The facility now operates at 82.5 percent of the original design capacity with minimal impact on the adjacent community. Performance tests to further increase the contract capacity are anticipated. A 95 percent solids "Class A" granular product is produced and markets are being developed for use as a soil amendment.

Snyder, David, and Frederick Kunkle. 2001. Health Fears Over Sludge Spur Quest for Controls: EPA Stand Challenged After Suspicious Deaths. *Washington Post.* B01. August 6.

Social Issues Research Centre, in partnership with the Royal Society and the Royal Institution of Great Britain. 2001. *Guidelines on Science and Health Communication*. November, pp. 1-8**. #1. Fairness, communications, media relations.** An excellent guidance document explaining the roles and responsibilities of media/reporters and those providing information to the media (e.g. plant managers, biosolids managers).

Solomon, John. (a). EPA Cites Sludge Recycling Concerns. *The Burlington Free Press,* February 7.

Solomon, John. 2002(b). Internal Probe Cites EPA for Lack of Research. *The Union Leader.* February 7.

Sorber, Charles A. 1994. Biosolids: A Blueprint for Public Acceptance. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation. 15-17. #2. Describes the Water Environment Federation/Powell-Tate plan for education and outreach regarding biosolids recycling. "It has been said that it takes 20 years to make an overnight success. Public acceptance of biosolids won't happen overnight, but it won't take 20 years, either. What it does require is sustained commitment…."

Stamp-Vincent, F.A. and M.J. 1999. Give us analysis. *The Keremeos Review*. April. **#2. Groundwater. Surface water. Class A. Class B. Local soils/climate/natural conditions. Education.** Presented concerns, but also thanked Braman for providing answers.

Stark, S.A. 1993. Building Acceptance. *BioCycle*. 34(4):78-80. #2, important concept, land application, increasing public knowledge.

Stauber, John and S. Rampton. 1995. *Toxic Sludge is Good For You.* Monroe, ME: Common Courage Press. **#1. Lack of trust, concerned citizens, politics, public relations.** A classic "exposé" of the public relations industry, including a chapter on the topic of the book's title: biosolids recycling. Critiques the Powell-Tate/Water Environment Federation efforts to improve public acceptance of biosolids (see Powell-Tate, above). Commonly cited and quoted (e.g. see Bleifuss, above).

Staudinger, Henry J. 1999. Land Application of Sludge (Biosolids), The Uncensored Story. A presentation to the Water Environment Federation seminar, Richmond, VA, November 4. http://www.safer-world.org/e/topics/sludge.htm . **#3 Concerned citizens, land application, lack of oversight/enforcement, liability, odors.** "I have been asked to address citizen concerns related to land application of sludge, and to focus on more than just the odor issue. My comments are based on personal experience, experiences of other victims, review of thousands of pages of scientific and permit documents, meeting with numerous experts, and unsuccessful efforts to interest the regulatory community to better address demonstrated sludge risks….Current permit policies and practices in Virginia are totally inadequate to protect public health and water quality where sludge is land applied.

Stevens, Jane E. 1998. Sludge-fest, Scientists Exchange Verbal Blows Over Risks of Recycled Sewage. *The Dallas Morning News*. March 23. **#1, biosolids safety, deals with both sides of issue.** One of the best popular press treatments of biosolids recycling concerns and responses to those concerns. It begins “at a major scientific meeting at which a shouting match erupted between Cornell University scientists and people in the business of selling biosolids – treated municipal sewage familiarly known as sludge. But the issue – raised during a gathering in Philadelphia of the American Association for the Advancement of Science – was not a debate between scientists expounding the truth and greedy businesses concerned with profits, as it appeared on the surface. The simmering disagreement recently erupted to involve the entire community of researchers who have been working for the past 25 years to find a safe way to enrich and replenish soils by recycling human byproducts.”

Stier, Jeff. 2000. Facts Versus Fears: How Science Does or Does Not Influence Public Opinion and Policy. *14th Annual Residuals and Biosolids Management Conference.* Water Environment Federation.

Stoddard, Carolyn L. 2001. Hill Man Hopes to be the First to Obtain Biosolids Under New Rules. *The Telegram*, 12(34), June 7-13. New Hampshire.

Stowe, Gene. 1987(a). Mecklenburg Sludge Not Welcome, Union County Board Informs State. *The Charlotte Observer.* August 4.

Stowe, Gene. 1987(b). Union County to Consider Taking Sludge. *The Charlotte Observer.* July 31.

Stowe, Gene. 1988. Union County to Air Plan for Sludge. *The Charlotte Observer.* February 16.

Stowe, Gene. 1989. The Ever-Arguing Monroe, Charlotte-Mecklenberg, and Union County Governments Have Found Some Common Ground. *The Union Observer.* March 26.

Stowe, Stacey. 1999. Dealing With Odor From Plant. *New York Times, Connecticut Weekly,* December 12, 1999. **#4.** Reports on the fire that destroyed the Hartford, CT biosolids composting facility.

Student Environmental Action Coalition. 1999. Letter to the Editor: Lowry Landfill. University of Colorado, Boulder. http://ucsu.colorado.edu/~seac/index2.html.

Stukenberg, J.R., S. Carr, L.W. Jacobs, and S. B. 1993. *Final Report, Document Long-term Experience of Biosolids Land Application Programs*. Water Environment Research Foundation, Project 91-ISP-4. #**2.** Ten successful, long-term, biosolids reuse programs were evaluated. The programs ranged from agricultural to dedicated sites. Both of the dedicated sites [SMSD (Springfield, IL) and Albuquerque, NM] owned the land used. Some of these programs use their own land [HRSD (Virginia Beach, VA); Ag-Tech (Yuma, AZ); Raleigh, NC; and MWRDGC (Chicago, IL)], while others rely on private farmland [Port Huron, MI; MWRD (Denver, CO); Sparks, NV; and MMSD (Madison, WI)]. Most of the programs using only private farmland have considered the purchase of land for application purposes. In fact, the MWRD (Denver, CO) purchased 10,000 acres following the project team's site evaluation visit. The MWRD plans to use the land for application manage the entire program, including the farming. Typically, the biosolids generated by these publicly owned treatment works (POTWs) had metal concentrations below those specified as the Pollutant Concentrations in the 40 CFR Part 503 regulations. (Note: MWRDGC data evaluated in this study were above these limits, but the MWRDGC recently reported that metals concentrations have been reduced to below the limits through increased enforcement of pretreatment standards.) The trace element concentrations in the biosolids have shown a decreasing trend at all of the sites. Sampling protocols and analytical methodology varied among and within programs. The intensity of sampling and the number of parameters monitored varied widely. Differences in analytical procedures and laboratories used to make it difficult to compare different programs against one another as well as test results from earlier samples with more recent test results. Increased nitrate concentrations could be detected in groundwater near some biosolids application sites in humid climates. At SMSD (Springfield, IL) and Raleigh, NC, this appeared to be related to the unusually high biosolids applications, but at HRSD (Virginia Beach, VA), high nitrate levels were shown to exist prior to biosolids application. In a field study at MMSD (Madison, WI), increases in nitrate levels in groundwater under biosolids-amended fields were found to be similar to levels below manured or commercially fertilized fields. Accumulation of metals in the soil was observed. Where total metal concentrations were available, the applied metals could generally be accounted for in the top 12 inches of soil. Some increases in the concentration of metals, especially zinc and cadmium, were found in the plant tissue at some of the sites. Accumulation of nutrients in the soil was observed in some fields where loading rates exceeded the nutrient requirements of the crops grown. For example, significant increases in available phosphorous levels occurred at several sites. If long-term programs are to remain environmentally sound, over-application of phosphorous must be avoided. All of the programs have adopted a pro-active public relations stance by informing the media about activities of the program by holding farm and classroom demonstrations or by inviting the public to visit. Some programs, such as Ag-Tech, also have a concerted outreach effort directed at educating legislators and regulators. Those programs that have their normal activities visible to the community tend to have a greater degree of community involvement in governing how their program operates. Benefits from biosolids application to land included reduced fertilizer costs for farmers, reduced disposal costs for the POTWs, reduced water usage in arid climates, and reclamation of minespoil. Biosolids were generally applied for free. MWRD (Denver, CO) and MMSD (Madison, WI) currently charge a nominal fee for biosolids application, but both fees are still less than one-third the cost of commercial fertilizer nutrients. Ag-Tech reported a 26 percent reduction in the irrigation requirements of crops grown on biosolids-amended soils compared to unamended soils. No water usage comparison was available for any of the other programs. In general, the programs reported few technical problems, a fact that speaks well of the overall management and success of these long-term biosolids application programs. Most of the problems encountered concerned public opposition to some aspects of biosolids application to land.

Stulp, John R. 1995. Social, Political, and Educational Factors Involved in Facilitating Municipal Waste Utilization. In *Agricultural Utilization of Urban and Industrial By-Products,* American Society of Agronomy Special Publication no. 58, 1-9.

Sturgill, Dan. 1997. The Pathway to Becoming a Regional Site. *Illuminating the Future*. Vancouver, WA. Northwest Biosolids Management Association 9th Annual Biosolids Management Conference. #**2.** Provides suggestions on how to establish a successful regional site.

Successful Farming. 2000. What Do You Think About Applying Sewage Sludge? 98(2):26. February.

Sullivan, Dan. 1999. Toward Quality Biosolids Management: A Trainer's Manual. #**1.** Discusses how to develop a biosolids training course that is geared towards specific audiences (biosolids managers, farmers, public, etc.). Great public information section (Training Module 3) that discusses things such as what to know before siting an application area near neighbors.

Susskind, Lawrence. 1984. The Siting Puzzle: Balancing Economic and Environmental Gains and Losses. Presentation to the 13th Annual Conference of the Illinois Dept. of Environment and Natural Sciences, Sept. 13, 1984. **#1. NIMBY, siting.** An early clear explanation of the different levels of impacts on local residents of the siting of a facility that will have some negative local impacts. Discusses fairness and compensation of those most impacted.

Susskind, Lawrence and Patrick Field. 1996. *Dealing with an Angry Public: A Mutual Gains Approach to Rebuilding Trust and Improving Long Term Relationships*. New York: The Free Press. **#1. Trust, outrage, public participation.** An excellent book on the Mutual Gains Approach, risk communications, public participation.

Susskind, Lawrence, Sarah McKearnan, and Jennifer Thomas-Larmer (eds.). 1999. *The Consensus Building Handbook: A Comprehensive Guide to Reaching Agreement.* Thousand Oaks, CA: Sage Publications. **#1**.

Susskind, Lawrence, Paul Levy, and Jennifer Thomas-Larmer. 2000. *Negotiating Environmental Agreements: How to Avoid Escalating Confrontation, Needless Costs, and Unnecessary Litigation.* MIT-Harvard Public Disputes Program. Island Press. **#1. Conflict, consensus.** A primer on the mutual gains approach, including “negotiating as if relationships mattered.”

Sustainable Agriculture Network. 2002. Meeting the Diverse Needs of Limited Resource Producers. Sustainable Agriculture Research and Education program, U.S. Department of Agriculture. http://www.sare.org/bulletin/limited-resource **#2, communication, information.** Provides examples of outreach and communication with farmers who have limited resources, ideas for how to work with resource-limited populations toward changing behavior.

Swedish Association of Food Processing Industries. 1999. Letter to the Swedish Department of the Environment re: the use of sewage sludge on farm land. http://www.safesoil.com/liletter.htm. September 6.

Swinwood, J.F., and T.E. Bates. Sludge Disinfection by Irradiation: A Canadian Approach to Recycling. *Specialty Conference on the Status of Municipal Sludge Management for the*

1990s, New Orleans, LA: Water Pollution Control Federation. #**4, public concerns and how irradiation alleviates them.**

Switzenbaum, M.S., L.H. Moss, E. Epstein, A.B. Pincince, and J.F. Donovan. 1997. *Defining Biosolids Stability: A Basis for Public and Regulatory Acceptance*, Project 94-REM-1. Alexandria, VA: Water Environment Research Foundation. **#3. Product quality, best management practices.** Provides information on treatment technologies that are key to producing marketable results, as well as information on biosolids stability criteria and recommendations for definitions of stability for various biosolids processes.

Synagro Technolgies, Inc. 1999. Advertising brochure.

Synagro Technologies, Inc. 1999. The Organic Waste Cycle. Pamphlet.

Tackett, Stanford L. 1994. Op-Ed: The Sewage Sludge Scam. *The Indiana, PA Gazette*, October 2. **#3. Profit motive, pathogens, metals, chemicals, lack of trust, concerned citizens.** Professor Emeritus Tackett of the Indiana University of PA Chemistry Department states "The land spreading program for sewage sludge is a scam of enormous proportions, driven mainly by money."

Tacoma, WA, City of. 2000. TAGRO Mix, product description. http://www.ci.tacoma.wa.us/biosolids/tagro.htm

Talbot, Margaret. 2002. Hysteria Hysteria. *New York Times Magazine*, June 2. **#2. Risk perception, environmental attitudes.** Discusses small outbreaks of itching, rashes, and other minor ailments at a variety of schools around the U.S. and the theory that many of the cases were “sympathetic,” psychogenically-developed. “Terms like psychogenic illness and hysteria have such a checkered history that even talking about them in connection with real people can quickly become a fraught pursuit. It was the ancient Greeks who first identified hysteria as the manifestation of physical symptoms with no discernible organic cause…. The smart and sensible feminist critique of hysteria -- a huge academic literature exists on the subject -- has led to a good deal of healthy skepticism about the diagnosis. But it has also made many people unduly suspicious, perhaps, of the very notion that the mind can generate symptoms that only the body manifests. And this may be all the more true when we consider this phenomenon among groups of people in the grip of unexplained symptoms…. More recently, a fear of environmental contamination has become the most common source of psychogenic illness, but this complicates matters still further since, after all, there is such a thing as a real environmental hazard. People who are ill with multiple-chemical sensitivity and chronic-fatigue syndrome -- syndromes that many doctors dispute the existence of -- reject any discussion of a psychological component to these ailments as ignorance or insensitivity. But none of this should blind us to the fact that well-documented outbreaks of mass psychogenic illness do occur -- and not all that rarely. Between 1973 and 1993, there were 70 reports of mass hysteria in medical journals; most took place in self-contained communities, like schools, barracks, and factories. Sixty percent of the incidents of epidemic hysteria written up in English-language journals this century occurred in schools. "I continue to be struck by how much more common mass psychogenic illness is than people generally think," says Timothy Jones, who was the lead author of an article in *The New England Journal of Medicine* two years ago in which he identified a psychogenic outbreak of nausea and dizziness among 170 students and staff members at a Tennessee high school. "I bet you there are a ton of cases when professionals back in their office are saying, 'This is what we think it is.' But maybe in only one out of 100 cases is it going to leave the office, and when it does it will be maybe two or three years later in a journal article that the local community is never going to read. Public health people are going to be extremely hesitant about labeling an illness as psychogenic. Because as soon as you say that aloud, people are telling you, 'You're not taking it seriously, you don't believe us, you missed something, you're covering something up.' It makes people really, really mad to hear that diagnosis. So a lot of times when mass psychogenic illness occurs, you don't hear about it as such. Public health people will continue to say, 'We're looking at all the possibilities and not finding anything, and we're waiting for the final results.' And privately, they sort of just hope it goes away and people stop asking about it." Part of the problem with making a diagnosis of mass hysteria is that it carries such a freight of pejorative associations. Ever since the Salem witch trials, it has been seen as the kind of phenomenon that occurs only in "backward" communities or among religious zealots…. Most cases of epidemic hysteria are characterized by symptoms like nausea, abdominal pain, dizziness and lightheadedness -- all of which can be produced or aggravated by anxiety and hyperventilation. But there are also several documented cases of rash as a psychogenic symptom…. It's true that in most cases of actual chemical spills or water contamination, environmental investigations do reveal something amiss. In an article for *Psychiatric Times*, Jones reviewed outbreaks of mass psychogenic illness and compared them with incidents of confirmed toxic exposures; he "was unable to identify any outbreaks of acute illness from toxic exposures, with minimal physical findings, where the cause was not quickly apparent to investigators….' Why, exactly, the idea of psychogenic illness should be so offensive is a little baffling. In many other areas of life and health, we recognize and even celebrate the mind-body connection: think of alternative therapies, yoga, the placebo effect, endless magazine articles about reducing stress to improve physical health, meditation, the power of positive thinking. Sympathy reactions to other people in physical distress are a rather touching phenomena, really, revealing us for the social and interconnected creatures that we are. Yawning, queasiness, malaise, vague "funny feelings" and certainly itching are suggestible symptoms for adults."

Tannen, Deborah. 1990. You Just Don't Understand: Women and Men in Conversation. NY: Ballentine. pp. 281-298. **#2**. **Communications**. A groundbreaking book about the differences between the communication styles of women and men. In general, girls and women learn early in life to communicate in ways that enhance relationships, whereas men learn to communicate in ways that establish hierarchies. Given that the wastewater treatment and biosolids management industries, including engineering, have been traditionally dominated by men, the perspective provided by Tannen's work may be helpful in understanding how to improve communications and public relationships.

Taylor, Stephen H. 2002. An Unwise Controversy: Organic vs. Conventional. *Weekly Market Bulletin*, Concord, NH: Department of Agriculture, Markets & Food. 81(9), May 8.

Tedder, Steve, Cindy Finan, A. R. Rubin, Frank Post, and Trille Mendenhall. 1991. Public Information Concerns and Management. *Land Application of Sludge and Residuals Guidance Manual.*

Tenenbaum, D. 1997. The Beauty of Biosolids. http://ehpnet1.niehs.nih.gov/docs/1997/105-1/focusbeauty.html. Environmental Health, Vol. 105, No. 1. January.

Terratec Environmental Ltd. 1998. Land Application of Sewage Biosolids for Crop Production. http://www.terratec.com.

Terratec Environmental Ltd. 2000. Why Recycle Biosolids. http://www.terratec.com/biosolid.htm.

Thompson, Dan. 1995. Wetland Restoration with Biosolids and Yard Debris: Changing the Paradigm from NIMBY to YIMBY. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1.** Discusses how it was an overwhelming success to go out and talk one on one with the neighbors surrounding the project. The City of Everett gained internal support for the project from community members and the project was passed. The city collaborated with the community on what important aspects should be incorporated into the project.

Thompson, D.C., and B. True. 1994. The Future of Biosolids Recycling in the Pacific Northwest: Roadblocks, Roles and Responsibilities. In *12th Annual Residuals and Biosolids Management Conference,* Bellevue, WA: Water Environment Federation. 229-239. #**2, northwest states, self-implementation, public involvement.**

Thompson, Dan, Carol Ready, and Tanya Moll. 1996. From Sludge Management to Biosolids Recycling. *BioCycle*, February 1996.

Thompson, Lorrine. 2001(a). Residents Wary of Plan for Sludge Treatment. *The Olympian.* March 5.

Thompson, Lorrine. 2001(b). Yelm Residents Slam Proposed Sludge Plant. *The Olympian.* March 7.

Thorud, David B. 1994. The Communication Puzzle: Putting the Pieces Together. *Conveying the Message.* Chelan, WA. Northwest Biosolids Management Association 6th Annual Biosolids Management Conference. #**1.** Discusses the importance of maintaining alliances with environmental organizations and how demonstration projects aid in overall biosolids development and the public's acceptance of it.

Toffey, Willam E. 1997. Educating the Wastewater Industry on How to Market Itself. Presentation to the Ohio Conference on Land Applied By-Products. Columbus, Ohio. November 17-18.

Toffey, William E. 1999. Making Heroes of Wastewater and Biosolids Operators. Presentation to the Minnesota 10th Annual Conference on Land Application of Biosolids, Residuals, and Effluents, February 18.

Toffey, William E. 2000(a). Risks of Not Building Public Support for Biosolids. *BioCycle*. 4(1):76. **#2.** "We are at risk of losing our programs and increasing costs of our programs because of our failure to communicate the benefits of biosolids."

Toffey, William E. 2000(b). Gatekeepers:Who They Are? What They Think About Us? And What We Can Do About It? *14th Annual Residuals and Biosolids Management Conference, Boston, MA.* Water Environment Federation. **#1.** Suggests that gatekeepers are telling biosolids managers what to pay attention to: academics are encouraging support of further research, training, and development of outreach materials; water quality professionals are encouraging environmental management systems (EMS), training, and certification; public health officials are encouraging demonstration of best management practices, control of objectionable odors, attention to emerging health issues, and taking a firm stand in the public debate; agricultural institutions are supportive of biosolids recycling, but there is a need to work with them more; environmentalists encourage reduction of trace toxics in biosolids and embracing of the new environmental philosophies; regulatory officials encourage documenting compliance, standing up for biosolids, and industry self-regulation; and the media encourage openness and accessibility.

Toffey, William E. 2000(c). Having Fun with Biosolids: Examining New Ways to Communicate the Benefits of Biosolids. Unpublished comments to Biosolids Tek-Con, Atlantic City, New

Jersey, May 2000. #**2.** Ideas for better communications, public relations, marketing, and increasing public acceptance of biosolids from one of the nation's most creative thinkers on biosolids public acceptance issues.

Toffey, William E. 2000(d). Virtuous Biosolids: Earning Love for Biosolids Through Our Commitment to Virtuous Practices. Presentation to the Mining, Forest, & Land Restoration Symposium/Workshop, July 17.

Toffey, William E. 2000(e). Latex or Mylar Biosolids Balloons: MABA's Experience in Getting the New Biosolids Organization to Float. Mid-Atlantic Biosolids Association presentation to Ohio WEA Conference, December 1, 2000. **#2** "The tremendous breadth of responsibilities we in the biosolids/residuals business assume on technical, community, and research issues demands that we find better ways of getting these jobs done….MABA intends to be the local places to which biosolids technicians and managers--as well as regulators, the media, and the public--turn for information regarding the recycling of biosolids and other residuals."

Toffey, William E. 2002. Biosolids Good Practices: How Far Do We Go and How Do We Get There? Presentation to the Northwest Biosolids Management Association conference, September 23. **#2, best management practices.** Challenges biosolids managers to go further in demanding excellence in biosolids quality and programs.

Toffey, William E., Charles R. Miller, and L. Douglas Saylor. 1997. Two Decades of Mine Reclamation: Lessons Learned from One of the Nation’s Largest Biosolids Beneficial Use Programs. From PDEP web site.

Toronto Works and Emergency Services. 1999. What Are Biosolids? Internet fact sheet.

Touart, Adrienne. 1997. Creating An Effective Biosolids Information Network. *BioCycle*. August. **#1.** How regional associations help facilitate technical expertise, information sharing and collaboration to increase public acceptance of biosolids.

Touart, A.P. 1998. Acceptance Strategies: Winning Biosolids Support. *BioCycle* 39(2):86-90. February. #**1, land application.** Preserving Pacific Northwest forests in the face of enormous growth pressures and using biosolids locally are being accomplished through the Biosolids Forestry Program initiated by the Mountains to Sound Greenway Trust (MTS). MTS works to preserve and protect the scenic, recreational, and historic character of the forestlands flanking I-90, which are under intense population pressure. The key to the program’s success was linking biosolids to the much larger beneficial goal of preservation. Once the program was authorized to proceed, MTS decided to use a 20-acre state forest site along a high traffic road frequented by bikers and hikers just 20 miles east of Seattle for the first biosolids application. Implementation strategies included posting a sign at the site; inviting the news media, officials, and environmentalists to tour and witness the week-long application; and ensuring that all user groups were informed and comfortable with the project.

Trettin, L. and C. Musham. 2000. Is Trust a Realistic Goal of Environmental Risk Communication? *Environment & Behavior*, 32(3), 410-26**. #2: acceptance, trust, trust of government or science, risk communication.** Environmental risk communication often fails to overcome public distrust of government and industrial agencies. The role of trust in risk communication is discussed in context of nuclear power and hazardous waste storage facilities. Strategies of risk communication need not focus on building trust, but should focus on establishing procedures and standards that the public understands and accepts.

True, Brian. 1998. *Regional Biosolids Information Networks Report*, Report to the US Environmental Protection Agency.

Truini, Joe. 2001(a). NYC Drops Sludge Pact. *Waste News*. July 9.

Truini, Joe. 2001(b). Va. College Issues Compound Warning. *Waste News*, 7(7):13. August 6.

Tuler, Seth and Thomas Dietz (eds.). 2001. Factors Influencing the Success of Public Participation in Environmental Decision-Making: A Review of the Literature. July 10. **#1. Public Participation.** This is an unpublished literature review by two social scientists expert in the field of public participation.

Tuohy, J. 2000. 2 Mothers, 2 Deaths, Too Many Questions – Sickness Was in the Air, But Officials Wouldn't Blame Sludge. *USA Today, Final Edition*. 13D. July 13. #**2, pathogens, death, land application, Class B, liability, media.** A rare national newspaper story; considerable impact.

U.S. Composting Council. 2000. *Field Guide to Compost Use.* PDF document, www.uscc.org.

U.S. Composting Council. 2000. USCC Promotes STA Program to National Council of State Garden Clubs. *The Quarterly,* Amherst, OH: USCC, Summer. **#4. Education.** Outreach to garden clubs regarding Seal of Testing Assurance program.

U. S. Department of Agriculture Cooperative State Research Service. 1989. *Peer Review: Standards for the Disposal of Sewage Sludge U. S. EPA Proposed Rule 40 CFR Parts-257 and 503.*

U. S. Environmental Protection Agency. 1977. *Municipal Sludge Management: Environmental Factors*. [MCD-28] EPA430/9-77-004, October.

U. S. Environmental Protection Agency, 1980. *Information Programs Affect Attitudes Toward Sewage Sludge Use in Agriculture*. Municipal Environmental Research Laboratory, Cincinnati, OH: USEPA 600/2-80-103; July. **#2.** This is an Office Research and Development report developed by the Ohio Farm Bureau Development Corporation that examined the attitude of Ohio residents toward land application and the influence of educational meetings on these attitudes.

U. S. Environmental Protection Agency. 1981. *Institutional Constraints and Public Acceptance Barriers to Utilization of Municipal Wastewater and Sludge for Land Reclamation and Biomass Production*. Office of Water Program Operations (WH-547), Washington, DC: EPA430/9-81-013; July. **#2.** An early EPA report that includes a series of case study summaries (see also Bastian, Robert).

U. S. Environmental Protection Agency. 1983(a). *Land Application of Municipal Sludge Process Design Manual*. EPA-625/1-83-016, October.

U. S. Environmental Protection Agency. 1983(b). A Practical Technology: Land Application of Sludge: A Viable Alternative. USEPA pamphlet.

U.S. Environmental Protection Agency Environmental Response Team (ERT). *Biosolids Recycling: Restore, Reclaim, Remediate.* Videotape.

U.S. Environmental Protection Agency. 1986. *Working to Gain Public Acceptance of Sewage Sludge Composting and Use of Liquid and Dewatered Sludge on Land,* USEPA Office of Wastewater Management, March.

U.S. Environmental Protection Agency. 1989. EPA's Policy Promoting the Beneficial Use of Sewage Sludge *and* The New Proposed Technical Sludge Regulations. Office of Municipal Pollution Control (WH-595), Washington, DC. USEPA pamphlet.

U.S. Environmental Protection Agency. 1991. Beneficial Use of Sewage Sludge. Brochure. **#2. EPA policy, land application.** Quotes the June 12, 1984 49 Federal Register 24358 U.S. EPA policy on municipal sludge management: "The U.S. Environmental Protection Agency (EPA) will actively promote those municipal sludge management practices that provide fore the beneficial use of sludge while maintaining or improving environmental quality and protecting public health. To implement this policy, EPA will continue to issue regulations that protect public health and other environmental values. The Agenc will require states to establish and maintain programs to ensure that local governments utilize sludge management techniques that are consistent with Federal and state regulations and guidelines. Local communities will remain responsible for choosing among alternative programs; for planning, constructing, and operating facilities to meet their needs; and for ensuring the continuing availability of adequate and acceptable disposal or use capacity."

U.S. Environmental Protection Agency. 1992(a). 40 CFR 503 Use and Disposal of Sewage Sludge: Questions and Answers. USEPA Briefing Book. Region 10, Seattle, WA. December.

U.S. Environmental Protection Agency. 1992(b). EPA Workshop. *1992 Water Environment Federation Specialty Conference, The Future Direction of Municipal Sludge (Biosolids) Management: Where We Are and Where We're Going*, Portland, OR: Water Environment Federation. July 29. **#4,** review of proposed 503 rule as of 1992.

U.S. Environmental Protection Agency. 1994(a). *A Plain English Guide to the EPA Part 503 Biosolids Rule*, Washington, DC: USEPA Office of Wastewater Management.

U.S. Environmental Protection Agency. 1994(b). *Biosolids Recycling: Beneficial Technology for a Better Environment.* Office of Water (4204), Washington, DC: USEPA 832-R-94-009. **#3.** The short primer on biosolids recycling.

U.S. Environmental Protection Agency. 1994(c). *Composting Yard Trimmings and Municipal Solid Waste*. Office of Solid Waste and Emergency Response, Report No. EPA/530/R94/003. 12-13, 108, 111-114. **#4, composting, odors, traffic, need for public information.**

U.S. Environmental Protection Agency. 1995. *A Guide to the Biosolids Risk Assessments for the EPA Part 503 Rule*, Washington, DC: USEPA Office of Wastewater Management.

U.S. Environmental Protection Agency. 1997. Compost – New Applications for an Age-Old Technology. Folder & Fact Sheets. No. EPA/530-F-97-047. October.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. 1999. *Biosolids Generation, Use and Disposal in the United States*. EPA 530-R-99-009. **#2.** This current assessment of biosolids use and disposal practices includes a discussion of public acceptance as an obstacle to further biosolids recycling efforts.

U.S. Environmental Protection Agency Office of Water. 1999. Biosolids Data Management System. http://www.biosolidsinfo.com **#3. Lack of information, oversight/enforcement.** A biosolids data system that could assist in providing information on where, when, how much, and the quality of biosolids recycled.

U.S. Environmental Protection Agency Office of Inspector General. 2000. *Audit Report, Water, Biosolids Management and Enforcement (2000-P-10),* March 20. **#3. Lack of oversight/enforcement, lack of public information/data.**

U.S. Environmental Protection Agency Office of Inspector General. 2002. Memorandum: EPA's Key Management Challenges. Washington, DC: USEPA. September 6. **#1. Public concerns.** The Office of Inspector General (OIG) at the U. S. Environmental Protection Agency (USEPA) sent Administrator Christine Todd Whitman an updated list of the "key management challenges confronting the… Agency. The list includes two new challenges, *Challenges in Addressing Air Toxics Program Phase 1 and Phase 2 Goals* and *Management of Biosolid."* Here is the description of the rationale for adding biosolids management to the list: **"**Approximately six million tons of sewage sludge ("biosolids") are produced annually by sewage treatment plants in the United States. With inadequate treatment these biosolids may contain a wide variety of chemicals and pathogens, the remains of the sewage treatment process. (1) EPA does not know whether current regulations, when adhered to, are protective of public health; (2) EPA does not have an overall understanding of the magnitude and quality of Biosolids production and disposal practices; (3) EPA does not know if the enforcement and compliance resources committed to managing biosolids are adequate to ensure that the regulations are adhered to. EPA has not conducted the basic research needed to determine the risk associated with certain biosolids disposal practices. The Agency has taken the position that biosolids management is a low-risk activity. As a result, EPA has failed to adhere to its commitment to comprehensively assess the extent of the risk. EPA issued Part 503 of Title 40 of the Code of Federal Regulations ("The Sludge Rule") to govern the use and disposal of biosolids in February 1993 under court order. When it issued the rule, EPA committed to conducting a comprehensive research program to assess the risks associated with land application of biosolids, yet it has not yet done so. In June 2002 the National Academy of Sciences (NAS) recommended additional research. EPA is currently studying those recommendations, and has committed to producing a research work plan by the end of 2003, nearly 11 years after committing to do so. EPA uses the Permit Compliance System (PCS) to manage water quality activities of point source dischargers such as sewage treatment plants, but PCS is acknowledged by the Office of Water (OW) as inadequate for managing biosolids. EPA is unable to answer basic questions such as how much biosolids are land-applied. As a result of this data gap, OW developed an independent system, the Biosolids Data Management System (BDMS), to track compliance with biosolids regulations. EPA is revising PCS, but has not yet decided whether to incorporate BDMS into this new version. According to OW, "the ultimate usefulness of the BDMS on a national basis is likely dependent upon its adoption into PCS." EPA has diverted compliance and enforcement resources away from this program. The safety of biosolids land application depends on the adherence to highly technical treatment standards by land applicators across the country. In a 2000 report we found inadequacies in EPA's management and enforcement of the biosolids program. In a status report on the biosolids program published two years later, we reported a further 44% reduction in full-time equivalent (FTE) positions (from 18 to 10). This is a particular concern because EPA runs the biosolids program in 45 states. Adequate oversight of this program is critical for ensuring regulatory compliance. To date, EPA has not committed the resources needed to fulfill its oversight responsibilities. In convening a committee to study the NAS recommendations EPA is beginning to address these issues. However, several issues remain unsettled and we are not convinced that the agency is directing adequate resources to resolving these concerns once and for all. We will continue to monitor EPA's progress in this area until these issues are settled. In May 2002, we recommended this issue from as an Agency-level weakness candidate under the Federal Managers' Financial Integrity Act."

U.S. Environmental Protection Agency Office of Water. 2000. *Progress in Water Quality: An Evaluation of the National Investment in Municipal Wastewater Treatment.* Washington, DC: U.S. EPA. **#3. Water quality**. This report evaluates whether or not the huge public investment in wastewater treatment during the last third of the 20th century provided benefits to surface waters, as intended. "At both broad and local scales, the water pollution control policy decisions of the 1972 CWA have achieved significant successes nationwide in terms of reduction of effluent BOD from POTWs, worst-case (summertime, low-flow) DO improvement in waterways, and overall water quality improvements in urban case study areas."

U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management. 2000(a). *Guide to Field Storage of Biosolids.* EPA/832-B-00-007. July. **#2. Odors, aerosols, trucking & traffic, appearance, best management practices, Class B, stockpiling, land application, communication.** Includes a chapter on "Community Relations." "The ultimate goal of the community relations program is to develop public acceptance of biosolids storage within the community…The public desires a voice in activities that may impact their community, and they need to know that biosolids managers share their concerns and are responsive to their comments. Seeking early input from local officials and the citizens during the planning phase is the best way to gain public support. Active listening and responsiveness to public concerns builds trust and ensures that the project fits successfully into the community." Recommends adapting program to local needs; establishing system to address complaints and take corrective actions; noting the variety of "publics:" government officials, citizens groups, agricultural organizations, etc.; and educational tools and outreach options.

U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management. 2000(b). *Biosolids*. http://www.epa.gov/owm/bio.htm, retrieved November 27.

U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management. 2000(c). *Summary of State Biosolids Programs: Draft Report*. December.

U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management. 2000(d). *Biosolids and Residuals Management Fact Sheet: Odor Control in Biosolids Management*. September.

U.S. Environmental Protection Agency, Office of Policy, Economics, and Innovation. 2001. *Stakeholder Involvement & Public Participation at the U.S. EPA: Lessons Learned, Barriers, & Innovative Approaches.* Washington, DC. January.

U. S. Environmental Protection Agency. 2002. Enhancing Facility-Community Relations. Brochure. “This is the third document in a series of U.S. EPA Office of Solid Waste (OSW) publications on hazardous waste management facility locations as they relate to social and environmental issues. For more information, read *Social Aspects of Siting RCRA Hazardous Waste Facilities*, EPA530-K-00-005, April 2000. *Sensitive Environments and the Siting of Hazardous Waste Management Facilities*, EPA530-K-97-003, May 1997. Both are available at http://www.epa.gov/epaoswer/hazwaste/tsds/site/sites.htm…. With more than 2,260 hazardous waste facilities in the U.S., developing and maintaining good community relations is vital. It is important for facilities to maintain continuous, strong relationships with neighboring communities throughout their operation and after closure. Although not all communities are affected by federal hazardous waste regulations, for those that are, their concerns need to be addressed early, collaboratively, and compassionately.”

U.S. Environmental Protection Agency. 2003a. Public Involvement Policy of the U.S. Environmental Protection Agency. http://www.epa.gov/publicinvolvement/policy2003.htm

U.S. Environmental Protection Agency, 2003b. Response to the Center for Food Safety et al. petition seeking an emergency moratorium… Washington, U.S. EPA Office of Water, December 24.

U. S. Environmental Protection Agency, 2003c. Standards For The Use Or Disposal Of Sewage Sludge; Final Agency Response to the National Research Council Report on Biosolids Applied to Land and the Results of EPA’s Review of Existing Sewage Sludge Regulations, in the *Federal Register*, December.

U.S. Geological Survey. Expanded Monitoring Program Near Deer Tail, Colorado. *USGS Quarterly Report*, 2(2):1-12, April-June 2000. Research monitoring Denver's land application program.

U.S. House of Representatives. 2000. Hearing Charter: EPA's Sludge Rule: Closed Minds or Open Debate? March 22, 2000. **#2. Concerned citizens, politics**. This hearing addressed whether EPA, in its development and enforcement of the Part 503 Sludge Rule, is failing to foster sound science with an open exchange of ideas and information between scientists, EPA officials, and private citizens.

UC Berkeley Wellness Letter. 2000. Organic Questions: The Answers May Surprise You. Berkeley, CA. October, p. 6.

U.S. 9th Circuit Court of Appeals. 2000. Decision filed on the Appeal From the United States District Court for the District of Montana regarding "Gunk" from Septic Tanks, Classified as "Sewage Sludge" from a "...treatment works treating domestic sewage" making illegal disposal of septic tank septage subject to enforcement under the Clean Water Act. *http://laws.findlaw.com/9TH/9930112.html*. March 22. #**4, 503.**

U.S. District Court for the Western District of Virginia, Charlottesville. 1995. *W. Dale Welch, et al., Plaintiffs, v. The Board of Supervisors of Rappahannock County, Virginia, Defendant*. Civil Action No 94-002-C. May 24. #**2, health, land application, local ban.** The County did not want sewage sludge land applied at all, no matter the source. Farmers fought for the right to apply sewage sludge on their lands and lost. The court cited that the County had a real view of protecting human health and the environment. "Safety concerns are not illusory." See also Hassell (above).

University of Nebraska. 2000. Biosolids Land Application Program: A Partnership Between the City of Lincoln, UNL Cooperative Extension in Lancaster County, and County Crop Producers. http://www.ianr.unl.edu/ianr/lanco/enviro/biosolids/overvew.htm.

University of Nebraska. 2000. http://www.ianr.unl.edu/ianr/lanco/enviro/biosolids/research.htm. Research description.

USA Today, 1999. Faced With Evidence of Health Threat, EPA Looks the Other Way. *USA Today* editorial, October 7. #**3. Lack of trust.** Criticism of USEPA; mention of Shayne Conner, NH case. "And when not attacking critics, the agency has been busy promoting sludge use. Over the past threee years, for example, it has spent almost $70,000 on grant to the Water Environment Federation for a sludge 'public acceptance campaign,'…."

USA Today. 2000. Faced With Faulty Science, EPA Muzzles Critics. *USA Today* editorial, Oct. 5. http://www.usatoday.com/news/comment/nceditf.htm

Vanderford, Ken. 2001. Having Trouble Farming Out Your Biosolids?: Follow Tried-and-True Tips to Sell Your Biosolids for Land Application. *WE&T*. February.

Vaughan, F., L. Koontz, and B. Barnes. 1994. Planning and Implementation of Wichita's Successful Biosolids Reuse Program. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 347-353. #**2, land application, city with extensive public education outreach plan, biosolids management plan.** When new federal regulations for monitoring and disposal of sewage sludge were published in 1993, the City of Wichita Water and Sewer Department knew that significant changes were required to comply with the new regulations. The City determined through the development of a Biosolids Management Plan that a beneficial reuse program was the most practical and effective means of achieving compliance. Implementation of the Biosolids Management Plan has resulted in higher quality biosolids and a reliable method of disposal. The biosolids reuse program has been unusually successful due to a combination of thoughtful planning, honest dialogue with the public, facilities improvements, and responsible operation. A certain measure of the noted success is due to the City's accommodation of the farmers' crop and site requirements. In this way, the City provides the farmer with a valued service in addition to the product.

Vermont Agency of Natural Resources. An Assessment of the Quality of Vermont's Environment. *Environment 1999*. http://www.anr.state.vt.us/env99/index.html "While great strides have been made in recycling and reuse of other waste streams, there has been a substantial decline in beneficial use of biosolids, from about 98 percent in 1987 to the 40 percent of 1997. While the amount of biosolids being composted has increased, there has been a significant decline in direct land application. Vermont's beneficial use of biosolids is below the national average of 54 percent and lower than some northeastern states, such as Maine, which reuses 90 percent."

Vermont Public Interest Research Group (VPIRG). 1999. *On the Ground: The Spreading of Toxic Sludge in Vermont*. Montpelier, VT: Vermont Public Interest Research Group. June. **#1, public acceptance, concerned citizens, personal control.** Thousands of tons of sewage sludge and septage have been distributed through Vermont's environment by being spread directly on land or composted and given away for use on home gardens, farms, and landscape projects. In 1997 alone, 1,535 tons of sewage sludge were applied to Vermont land, while 767 tons were distributed as compost. Reusing clean human waste would be a positive practice. But sludge contains far more than just human waste. The practice of applying municipal sludge to the land entails many serious risks to environmental sustainability and public health. It is economically short-sighted, given its potential to contaminate the land, undermine Vermont foods' reputation for purity, and undercut the pristine environmental image that brings so many tourists into our state. Many citizens oppose it on grounds ranging from issues of local control to public health fears to aesthetic concerns. Yet regulators with the state's Department of Environmental Conservation steadfastly maintain that the only problem with sludge "recycling" is the public's attitude toward it and insist that there is no need to reexamine the current system of regulation or make it more stringent.

Virginia Cooperative Extension. 1999. *Agricultural Land Application of Biosolids in Virginia: Risks and Concerns.* Crop and Environmental Sciences Publication 452-304. Petersburg, VA: Virginia Cooperative Extension. **#3. Land application, education.**

Virginia, State of. 2000. Biosolids Lifecycle: Concerns & Risks. http://www.biosolids.state.va.us/concerns.htm. **#3. Metals, chemicals, pathogens, odors, surface water, groundwater, trucking.**

Vos, Sarah. 2001. Farmer Wants to Spread Sludge by Marriott Hotel. *Concord Monitor*. August 20. New Hampshire.

Wagner, E.O. 1990. Sludge Management Concerns in the United States. In *Water Pollution Control Federation Specialty Conference, The Status of Municipal Sludge Management for the 1990s*, New Orleans, LA: Water Pollution Control Federation. OGS-1–OGS-5. **#2, using sludge (biosolids) in a beneficial way, public participation, public education.**

Wagner, Holly. Biosolids: A Financial Look. #**2.** A worksheet that teaches kids the financial side to biosolids recycling by comparing yields and costs to conventional and no fertilizer treatments.

Wakefield, S. and S.J. Elliott. Environmental risk perception and well-being: effects of the landfill siting process in two southern Ontario communities. Hamilton, Ont: School of

Geography and Geology. **#2. Risk perception, public participation, personal control.** "In the context of siting (environmentally) noxious land uses, recent research suggests that the well-being of individuals and communities is impacted as much by the decision-making process as the outcome itself. The study results presented in this paper stem from an ongoing, two-stage quantitative/qualitative investigation of impacts on individual and community well-being associated with the environmental assessment process in Ontario, Canada. This research uses a parallel case-study design to investigate two proposed landfill sites in southern Ontario. Qualitative in-depth interviews (n = 36), conducted across a variety of stakeholder groups, were used to address the following objectives: to explore the nature of concerns experienced by individuals faced with a local landfill site proposal; to explore the effects of the siting process on individuals and communities; and to examine the coping strategies employed by individuals in response to impacts experienced. The work attempts to apply theories of risk society (as conceptualized by Beck and Giddens) at a community scale. In so doing, we build on the work of health geographers attempting to link the social and contextual with the medical. Overall, substantial impacts on individual and community well-being were reported across all stakeholder groups interviewed: these included stress, disempowerment, hostility and divisions within the community. The experience of psychosocial impacts and effectiveness of coping strategies is shaped by certain factors associated with the site and the siting process (including uncertainty and the perceived lack of meaningful participation). The links between risk, process and impacts are theorized using a conceptual framework which incorporates site and process factors, effects on daily life (e.g. feelings of losing control, mistrust), and Gidden's conception of 'ontological security'. These findings have implications for environmental decision-making, as they suggest a need to locate the delicate balance point between community involvement and an expedient decision-making process within variable community contexts."

Walker, J. 1997. *Rutland, VT*. Draft Report to Katie Gehr, VT DEC for comment. United States Environmental Protection Agency. August 18.

Walker, J.M. 1993. Production, Use & Creative Design of Sewage Sludge Biosolids. *Sewage Sludge: Land Utilization and the Environment*, Bloomington, MN: Soil Science Department and USDA-ARS, University of Minnesota. August 11-13. #**4, end product concerns, beneficial use, education.**

Walker, J.M. 2000. A Regulatory Perspective on Biosolids Management. In *Biosolids Management in the 21st Century Conference*, College Park, MD. 5-11. #**2, biosolids management, negative cases.**

Walker, John M., Robert W. Southworth, and Alan B. Rubin. 1997. EPA Regulations and Other Stakeholder Activities Affecting the Agricultural Use of By-Products and Wastes. Washington, DC: U.S. Environmental Protection Agency, Office of Water.

Walsh, Kate. 2002. Compost Using Sewage Sludge as Seed Material - Is It Harmful? *Townsend Times*. May 3.

Walter, F. 1997. Washington Zoners Approve Composting. *The Morning Call*, Easton Section, p. B3. Allentown, PA. April 2.

Wantland, Sheri (ed.). 2002. *Survival Guide: Public Communications for Water Professionals.* Alexandria, VA: Water Environment Federation. **#1. Communications, public participation, media.** An excellent resource for communicating with the public and the media. Includes resources on public participation.

Wardell, M.R.1994. Building Acceptance for Biosolids Use. *BioCycle*. 35(7):56-59. **#1, land application, facility siting, lack of public information/data, liability.** Identifying what the obstacles are to the beneficial use of biosolids in the Northeast depends on who is asked. Lack of effective regulation, questions concerning health or environmental impact, lack of farmer or landowner interest in using biosolids, overregulation and the cost of permitting and compliance, and fears over potential liability are all among the answers given by the various parties involved in managing or using these materials. Another frequently cited obstacle is public opposition to the siting of beneficial use facilities. This problem is especially acute in the Northeast, where population density makes it difficult to site facilities away from residential development.

Warrick, Joby and Pat Smith. 1995. New Studies Show That Lagoons Are Leaking: Groundwater, Rivers Affected by Waste. *The News & Observer*. February 19. http://www.pulitzer.org/year/1996/public-service/works/1water.html.

Warrick, Joby and Pat Stith. 1995. New Studies Show the Lagoons Are Leaking. *The News & Observer*. February 19.

Washington (DC) Suburban Sanitary Commission website http://www.wssc.dst.md.us/about/history.html:

Washington (DC) Suburban Sanitary Commission. Late 1990's. Beneficial Use: The Successful Management of Wastewater Products. Hyattsville, MD: Washington Suburban Sanitary Commission. **#3.** Booklet describing biosolids recycling program.

Washington State Department of Ecology. 1998. Fact Sheet: Washington State fertilizer and soils studies

Washington State Department of Ecology. 2000. State biosolids recycling program. http://www.ecy.wa.gov/programs/swfa/biosolids/index.html. **#2.** A respected and well-developed state biosolids management regulatory program that supports recycling.

Washington State Department of Natural Resources. 1995. *Sustained Forest Growth: Biosolids Recycling.* University of Washington, College of Forest Resources; King County; and Weyerhauser. #4

Washington State University Cooperative Extension. 1998. Biosolids, A Recycled Organic Fertilizer. http://gardening.wsu.edu/stewardship/biosolid/biosolid.htm. **#3. University involvement.**

Washington, University of, Pack Experimental Forest. 1995. *Recycling a Resource: Biosolids Self-Guided Trail.* **#3.**

Waste News. 2002. Land Application of Biosolids Draws Flak: EPA Neutralizes Stance. March 4.

Water Environment Federation and United States Environmental Protection Agency. 1997. *Biosolids Fact Sheets*. March. **#3. Bad management, metals, chemicals, groundwater, urban/rural conflict, someone else's biosolids…** Informative fact sheets that detail investigations of cases where harm from biosolids was alleged, as well as an introduction to biosolids recycling. Includes peer-reviewed fact sheets on "Biosolids Recycling in West Texas" (Sierra Blanca), "Biosolids in Southern California" ("Mount San Diego"), "Biosolids in Northern Washington State" (Zander Farm), "Biosolids and Miniature Horses in Oklahoma," "Can AIDS Be Transmitted by Biosolids?," "Biosolids and Bahamian Papaya Crops," and "Biosolids Application to Forestland in the Pacific Northwest." In the introduction regarding biosolids recycling: "Why Should I Care About Biosolids?

Wastewater treatment and management of wastewater residuals should concern all municipal sewer users, agricultural interests, and environmentalists. More than $2 billion is spent annually treating and managing approximately 5.3 million dry metric tons of biosolids from public owned wastewater treatment plants in the United States….National biosolids generation rates are estimated to reach 47 dry pounds per American yearly. Regarding Sierra Blanca: "In 1991, MERCO applied for a land application permit with the State of Oklahoma. The application was withdrawn, company officials explain, when logistical difficulties threatened to delay the project past July 1, 1992, the deadline for New York City to stop ocean dumping of wastewater residuals. Public criticism of the proposal was linked mostly to disapproval of a rural state acting as a 'dumping ground' for large eastern cities." Regarding the Zander claims and resulting articles by Ed Haag in *Farm Journal*: One quoted expert, "Darrell O. Turner, a retired soil scientist from Washington State University and witness for the plaintiffs in the Zander case, stated in Haag's article that farmers should not land apply biosolids to their crops. In a later, private correspondence, Turner stated that contemporary wastewater treatment technology can produce safe, clean biosolids if properly implemented by responsible operators. 'This is not a problem resulting from lack of technology; it is a people problem….When and if we succeed in bringing our agencies into line…I will support land application,' Turner wrote." Regarding the

Water Environment Federation. 1985. *Nature's Way- How Wastewater Treatment Works for You*. Brochure.

Water Environment Federation. 1990. *Biosolids - Too Valuable to Waste*. Brochure.

Water Environment Federation. 1990. *Biosolids, Too Valuable to Waste*. Alexandria, VA. #**2.** "What happens to the materials that disappear down our drains and storm sewers? In our modern society, it's easy to think that "out of sight is out of mind," that waste miraculously evaporates once it has vanished into the pipeline. Early humans knew better. Agrarian societies have been using both human and animal wastes to fertilize the land for as long as humans have planted seeds, and those seeds have been thriving. The materials that wash down our drains are not wastes: they are a valuable, age-old resource for enriching the soil. Our modern wastewater treatment facilities are not only water cleaning systems, but they are also reclamation factories that produce safe, reusable solids – biosolids. Recycling wastewater solids for beneficial use is gaining acceptance worldwide and is encouraged by the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, the U.S. Food and Drug Administration, and the National Association of Conservation Districts. Most important, these recycling efforts put valuable resources back where they belong – in the natural cycle."

Water Environment Federation. 1992(a). Executive Committee Supports Biosolids. *Federation Highlights* 29(3). March.

Water Environment Federation. 1992(b). Federation Opposes New Sludge Legislation. *Federation Highlights* 29(6). June.

Water Environment Federation. 1992(c). Biosolids Conference a Success Despite Regulatory Delay. *Federation Highlights* 29(9). September.

Water Environment Federation. 1992(d). The National Beneficial Biosolids Use Awards. *The 1992 EPA Awards*, Operating Projects >5 MGD. October.

Water Environment Federation. 1993. National Sewage Sludge Standards Rule Signed: Federation Applauds Culmination of Effort, Calls for Public Support. *Federation Highlights* 30(1). January.

Water Environment Federation. 1994(a). Educate Your Public About Biosolids Recycling. *Federation Highlights* 31(6). June.

Water Environment Federation. 1994(b). Beneficial Use of Biosolids. *Operations Forum* 11(11). November.

Water Environment Federation. 1994(c). *Biosolids Recycling – Beneficial Technology for a Better Environment.* #**2. Video promotes recycling and reuse, especially for the Northeast and Mid-Atlantic.**

Water Environment Federation. 1994(d). Biosolids Recycling: Beneficial Technology for a Better Environment. Brochure. **#3. Education.** Stresses environmentally sound practice, strict standards and scientific controls, makes economic sense.

Water Environment Federation. 1995(a). Earth Day Calendar Features Biosolids. *Federation Highlights* 32(1). January.

Water Environment Federation. 1995(b). EPA and WEF Collaborate on Radioactivity in Wastewater Solids Issue. *Federation Highlights* 32(1). January.

Water Environment Federation. 1999(a). Biosolids: NBP Focuses on Environmental Management System, communication. *Water Environment & Technology*. November, pp. 15-17.

Water Environment Federation. 1999(b). *Response To Biosolids Questions and Current Public Acceptance Issues*. WEF Residuals and Biosolids Committee, Public Acceptance Subcommittee. **#2. Dioxin, food safety, metals, concerned citizens.** Includes responses to Cornell "Case for Caution" and National Sludge Alliance.

Water Environment Federation. 2000(a). *Biosolids Success Stories.* Alexandria, VA: Water Environment Federation. #**1.** A collection of narrative case studies of successful biosolids recycling programs from around the United States; includes a thorough summary of background/history of US biosolids recycling and occasional discussions of public acceptance efforts. "Through this publication, readers may recognize a recycling technology that is used or proposed for use in their own community. Raising the level of awareness, locally and nationally, that biosolids recycling is a viable alternative to disposal is a necessary first step in gaining public acceptance. The success stories presented are ways to measure and document progress. The present publication emerged from a proposal to share with the public and with other interested parties the variety of ways in which biosolids are beneficially used in the United States. An initial set of drafts was solicited from the members of WEF's Residuals and Biosolids Committee, state officials, federal regulators, and others who were asked to provide stories and suggestions of biosolids projects that have been successfully implemented and are environmentally sound. The intent was to provide relatively detailed information on the range of options available to municipal owners, managers, and consultants." From chapter "Fort Worth Texas: Biosolids Recycling Expanding Far and Wide in Texas." "Public Acceptance Activities: The Fort Worth program has met the five basic strategies of the Biosolids 2000 goals articulated by the Water Environment Federation by: Promoting Recycling 100% Biosolids Recycling, Providing Information Video & Publications, Developing Partnerships County Officials & Farmers, Be Pro-Active Open and Aggressive, Insure Compliance/No Enforcement Violations. In addition, the Fort Worth beneficial recycling program has met the five measurements for public acceptance outlined in the Biosolids 2000 Program: % Biosolids Recycled =100%, No Major Controversies, Public Demand for Biosolids Recycling: 60 Day Waiting Period, Users Willing to Pay for Biosolids: Yes, Agencies "advertise" their Biosolids Products: Being

Developed. The success of the City and the contractors public acceptance efforts have achieved positive results: Majority of local & vocal public opposition, now generally supportive of program, Opposition now wanting to participate in the program, More land owners wanting to participate, Larger land owners wanting to participate, More "prominent" land owners interested in participating in the program, Land owners closer in towards the city limits wanting to participate in the program, Greater support & acceptance from other local and county governments, Pamphlets, brochures, literature and handouts have been developed and are made available to the public, providing educational and informational facts about biosolids and the City of Fort Worth's "beneficial recycling" of biosolids program. Over-Coming Obstacles: Misinformation: Science based management combined with dedicated employees using common sense and good management practices have overcome public misinformation and emotion based opposition. Organization Opposition: Operating biosolids dewatering, sampling and testing, transport and field application activities in compliance to state and federal rules has allowed the City of Fort Worth's land application program to grow in agricultural communities even with organized public opposition. Political Campaigns: False accusations of environmental contamination, political campaigns "sludge judge that won't budge" have all been overcome by patience, community dialogue, science based site management, public relations and local farm and rancher support in these areas." From the chapter "King County, Washington: The Mountains to Sound Greenway Biosolids Forestry Program." "The public acceptance campaign demonstrated the benefits of having an independent third party deliver information about biosolids. The Greenway Trust had a reputation for obtaining collaborative, reasonable solutions among divergent interests. They were well known as conservation and environmental advocates. They were able to research biosolids and tell people, in a direct, believable manner, what they had found. The campaign employed a series of consistent message points summarizing the Greenway's independent conclusions about biosolids: Recycling biosolids in our home county is the responsible thing to do, Recycling biosolids in our forests builds a sustainable habitat for plants and animals, Using forests productively encourages landowners to keep lands on the edge of the city in forest use, Biosolids have been researched thoroughly by scientists and found to be safe and beneficial for the environment, Recycling biosolids produces many environmental and economic benefits such as soil enhancement, maintenance of water quality, improved wildlife habitat, and increased sustainable timber production. During the development of the program, more than 20 local groups endorsed the program. A pair of prominent environmentalists, including a representative from the Sierra Club, volunteered to serve as program spokespersons. Presentations were made to local mayors, councils, agencies, the media, and environmental groups. The effort yielded broad political and environmental support for the program and more than 40 positive media articles about recycling biosolids in local forests….For the past three years, consultants for King County Wastewater Treatment Division have conducted public opinion surveys by telephone of ratepayers in the greater Seattle area. In 1994, 50 percent of respondents approved of the use of biosolids in forests. In 1995, the approval rate was 75 percent. The unprecedented amount of media coverage about biosolids in the first half of 1995 may have contributed to this increase. The surveyed public also gave higher approval rates to other uses of biosolids: agricultural use increased from 49 percent to 67 percent, and composting rose from 55 percent to 70 percent approval." From the chapter "Lincoln, Nebraska: A Biosolids Program With Strong Links to University:" "The City of Lincoln's biosolids program is an innovative effort to bring new technology, scientific research, and a variety of agencies together for the betterment of biosolids application in Lancaster County. All the entities involved - the

University of Nebraska, Cooperative Extension, and the City of Lincoln - have specific strengths and roles that are well suited to various aspects of the program. This unique relationship and progressive approach to the management of the program sets it apart from many other land application programs, and has led to a successful program." From the chapter "Montgomery Area, Pennsylvania: Nourishing Farmland on a Regional Basis:" "Public Acceptance: Through conscientious project management, UAJA has maintained a publicly supported program. When the permit application was initially submitted, however, some neighbors of the Crossley Farm expressed concern about the biosolids project. The public's trust was won by personal communication with UAJA staff and board members, responsiveness to inquiries, presentations at local meetings, distribution of literature explaining biosolids recycling, and tours of the wastewater treatment plant. In addition, the local press is invited to the wastewater treatment plant on an ongoing basis. When UAJA applied for a PADEP Agricultural Use Permit, a certified letter was sent to 149 contiguous land owners, township supervisors and the County Planning Commission. The letter emphasized that biosolids recycling was a normal agricultural practice, explained that modern equipment would inject the liquid, and provided the name and number of the executive superintendent. A colorful WEF brochure was enclosed with the letter. All calls to the superintendent were promptly returned with an offer to tour the facility. UAJA board members and staff volunteered to attend a town meeting in Seisoltzville to answer questions. UAJA representatives were trained to answer questions effectively by: Expressing empathy with the resident's concerns, Gaining trust by emphasizing a local, good neighbor presence, Repeating key message points, such as: Agricultural use is recycling, Biosolids recycling is beneficial, UAJA's facilities use the latest technology to produce a safe product, UAJA's water quality professionals have the expertise needed to correctly, carry out the program. As a result, a majority of residents accepted the program. At a second meeting with the Berks County Planning Commission, a similar approach was used to respond to questions from the commissioners. Since UAJA's PADEP permit was issued, UAJA has received no odor complaints. Questions about the project from residents are answered by the Executive Superintendent with an offer to tour the wastewater treatment plant and to meet the caller at the farm site. UAJA board and staff have met with local newspaper reporters several times to educate them about biosolids recycling. Public acceptance tools developed by EPA and professional organizations are used whenever possible. UAJA distributes brochures prepared by EPA and WEF to explain 150 the science and policy behind land application of biosolids. UAJA loans its copy of WEF's "Biosolids Recycling" video to all interested parties." From the chapter "Wichita, Kansas: Working to Help Farmers Throughout the State:" Bringing agricultural landowners on board was the key to launching a successful land application program. This was achieved through a gradual demonstration process. Landowner demand for the biosolids product now is self-sustaining as a result of the high level of service provided by biosolids management staff." "Social Impact: The transformation of local attitudes toward biosolids and, more specifically, biosolids-derived compost in Centre County was profound. When the program began in 1992, UAJA had difficulty in finding adequate distribution for free material. Initial contacts with the local green industries and general public revealed considerable hesitance to try UAJA compost. The concept that biosolids could be composted and made suitable for home use was completely new to most area residents. After several years of hard work, product demand now exceeds supply. In fact, the enormous success of UAJA's marketing program has led to some ruffled feathers. At this time, supply to local customers is limited, despite efforts to give preference to sewerage customers. The Authority's efforts have succeeded in changing public perception of biosolids compost from that of a waste to that of a beneficially reusable product."

Water Environment Federation. 2000(b). The Nature's Blend Story. *14th Annual Residuals and Biosolids Management Conference*. (1-12) Specialty Conference Paper. Water Environment Federation. February/March.

Water Environment Federation, 2000(c). The Nature's Blend Story. 14th Annual Residuals and Biosolids Management Conference, February/March, (1-12) Specialty Conference Paper.

Water Environment Federation. 2001. Steve Frank: An Expert in Biosolids Communications. *WEF Highlights.* January.

Water Environment Research Foundation. 1999. *Watershed Effects of Biosolids Land Application: Literature Review.* . Alexandria, VA: WERF. **#4. Groundwater, surface water.**

Water Environment Research Foundation. 2001. *Public Perception and Participation Workbook,* developed for WEFTEC 2001 conference, Atlanta, GA, October 14. **#1. Public participation.** Includes copies of excerpts of recent work on this topic and a full summary of the workshop, including questions raised by participants during the workshop and answers to those questions. Includes some workshop presentations.

Water Environment Research Foundation. 2002. *The Development and Implementation of Successful Outreach and Community Partnering Programs*, a seminar workbook developed for WEFTEC 2002 conference, Chicago, IL, September 29. **#1 Media, public perceptions, public participation, communications.** MeIncludes summaries and copies of workshop presentations by Ned Beecher ("Public Perception of Biosolids Recycling"), Linda Kelly ("Marketing for Success and Understanding"), Linda MacPherson ("Changing Mindsets: Are New Vocabulary and New Images Needed for Success?"), Mary McDaniel ("How to Talk About Water Reuse"), Juliana Birkhoff ("Development and Implementation of Successful Outreach and Public Partnering Programs"), Dale Manty ("Public Outreach and Co-Learning"), and Steve Frank ("Media Relations for Water Quality Professionals").

Water Pollution Control Federation. 1989. Review of EPA Sewage Sludge Technical Regulations. *Journal: Water Pollution Control Federation* 61(7): 1206-1213. July.

Water Pollution Control Federation. 1989. The Sludge Pie. *Operations Forum* 6(11):20-21. November.

Wegner, Gary. 1993. The Benefits of Biosolids: A Farmer's Perspective. *Water Environment* 7(1). Spring.

Welch, Craig. 2000. Some Say Poplars Are Eco-Marvels. *The Seattle Times*. October 9. **#2.** Poplar farm in Everett is seen from highway where everyone can see what the benefits of biosolids applications.

Werner, Kathleen and Jacques Martineau. 2001. O.K. in my Backyard. *Water Environment & Technology*. September, pp. 118-125.

West, R. 1994. Western Carolina Regional Sewer Authority's Long-term Plan for Biosolids Management. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 371-376. **#2, land application, excellent public acceptance, education program.** Western Carolina Regional Sewer Authority (WCRSA) operates 12 wastewater facilities in the upstate of South Carolina. During the past 10 years, the Upstate has realized tremendous growth, and the quantity of solids generated has increased with regional growth and more stringent NPDES permit requirements. As a result, Western Carolina implemented a long-range plan for biosolids management in 1994. This plan provides for 100% reuse of the biosolids generated by all WCRSA facilities, cooperative efforts between other municipalities in the Upstate to recycle their biosolids, and the development of a sustainable program that will provide for efficient management of all solids produced.

West, R. 2000. Biosolids Carolina Style--Over Easy Without the Grits! *Beneficial Use of By-Products: Regional Issues,* a conference at The Ohio State University, December 1.

Westell, Dan. 1994. Town turning sludge into germ-free fertilizer. *The Globe and Mail.* March 2. **#2. Pathogens. Landfilling. Heat drying. Education.** Expresses gain of diverting waste from landfill.

Wheelabrator Water Technologies, Inc. 1996? What New England Should Know About Biosolids Recycling and Land Application. Pamphlet.

Wheelabrator Water Technologies. 2000. Wheelabrator Defendants' Memorandum of Law in Support of Motion to Exclude Plaintiffs' Expert Evidence on Causation. Filing at Rockingham Superior Court, NH. **#3. Land application, concerned citizens, pathogens, chemicals.** Rebuts claims by David L. Lewis and others that biosolids were linked to death of Shayne Conner, Greenland, NH.

Whitcomb, J.L., J.M. Halstead, L.C. Hamilton, and G.O. Estes. 1994. Community Issues in Facility Siting: The Case of Municipal Solid Waste Composting. New Hampshire Agriculture Extension Station, University of New Hampshire. 18p. #**1, toxins, groundwater, compost, lack of oversight/trust, personal control.** In the fall of 1993, a public attitude survey was administered to 2,000 randomly selected households in Greenfield, Massachusetts and Keene and Rochester, New Hampshire. The goal of the survey was to determine the attitudes towards siting a hypothetical MSW composting facility. More than 36 percent of the 725 survey respondents said they would accept the facility, 33 percent said they might accept the facility, while 31 percent rejected the facility. A model was developed based on the economic utility theory. The results show that as distance to the facility, perceived economic opportunity, and waste involvement increases, the probability of facility acceptance increases. Perceived environmental impact, levels of no trust, age, and income negatively affected the public’s attitude. Women seemed less willing to accept a facility than men did. These relationships are critical pieces of the siting puzzle for waste managers, planners, and developers. Six general siting principles emerged from the research: to clearly establish need, to involve trusted officials, to address perceived risk, to generate support for waste management, to ensure public safety and local control before compensation, and to provide a predictable siting and permitting process. While none of these principles guarantee siting success, they could reduce the chance of failure.

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"There is no doubt about it, the basic satisfaction in farming is manure, which always suggests that life can be cyclic and chemically perfect and aromatic and continuous."
-- E.B. White

ANNOTATED BIBLIOGRAPHY

Comprehensive, But Not Exhaustive

This bibliography is a comprehensive listing of significant papers and gray literature, mostly from the 1990s through 2002, relating to biosolids recycling and social science evaluations of public knowledge, opinion, and behavior around other environmental issues. However, it is not intended to be exhaustive and some literature of significance to the topic may have been overlooked. The authors welcome feedback, including suggestions for inclusion in future editions.

Using this Bibliography

This bibliographical listing includes numerical ratings (in **bold**) regarding the significance of the particular entry to the topic of biosolids recycling public perception and participation (#1=highest significance, #5=lowest significance), as determined subjectively by the bibliography editors (project team). Also included are keywords (in **bold**) followed by short descriptions of the papers developed specifically for this project. In some instances, longer abstracts have been included.

The electronic version of this document (see www.nebiosolids.org/werf) can be searched for particular topics of interest using the "Find" and "Find Next" commands. This bibliography is best used in conjunction with the Literature Review (Chapter 1): find your particular topic of interest in that document, look up in the bibliography the documents referenced there, and then search the bibliography for more information using keywords that are part of the citations you have read on the subject. Note that the most significant, useful resources for biosolids management professionals—the documents to read today and to keep handy for reference—are listed at the end of the report's final chapter regarding recommendations.

A large percentage of the literature and information included in this bibliography is available on the Internet. Internet addresses (urls) are included for many of the documents listed below. The electronic version of this bibliography allows you to use direct hyperlinks to Internet addresses if the document is read on a computer that is connected to the Internet with a browser running. Some addresses may prove to be outdated.

Finally, it is important to recognize that the documents listed below and cited in the Literature Review are not necessarily peer reviewed may or may not contain technically accurate information. Many are not at all objective—a wide variety of perspectives and a wide variety of quality of information have been included. It is advisable to carefully assess the source(s) and reliability of any and all information.

Bibliography Keywords

Biosolids Issues	**Type of Program**	**Program Issues/Social Science**
chemicals	Class A	acceptance, public acceptance
dioxin	Class B	bad management
dust	composting	ban
groundwater	facility siting	behavior
metals	heat drying	best management practices
nutrients	incineration	communication
nitrogen	land application	concerned citizen
odor	landfilling	credibility
pathogens	manure	education, public education
soils	septage	EMS (environmental management system)
spills	water reuse	enforcement
stockpiling		environmental attitudes
surface water		environmental justice
trucking		fairness
wildlife impacts		hazard
		health
		information
		lack of public information/data
		liability
		media
		outrage
		oversight
		participation
		personal control
		politics
		profit motive
		risk communication
		risk perception
		siting, facility siting
		technology
		trust
		understanding, risk understanding
		worker
		yuck

Acknowledgments

The authors wish to acknowledge the consultation and assistance provided by Dr. Elaine Vaughan, whose expertise and knowledge of the behavioral sciences informed the development of parts of this bibliography. Appreciation is also extended to the many individuals across the continent who have provided resources and input on topics, cases, and papers of significance, as well as those who have provided document peer review, especially Troy Hartley and Robert Bastian, for several annotated entries, and Trille Mendenhall, who has collected a treasure trove of historic biosolids information over the course of a career.

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25 Environmental Groups Ask Harvard President Not to Allow Poisoning of the Medical School Quad Lawn. 2000. http://www.riles.org/HarvardPR.htm. **#2. Concerned citizens, outrage.** This response to a NEBRA demonstration of biosolids use shows how a biosolids promotional event can create backlash and outrage.

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Benbrook, Charles M. and Roger N. Allbee. 1993. Minimizing Risks and Sharing Liability from Application of Sludge and Sludge By-Products on Agricultural Land. Report from a Symposium Sponsored by the Springfield District Farm Credit Council, Springfield, MA. November 29-30. **#1. Liability.** Addresses the liability issue.

Bender, Michael. 2000. The 'Sludgefest' Continues Over EPA's Part 503 Standard, Talking Toxics. *Waste Dynamics Northeast.* May. #**3. Concerned citizens, chemicals, Part 503, lack of trust., politics.** Discusses the issues of 2000: "The Case for Caution," NIOSH HID #10, USEPA Office of Inspector General Report, U.S. House Science Committee hearing (see Harrison, E.Z.), proposed dioxin standard, and National Sludge Alliance. "'We are not getting to the bottom-line question that the science says that this is not safe,' said Charlotte Hartman of the National Sludge Alliance."

Berger, Ida E. 1997. The Demographics of Recycling and the Structure of Environmental Behavior. *Environment and Behavior*, 29(4), 515-531. **#1: environmental attitudes, public acceptance, technology acceptance.** The influence of socioeconomic and demographic variables on environmentally responsible behaviors was examined in data from 43,000 households. The data showed that socioeconomic and demographic variables play an important role as antecedents to consistent behaviors. The size of residential area, type of dwelling, education, and income are significant determinants of whether recycling facilities are available and will be used. Having convenient access to a recycling program mediates the relationship between socioeconomic factors and recycling practice. Environmental behaviors are structured around specific environmental issues such as water, energy, or waste disposal and suggest that recycling [or any other environmental acceptance, *ed*.] may operate as a first step toward the adoption of other behaviors.

Berry, Michelle and Clifford W. Scherer. (1990). Utilizing Surveys as Community Participation Mechanisms: Toward a Citizen Empowerment Strategy. Presented at the First United States Conference on Municipal Solid Waste Management; Solutions for the 90s sponsored by the U.S. Environmental Protection Agency, Washington, D.C., June 13-16.

Beutel, Trudi. 1994. Sewage Plant Scores Low. *South Delta Today.* December 2. **#3. Metals. Water reuse. Concerned citizen involvement. Education. Local ban.** Please reference response by Greater Vancouver Regional District (GVRD) on Dec. 11.

Bigsby, David. 1992. Making Sludge Work For Us. *Monday Magazine.* September. **#2. Odors. Pathogens. Land application. Successful programs.** King County is cited as being a successful biosolids recycling program. Used as model.

Billings, Loren. 1997. Citizens Win; Coleman Agrees to Withdraw Sludge Application: Owner Will Use Topsoil to Reclaim Gravel Pit. *The Conway Daily Sun,* NH, 9 (70), April 14.

Billings, Loren. 1997. Sludge Spreading: Organic Bounty or Toxic Threat? *The Conway Daily Sun*. July 14. New Hampshire.

Binder, D. L. and D. H. Sander. 2000. Biosolids Research: Sewage Sludge vs. Nitrogen Fertilizer. http://ianr.unl.edu/ianr/lanco/enviro/biosolids/research.htm.

Bio Gro Systems, Inc. 1988. Commonly Asked Questions About Sludge Recycling and Land Application. Pamphlet distributed by the Charlotte-Mecklenburg Utility Department's Biosolids sludge recycling program.

BioCycle. 1990. How to Tackle a Siting Challenge. 31(5):38-39. **#1, appearance, perceived odors, transfer station/recycling facility, NIMBY.**

BioCycle. 1993. From Stripmines to Forests: Thirty Years of Land Reclamation with Biosolids. October.

BioCycle. 1996. Vindication for Biosolids Land Application Project in Texas. 37(4):8. **#3. hazardous materials, land application, miscommunication by media, Sierra Blanca TX.**

BioCycle. 1997. County Bans Biosolids For Land Application. **#2. Ban, land application.** "The concern wasn't so much about the health effects of land application, but that it would harm the public's perception of the agricultural industry."

BioCycle. 1999. Compost Site Comes Back From the Brink. May. #**3.** Composting facility benefits from adopting an Environmental Management System (EMS).

BioGro Systems. *From Waste to Resource: Land Application.* Videotape. 15 minutes. **#3.**

City of Lincoln, 2000. Biosolids Land Application Program: A Partnership Between the City of Lincoln, UNL Cooperative Extension in Lancaster County and County Crop Producers. http://www.ianr.unl.edu/ianr/lanco/enviro/biosolids/overvew.htm, retrieved November 27, 2000. **#2. Public participation.**

Bisogno, T. 1995. The Sludging of America, Sewage Waste Spread on Farms and Landfills is Causing Chronic Health Problems. *E / The Environmental Magazine,* May/June: 19-22. www.emagazine.com. May-June. **#3, land application, health effects.**

Bleifuss, Joel. 1995. Nightmare Soil. *In These Times,* October 16-29: 12-16. A rebuttal by Alan Rubin, USEPA, is available. **#2. Metals, chemicals, pathogens, concerned citizens.** Summarizes parts of the book *Toxic Sludge is Good For You* (see Stauber, 1995, below). Includes discussions of Sierra Blanca, TX, support by EPA of WEF and other proponents, the Powell-Tate communications plan, and Abby Rockefeller: "'We need to make the public understand what is going on,' she says. 'Because you can't what people and industries pour down the drain, the toxicity of the sludge is unpredictable….But people don't know this because the EPA and some of the major environmental groups like the Natural Resources Defense Council and the Environmental Defense Fund [tacit supportes of the EPA's sludge-fertilizer policy] have kept their mouths shut on the subject. I had thought I could get support from environmental groups, but I was being naïve.'"

Blethen Maine Newspapers. 2001. Lyman's Sludge Debate is Likely to be Repeated. January 8. **#4. Urbanization.**

Block, Dave and Robert Rynk. 2000. Fire Destroys Hartford In-Vessel Composting Facility: From the Perspective of a Compost Operator, Key Questions Arise About How The Fire Could Have Been Prevented. *BioCycle*. 41(1): 51-52. January.

Bosomworth, C. Myrna. 1992. A Clean Valley, Please. *The Similkameen Spotlight.* October 28. **#2. Odor. Trucking. Land application. Someone else's biosolids are unacceptable.** Citizen speaks in support of sludge use, but states concerns with odors and transportation.

Boston University School of Public Health, Department of Environmental Health. 2001. Press Advisory. October 29.

Braile, R. 1998. Environmentalists Blast State Plans on Waste Control. *Boston Globe, NH Weekly*. November 15.

Braile, R. 2000. Disposal Methods for Sludge are Scrutinized. *The Boston Globe, NH Weekly*. August 27. **#3, groundwater pollution, nitrates, best management practices.**

Braman, Jonn. 1998. Princeton Will Be Main Show at Fall Symposium. *The Similkameen Spotlight*. April 21. **#3. Odor. Dust. Land application. Successful project. Education.** This biosolids land reclamation project improved environmental health noticeably (see Case Study #4).

Braman, Jonn. 1999. Braman Answers Questions on Biosolids in Keremeos. *The Keremeos Review*. March 18. **#2. Groundwater. Surface water. Nutrients. Land application. Landfilling. Lack of trust. Profit motive/lower cost.** Braman, biosolids manager, open about procedures.

Braman, Jonn. 2000. A Safe And Environmentally Responsible Product. *The Ashcroft Journal.* August 15. **#2. Pathogens. Land application. Incineration. Landfilling. Liability (responsibility). Education.** Braman responding to concerns directly.

British Columbia Lung Association. 2000. Changes in Princeton Bring Breath of Fresh Air. May. **#2. Dust. Land application. Successful program. NIMBY.** The BC Lung Association accredited biosolids reclamation for cleaning air in Princeton and vanquishing dust storms. There was opposition while the project was happening, but even the "naysayers who were adamant did a complete turnaround," once they saw the results. This article describes a significant benefit of biosolids recycling as a tool for addressing a significant environmental and public health problem. More on this in Case Study #4.

Brobst, R.B. 1994. Biosolids Project Acceptance; New York City's Biosolids are Land Applied to the Eastern Plains of Colorado. In *The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective,* Washington, D.C.: Water Environment Federation. 9-13–9-24. **#1, land application, heavy metals, environmental impact, lack of trust, public involvement throughout process, urban/rural someone else's biosolids.** A look at public acceptance success with a potentially very controversial project. Local public participation, open communications, strong oversight and enforcement, and making things better locally were critical. "Public awareness of health, safety, and environmental issues is increasing. Environmental professionals must be prepared to present their message in a matter that fosters confidence and encourages input. The "best professional judgment" takes the concern of the public and, within reason, places these concerns as permit conditions. The EPA's policy (i.e., the 1984 Beneficial Reuse Policy and the 1991 Interagency Policy on Beneficial Use of Sewage Sludge) of strongly supporting the beneficial reuse of biosolids is closely linked to its objective of reducing the volume of waste generated. Improving the productivity of our land using the soil conditioning properties and nutrient content of biosolids has human health and environmental advantages beyond those that are directly associated with applying biosolids to the land. Secondary or related benefits of reusing biosolids result from a reduction in the adverse human health effects of incineration and decreased dependence on chemical fertilizers."

Brockway, Dale G., Phu V. Nguyen. 1986. Municipal Sludge Application in Forests of Northern Michigan: A Case Study. *The Forest Alternative.* University of Washington, Seattle, WA.

Brooks, John P., Charles P. Gerba, and Ian L. Pepper, 2004. Biological Aerosol Emission, Fate, and Transport form Municipal and Animal Wastes. Journal of Residuals Science & Technology: vol. 1, no. 1, January.

Broten, Delores. 2001. When the Sludge Hits the Field…and the Water, and the Lettuce…. *Watershed Sentinel.* December 2000-January 2001. **#3. European standards, metals, pathogens, chemicals.** British Columbia. A typical environmental press story focused on the potential risks of using treated sewage sludge.

Brubaker, Gregory F., Gerald Conway, and Ken Kellum. 2000.Using Computerized Operations a nd Management Tools to Enhance Environmental Stewardship And Regulatory/Public Acceptance of Biosolids Land Application Programs. Water Environment Federation TEC Paper. October.

Brubaker, Gregory F., Gerald Conway, Ken Kellum. Using Computerized Operations and Management Tools to Enhance Environmental Stewardship and Regulatory/Public Acceptance of Biosolids Land Application Programs. October 2000, (28) WEFTEC conference paper.

Brusch, Kelly. 2004. Residents fear renewed use of sludge on farmland will bring health problems. *North County Times.* April 10. (San Diego & Riverside Counties, CA). Retrieved April 22, 2004 from http://www.nctimes.com/articles/2004/04/11/news/californian/23_29_374_10_04.html .

Buck, Fielding. Reporting Health Risk Stories. Obtained from *FACSNET* in 2003: http://www.facsnet.org/tools/ref_tutor/risk/wiener.php . **#2. Risk communications, media.** A primer for reporters and others regarding how best to present risk information (see also Kamrin et. al.)

Buckley, S.W., and T.J. Muirhead. 1994. Composting Success: An Odor-free Beneficial Use Product. In *Proceedings of the Water Environment Federation 67th Annual Conference & Exposition, WEFTEC '94*, Chicago, IL: Water Environment Federation. October 15-19. 677-686. **#2, composting, odor, public education/outreach.**

Bunn, Michael. 1995. Reader wants Nutrifor Used On Blockades. *The Similkameen Spotlight.* September 13. **#3.W. Stockpiling. Land application. Concerned citizen involvement.** Writer poking fun at using biosolids as a method of defense (blockade, dumping).

Burbridge, Don. 1998. Nutrifor takes naturalists on demo tour. *The Similkameen Spotlight.* June 10. **#2. Dust. Successful project. Land application. Education.** Positive article on use of demonstration tour.

Burch, Michael R. 2000. Sludge Claims Waste Time, Money. Letter to *USA Today,* July 31**. #3. Worker safety.** "In more than 15 years of treating, hauling, and applying biosolids to land throughout Ohio, my company knows of no resulting health problems experience by our employees or customers or by the workers in any municipal wastewater treatment plants we serve."

Burke, Thomas A. 2002. The Science of Recycling Sewage Sludge. Washington, DC: National Academy of Sciences. September 6. **#3. Science. Technology.** An op-ed clarification of the 2002 National Research Council report on biosolids and EPA's Part 503 regulation by the Chair of the council committee. See also National Research Council, 2002.

Burros, Marian. 2000. U.S. Imposes Standards for Organic-Food Labeling, *New York Times*, December 21, 2000. **#3. Organic foods.** Reporting on the final adoption of the National Organic Rule that precludes the use of biosolids.

Bynum, James. 1999. EPA and the New Plagues. Copake, NY: National Sludge Alliance. March 31. http://www.purefood.org/toxic/toxicpoison.cfm. **#3. Concerned citizens, pathogens, metals, chemicals, lack of trust, etc.** Lengthy summation of concerns and descriptions of alleged harm to animals, etc.

Cable News Network (CNN). 1997. Hazardous Harvest: More Than a Bad Smell?, Denver Sludge is Stinky Biz, and EPA Defends Sludge Rules. *Moneyline,* special reports (television) by Bill Dorman, June 25, 26, and 27. http://cnnfn.cnn.com/1997/06/25/busunu/hazard_one_pkg/ **#3. Concerned citizens, metals, pathogens, chemicals, Part 503 rule.** A significant national media event.

California Water Environment Association. 1998. *CWEA Manual of Good Practice, Agricultural Land Application of Biosolids*. Prepared by the CWEA Steering Committee on Manual of Good Practice for Agricultural Land Application of Biosolids, Oakland, CA. **#1, land application, best management practices.** The California Water Environment Association (CWEA) has prepared this Manual of Good Practice for agricultural land application of biosolids. The purpose of this manual is to establish a standard of excellence when applying biosolids to agricultural land. Issues addressed include nuisance abatement, good neighbor relationships, and shared responsibilities among all parties with the goal of enhancing biosolids recycling. The objectives are to: 1) Promote responsible and informed biosolids management and public acceptance of biosolids recycling, 2) Recommend good management practices for agricultural land application of biosolids to ensure the safe and beneficial use of biosolids, and 3) Encourage statewide uniformity in the application of these practices. The primary audience for the Manual consists of four groups: Generators, Transporters, Appliers, and Growers. Growers include landowners and lease holders, if applicable. A secondary audience includes farm advisors; cooperative extension agents; local, regional, and state regulators; residents; consultants; environmental organizations; and the general public. The Manual is written with the assumption that the audience has a basic understanding of land application practices and the federal biosolids regulation. Those wishing to become more familiar with these are encouraged to attend the CWEA Biosolids Land Application Training Course. The course provides both classroom and in-the-field training over a two-day period.

Calverton Citizens' Association, 1996. *Calverton Current*. Calverton, MD: Calverton Citizens' Association. December.

Calverton Citizens' Association, 1997. *Calverton Current*. Calverton, MD: Calverton Citizens' Association. February.

Campbell, Diana. 2000. Utility's compost recipe keeps gardeners smiling. *Fairbanks Daily News - Miner*. July 4. **#2.** Talks about process in making biosolids and how popular the material is (high demand).

Campbell. 1991. Cartoon. September 29.

Canadian Press, The. 1993. Sludgemeister Saddled With Dirty Job Of Marketing Sewage. January 25. #**3. Nutrients. Pathogens. Land application. Appearance. Class A. Class B. Media campaign. University involvement.**

Canning, K. 1999. Biosolids Initiatives Promote Beneficial Reuse. *Pollution Engineering* 31(2):40-42. February. **#1. Land application, environmental management systems, best management practices.** Determined to educate the general public as well as stakeholders, USEPA and other agencies and organizations have launched a number of initiatives to encourage the beneficial reuse of biosolids. To ensure the regulatory side of the federal biosolids program is working properly, USEPA formed the Biosolids Program Initiative Team in 1998. The National Biosolids Partnership – a joint effort involving USEPA, the Association of Metropolitan Sewerage Agencies, and the Water Environment Federation – is currently focused on the development of a national environmental management system for biosolids. Regional biosolids groups support the beneficial reuse of biosolids by sharing knowledge about biosolids management with a variety of stakeholders and the general public. A number of stakeholders are realizing success by designating specific sites for biosolids recycling.

Cannon, C. 1996. Work Continues on Public Health Issues. *BioCycle* 37(5):83. **#3, aerosols, composting, concerned citizen.**

Cannon, Mary Ellen.1996. All Sludges Are Not Created Equal. Reader’s Forum Column. *Coos County Democrat-Lancaster, NH*. 1-A. November 13.

Canody, Jeremy. 1997. Improving the Public's Perception of Biosolids. *Small Flows*, 11 (4): 5-6. National Small Flows Clearinghouse. **#2. Concerned citizen.** "According to John Walker, leader of EPA's Biosolids Management Implementation Team, the public and some environmentalist groups are concerned…for various reasons. These include problems with odors, fears about the potential for groundwater contamination, and fear that the federal and state regulations on biosolids reuse are not being properly followed." Each of these issues is discussed in this article.

Carlile, B.L. 1995. Perceptions of New York City Biosolids in Texas: The Sierra Blanca Ranch Report. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**2. Transportation. Land application. Profit motive/lower cost.** Talks about how this project brought a community back to life by providing jobs while nurturing the environment.

Carlile, B.L., and T. Gillane. 2001. Applying New York City Biosolids on a West Texas Ranch – Eight Years of Operation and Results. WEF Joint Residuals and Biosolids Management Conference, San Diego, CA. Discusses Sierra Blanca Merco Joint Ventures land application project.

Carpine, Joy. 1995. Sludge may be key to sweeping Scotch broom from Discovery Park. *Queen Anne/Magnolia News*. July 12. #**3. Pathogens. Trucking. Land application. Safety when transporting.**

Carpine, Joy. 1995. Stink Raised Over Sludge in Discovery Park. *Magnolia News*. August 9. **#2. Pathogens. Odor. Land application. NIMBY.** "I was more comfortable with it after the meeting."

Center for Environmental Communications. 1999. *Survey Report: opinions of selected respondents on the recycling of biosolids.* Unpublished report to the New England Biosolids and Residuals Association. **#3.** Provided input to report "Cultivating…" see Beecher, 1999, above.

Center for Food Safety, 2003. Petition Seeking an Emergency Moratorium on the Land Application of Sewage Sludge." **#1. Public perception, metals, chemicals, pathogens.** This petition, submitted to U. S. EPA by the Center for Food Safety on behalf of the Center and 72 other mostly small, local organizations, called for a moratorium on biosolids use because of various issues. U. S. EPA responded with a denial of the petition and detailed rebuttals to each allegation.

CH2M Hill. 1982(?). Sludge Management: Public Perceptions and Politics. A CH2M Hill study conducted by Consumer Concepts, Milwaukee, WI. **#2**. **Public perception, public participation.** "A survey of sewerage agencies identifying effective strategies for addressing public and political involvement in the waste treatment and sludge disposal management." Includes discussions of Boston MA, Centerville VA, Chicago IL, Houston TX, Los Angeles CA, Madison WI, New York NY, Philadelphia PA, St. Louis MO, St. Paul MN, Salem OR, and San Diego CA.

Chaney, Rufus, USDA Agricultural Research Service.1997. Review Comments on Cornell University's Draft Paper ("Case for Caution"). Unpublished letter. **#4**. This USDA scientist, who has studied biosolids use for three decades, provides a strong rebuttal to some of the claims of the "Case for Caution," especially concerning trace metals in biosolids.

Chaney, R. L. 1990(a). Public Health and Sludge Utilization. *BioCycle*, 31 (10): 68-73. **#3. Metals.** One of two articles in *BioCycle* summarizing the research, risk assessment, and resolution of technical issues that led to the final federal 40 CFR Part 503 biosolids rule.

Chaney, R. L. 1990(b). Twenty Years of Land Application Research. *BioCycle*, 31 (9): 54-59.

Chaney, Rufus L., James A. Ryan, and Sally L. Brown. 1999. Environmentally Acceptable Endpoints for Soil Metals. In W.C. Anderson, R.C. Loehr, and D. Reible (eds): *Environmental Availability of Chlorinated Organics, Explosives, and Metals in Soils*, Am. Acad. Environ. Eng., Annapolis, MD. ***#3*** Addresses concerns raised by Harrison/Cornell Waste Management Institute's "The Case for Caution."

Chapman, Liz. 2001. Neighbors Are Putting Up a New Stink About an Old Farming Practice. Lewiston, ME:*Sun Journal*, http://www.sunjournal.com/story.asp?slg=031801sludge. March 18.

Charlotte-Mecklenburg Utility Department (CMUD). Beneficial Use of Biosolids…A Success Story. Brochure.

Charlotte-Mecklenburg Utility Department. Artificial Soil Use as Landfill Cover Material. CMUD pamphlet.

Cherry, S.R. 2000(a). EPA's Secret Role in Toxic Sludge. *Insight on the News* 16(27):17. July 24. **#3. intended to scare, lack of trust EPA.**

Cherry, S.R. 2000(b). Sludge Excuses Still Stink. *Insight on the News*. May 29.**#2. Oversight, enforcement, concerned citizens.**

Cherry, S.R. 2000(c). Toxic Waste Used as Fertilizer? *Insight on the News*. May 15. **#3. lack of trust, oversight, enforcement.**

Chesapeake Occupational Health Services. 1991. Health surveillance program for compost workers: An epidemiological review. WSSC Site II, Silver Spring, MD.

Chess, Caron and Kristen Purcell, August 1999, "Public Participation and the Environment: Do We Know What Works?" *Environmental Science & Technology*, 33(16):2685-2692.

Chitwood, Tim. 2000. *Bright Side of Biosolids.* Columbus Ledger-Enquirer, Columbus, OH. **#4. Word biosolids v. sludge.**

Christen, Kris. Public Pressures Swiss to Ban Biosolids. *Water Environment & Technology*. March, pp.16-18.

Chrostowski, Paul C., Sarah Foster, and Damian Preziosi. 2002. *Scientific Peer Review of "The Case for Caution."* Presented at the New York Water Environment Association. Takoma Park, MD: CPF Associates. February 3-6.

Chrostowski, Paul C. and Robert G. O'Dette. 2002. Demystifying the Great Biosolids Debate: Sound Science Removes Emotion From Decisions About Biosolids Recycling. *Pollution Engineering*, 34: 8. Business News Publishing. August.

Circuit Court of Loudoun County, Virginia. 1990. *Ticonderoga Farms, Inc. v. Loudoun County, et al.; Ticonderoga Farms, Inc. v. Zoning Appeals Board of Loudoun County; William E. Detweiler, Zoning Administrator v. Ticonderoga Farms, Inc., et al.* Case Nos. (Chancery) 12368, (Law) 11075, (Chancery) 12545 Consolidated with Case No. (Law) 11075. August 17.

City of Salem. Protecting our Water Heritage. Brochure/Poster. Salem, OR.

Clapp, C.E., W.E. Larson, and R.H. Dowdy. 1994. *Sewage Sludge: Land Utilization and the Environment.* Madison, WI: American Society of Agronomy, Crop Science Society of America, and the Soil Science Society of America. **#3.** Comprehensive collection of papers regarding current knowledge at the time regarding biosolids recycling, including a review by Forste (see below) of public acceptance issues.

Clark, D. 1994. "Boulder Shouldn't Dump Sludge in Gunbarrel." *Boulder Daily Camera.*

Clark, K. 1998. Forum to Smooth Effluent Spread. *The Nelson Mail*. 3. January 26. **#4, inhibited recreational use, land application.**

Clayton Wastewater Sludge Gets Rave Reviews: Customers Line Up to Buy Products to Fertilize Farmland. 2001. *Atlanta Journal-Constitution*. June 25.

Clean Water Report. 2002(a). Both Sides in Land Application Will Take Views to the Public. Silver Spring, MD: Business Publisher's, Inc., 40(2):11-12. January 28.

Clean Water Report. 2002(b). NRC Report Important for Groups to Promote Their Viewpoint. Silver Spring, MD: Business Publisher's, Inc., 40(4):31,36. February 25.

Clean Water Report. 2002(c). Working Out Compromises. Silver Spring, MD: Business Publishers, Inc. 40 (21): 201, October 21. **#2. Concerned citizens, best management practices.** Reports on Virginia counties working negotiating agreements with biosolids users to ameliorate citizen concerns: ""The county may require new residents near farms to sign a disclosure statement with their real estate agents…. Officials also suggested farmers not spread biosolids near holidays; apply biosolids in a checkerboard fashion to avoid concentration; increase buffer zones near residential areas; study using other forms of biosolids, such as pellets; and hire independent consultants to test air, water, and soil quality after spreading is complete."

Cleveland, Charles B. 1976. Chicago: Joanne Alter, MSD Commissioner, Turns Engineering Ideas into Everyday Words. *Illinois Issues*, January. (Available at http://www.lib.niu.edu/ipo/ii760130.html.)

Clines, Francis X. 2000. The 2000 Campaign: The Battle For West Virginia; King Coal Casts Shadow on Governor's Race. *New York Times*, October 27, 2000. **#4. The word "sludge."** "It may be the ultimate political symbol for the coal fields of Appalachia: Just in time for the West Virginia governor's race, a slurry dam burst on the state's border with Kentucky, sending 250 million gallons of coal-dust sludge oozing down toward ..."

Cogger, Craig and Dan Sullivan. 1991. *Recycling Municipal Wastewater Sludge in Washington.* WSU College of Agriculture & Home Economics.

Cogger, Craig. 1993. Environmental Ethics: Why They Are Important to Us! *Entering a New Era*. Alderbrook, WA. Northwest Biosolids Management Association 5th Annual Biosolids Management Conference. #**2.** Looks at the ethics behind sustainability and how this is something that is of vital importance in not pushing nature's limits too far.

Cohen, Bonner. 1998. Blowing the Whistle on EPA's Misuse of Science, an Interview with Dr. David L. Lewis. *Environment News*, March. **#3. Metals, Part 503, regulatory climate.**

Cohen, Nevin, June 1995, "Technical Assistance for Citizen Participation: A Case Study of New York City's Environmental Planning Process," *American Review of Public Administration*, 25(2):119-135. **#1. Public participation.** While city-funded technical assistance have enabled citizen advisory groups to monitor environmental reviews and project design and to secure environmental improvements to proposed facilities, they have not helped to promote citizen acceptance of the technologies or their locations. Technical assistance has made environmental decisions more sensible, but not necessarily more democratic. The additional scrutiny provided by technically assisted citizens has prevented New York from making mistakes and has illuminated environmentally sound alternatives; yet, the technical advisors have done little to promote political consensus or to dramatically bolster citizen clout in administrative decision making. Factors that influence effectiveness of citizen advisory committees are discussed: composition of committee and credibility of its membership, members connected to advocacy groups with significant clout or resources, members' long-term commitment. If members are primarily people appointed by administration, then public may be suspicious of their conclusions. Timing of intervention - providing advice before city's proposals are finalized is preferable to a committee reacting to what city has already formalized. Politics of administration - a sympathetic administration to citizens and environmental interests is more likely to listen to advisory committee; if administration's hold on power is tenuous then more likely to pay attention to advisory committee.

Cohen, Nevin. 1997. The Politics of Environmental Risk: Perceptions of Risk in the State Legislatures. Urbana, IL: *Policy Studies Journal*. 25(3):470-484. Fall. **#3. Risk perception.**

Coleman, Cynthia-Lou and Clifford W. Scherer. (1990). Communication, Community Participation and Waste Management. Presented at the First United States Conference on Municipal Solid Waste Management; Solutions for the 90s sponsored by the U.S. Environmental Protection Agency, Washington, D.C., June 13-16.

Coleman, Steve and Fred Sherwin. Biosolids: A Rose by Any Other Name. Ontario, Canada: *The Star*. http://www.orleansnews.com/pages_star/biosolids.html.

Colorado Citizen Action Network.1998(?). Resolution in Support of Safe Communities, Farms and Food. Resolution and petition by citizen's group. http://www.ienearth.org/lowry.html. **#3. Radioactivity, Lowry Landfill, citizen concerns.**

Colorado Department of Public Health and Environment, Water Quality Control Division and the U.S. Environmental Protection Agency, Region 8. *Questions and Answers about Biosolids Recycling in Colorado.* **#2**.

Colorado State University. 2000. Research description. http://lamar.colostate.edu/~ippolito/biosolids/biosolids.html **#4**.

Communications System for the National Biosolids Partnership and Regional/Local Biosolids Groups. 1999. Suggestions from the "Re-Investing in Success" Workshop. Charlotte, NC. August 20.

Composting News. 2002. National Whistleblower Center Requests EPA Action on Sludge. March, pp.7,10-11.

Connelly, Shelagh. 2000. Beneficial Use, Politics, and the Cost of Upgrades, a presentation to the New England Water Environment Association Residuals Management Conference, November 16. **#3. Regulatory climate, septage, politics.** "The net effect of adopting regulations that are so stringent, in theory to protect the environment, may actually have the opposite effect as options to recycle are eliminated and communities are forced to landfill or incinerate…. What is the cost to municipalites of negative campaigning and 'politicizing of poop?' More rules, less trust from the public, policy driven by fear rather than science, mandate to 'make sludge safer.'"

Cooper, Chris. 1995. Save Our County from Perception. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1. Concerned citizen involvement. Education.** A regulator's standpoint in regards to public perception issues.

Cooper, Robert C. 1991. Public Health Concerns in Wastewater Reuse. *Water Science Technology*, 24(9), 55-65. **#2: risk acceptance, technology acceptance:** Specific public health concerns might fuel public opposition to wastewater reuse, and impede recycling of waters for groundwater recharge. There is particular emphasis on pathogens, and of trace organic compounds, which should not pose increased risk to those using the water if proper water quality standards are observed. The article is silent on social acceptance of wastewater discharge to potential drinking water supplies.

Cooper, S. 1998. Plant a Priority, Candidates Claim. www.augustachronicle.com. November. **#4, political.**

Cooperative State Research Service Technical Committee W-170. 1989. *Peer Review: Standards for the Disposal of Sewage Sludge, U.S. EPA Proposed Rule 40 CFR Parts 257 and 503*. A.L. Page and T.J. Logan, editors.

Cornell Waste Management Institute. Sewage Sludge Fact Sheets. http://www.cfe.cornell.edu/wmi/Sludge/Production.pdf

Cornell Waste Management Institute. 1996. *Land Application of Sewage Biosolids*, a video teleconference on sewage sludge/biosolids issues. Information available at http://www.cfe.cornell.edu/wmi/Sludge/biosolid.html Discussion of issues includes variety of perspectives and addresses neighbor concerns.

Cornell Waste Management Institute. 1997. Comparison of Sludge Standards: US EPA EQ versus Dutch Sludge (chart). October 15. http://members.tripod.com/~PA_Sludge/gifs/epa_neth.gif.

Cornell Waste Management Institute. 1997. Cornell Recommends. Available at http://www.cfe.cornell.edu/wmi/Sludge/Recommends.html.

Cornell Waste Management Institute. 2001. Ordinances. http://www.cfe.cornell.edu/wmi/Sludge/Role.pdf

Corraliza, Jose A. 2000. Environmental Values, Beliefs and Actions: A Situational Approach. *Environment and Behavior*, 32(6), 832-849. **#2: behavior, acceptance, attitudes, trust.** This study investigated the influence of the interaction between personal and situational variables in environmental behavior and the predictive power of values and beliefs. Three different kinds of questions (environmental beliefs, Schwartz's measure of values, and physical-environmental inhibition level) and one item of general environmental concern were presented, along with a 16-item list of environmental actions, to 125 randomly selected subjects. The conclusions were: (1) environmental behavior depends on personal and situational variables in an interactive way; (2) when high conflict level is generated between personal dispositions and situational conditions, the predictive power of attitudes tends to be minimal, whereas in the case of consistency between them it tends to be maximal. The influence of situational variables was found to depend on the environmental action considered. In some cases, situational variables were the most important, whereas in others, commitment or moral obligation played an essential role.

Couch, S.R. and S. Kroll-Smith. 1994. Environmental Controversies, Interactional Resources and Rural Communities: Siting vs. Exposure Disputes. *Rural Sociology*, 59(1), 25-44. **#1: Risk perception, siting, environmental risk.** There are differences in the types of social conflict in facility siting disputes and toxic contamination cases. An ecological-symbolic perspective and the concept of strong and weak ties are used to interpret the nature of social conflict in two rural PA communities. Community solidarity appears to be enhanced in siting disputes and undermined in exposure situations. The author follows two conflict paths that move from the presence or absence of the hazardous agent to individual perceptions, the generation of collective threat beliefs and formation of strong ties, the emergence of alternative leadership and its relationship to official authorities and formation of weak ties. In short, different types of disputes will have different effects on how a community responds.

County Commission. 2001. Jefferson County Use of Sludge Wins EPA Awards. Newsletter, Vol. 3, issue 4, June.

Court of Appeals of Ohio, Eleventh Appellate District, Trumbull County. 1995. *STATE ex rel. RONALD PAUL FOX, et al., Plaintiffs-Appellees, -vs- RICHARD ORWIG, et al., Defendants-Appellees, MARK BOCKELMAN, et al., Defendants-Appellants.* Case No. 94-T-5100. September 15.

Covello, Vincent. 1983. The Perception of Technological Risks: A Literature Review. *Technological Forecasting and Social Change*, Vol. 23, 285-297.

Covello, Vincent T. and F.W. Allen. 1988. *Seven Cardinal Rules of Risk Communication,* brochure. Washington, D.C.: U.S. Environmental Protection Agency.

Covello, V. and P. Sandman. 2001. Risk communication: evolution and revolution, in A. Wolbarst (ed.): *Solutions to an Environment in Peril.* Baltimore, MD: John Hopkins University Press, 164-178. **#1. Risk communication.** An excellent summary of the history and findings of risk communication research. Notes that obstacles to understanding risk include "the public's desire and demand for scientific certainty. People are averse to uncertainty, and find a variety of coping mechanisms to reduce the anxiety it causes. This aversion often translates into a marked preference for statements of fact over statements of probability—the language of risk assessment."

Covello, Vincent and Steven Wolf. 2003. Three Key Equations for Solving Public Meeting Nightmares. *Water Environment & Technology*. Alexandria, VA: Water Environment Federation, February. **#1. Risk communication.** Short synopsis of key risk communication concepts.

Craig, Rochelle. 2001. U. S. Filter Participates in STA Program, Guarantees High End Compost Product. *Waste Handling Equipment News,* September, p.6. **Product quality.**

Crawford, Scott. 1998. Paradise Sludged: Linda Lingle's Toxic Legacy. *Hawaii Environment & Health News* 1(1). September. http://www.hookele.com/hehn/98-09/sludged.html. **#3, land application, negative media campaign, carcinogens, metals, bad management, incorporation.**

Crittenden, Guy. 2001. Holy Sludge: Toronto's New Bylaw and Disposal Strategy for Biosolids Impacts Industry and Sets a National Precedent. http://www.hazmatmag.com/current/articles/0101.html. December/January.

Culos, Ermos. 2000. Let's Not Take This Crap From GVRD. *The Ashcroft Journal*. August 8. **#2. Pathogens. Land application. Facility Siting. Lack of public information. 'Yuck' factor. NIMBY. Lack of trust. Urban/rural conflict.** Culos feels betrayed by larger city coming in and disposing of waste.

Culos, Ermos. 2000. Stop the Mudballs. *The Ashcroft Journal.* August 29. **#2. Pathogens. Metals. Spills. Land application. Manure. 'Yuck' factor. Lack of trust. NIMBY.** Culos is restating his disagreement with biosolids applications.

Currie, Beth. 2000. Open Letter to the Town of Princeton. *The Similkameen Spotlight.* July 4. **#2. Dust. Land application. Education. Media campaign.** Currie submitted an article to celebrate a successful biosolids project.

Curtis, Maureen. 1995. Sewage for Sale, West Van Council Told Sludge Helps Heal Land. *NS News.* July. **#2. Stockpiling. Land application. Regulatory climate.** BC biosolids manager presents reuse options that replace ocean dumping.

Cusick, Daniel. 2000. Officials: Sludge Safe if Properly Managed. *Mobile Register.* March 28. http://www.enviroweb.org/issues/sludge/.**#3. Politics.** Coverage of the U.S. House Science Committee hearing March 2000.

Dahl, Diana and Roy Smith. 1998. Agricultural Use of Sludge: "Don't" is the Only Safe Guideline. *Hawaii Environment & Health News,* Vol. 1, No. 1. **#4. Lack of oversight/enforcement, testing, chemicals.**

Daily Commercial News and Construction Report. 1994. Lining Up For Sludge. March 8. **#3. Odor. Pathogens. Stockpiling. Land application. NIMBY. Profit motive/lower cost.** Landfill will use 27,000 cubic meters of biosolids.

Daley, Beth. 2001. As Big Dig Fill Rises, So Do Problems. *The Boston Globe*. June 21.

DaSilva, David. Sewage to Cover Landfill. *MetroValley Reporter*. **#2. Nutrients. Odor. Land application. Lack of trust. Education.** It was a high priority to communicate the benefits to the public and council members through presenting other successful biosolids projects.

Davidov, R. 1999. Baltimore City Turns Biosolids Into Composting Success. *Waste Age* 30(7):16-18. July. **#4, composting on adjacent site, best management practices.**

Davis, Charles E. 1993. *The Politics of Hazardous Waste*. Prentrice Hall, Englewood Cliffs, New Jersey. **#2: acceptance, hazards perception, public relations, siting, NIMBY.** This book traces the evolution of public acknowledgement and resistance to siting hazardous waste management facilities, as well as the political dimensions of spills or improper use. It reviews a number of celebrated cases that illustrate how political opposition influences the final disposition of policy matters and, in some instances, the technical choices that are made to resolve problems.

Decision Research. 2000. Riverside County Solid Waste Survey.

Denver Metro Wastewater Reclamation District. 2001. Metrogro biosolids program website. http://www.metrowastewater.com/environment/index.html.

Denver Publishing Company. 1998. Contamination Plans, an Underreported Story. *The Denver Rocky Mounty News*. 41A. August 19. **#3, sewage sludge from hazardous/nuclear facility, metals, dioxin, asbestos, plutonium, land application, concerned involvement.**

Desoff, Alan. 2001. Saga of Biosolids Ban Continues. *Water Environment & Technology,* 13(7)26-29. July.

Detergent Pollution. 2001. New York: *Chemical Week*. 163(39):32, October 24.

Doherty, Lyonel. 1999(a). Biosolids Still Worry Residents. *The Keremeos Review*. January 21. **#3. Groundwater. Nitrogen. Metals. Land application. Class A. Class B. Regulatory climate. Local soils/climate/natural conditions. Lack of trust. Education.** Public meeting held to inform all interested of project and impacts. High concerns regarding nitrate leaching.

Doherty, Lyonel. 1999(b). Council opposes application rates in biosolids plan. *The Keremeos Review*. February 4. **#3. Groundwater. Metals. Pathogens. Nutrients. Land application. Class A. Class B. Local soils/climate/natural conditions.** Biosolids professionals present specifics of biosolids applications, but council still remained skeptical.

Doherty, Lyonel. 1999(c). Rancher Still Trying To Find the Negative On Biosolids. *The Keremeos Review*. February 4. **#2. Pathogens. Metals. Nutrients. Land application. Lack of trust. Education. NIMBY.** Rancher encouraging concerned individuals to learn more about biosolids before judging the fertilizer. After researching himself, rancher supports biosolids reuse.

Dolan, Roger J. 1990. Letter to Peter Machno. August 16.

Donaldson, B.K. 2000. Sewage Sludge Composting: A Citizen's Perspective. In *Biosolids Management in the 21st Century Conference,* College Park, MD. 12-15. **#1, fears of odors/pathogens, composting, lack of public involvement in process, concerned citizen.** Discusses Calverton citizens' efforts to change and close the Washington Suburban Sanitary Commission's Site 2 composting facility bordering their town. In the face of determined politicians and water and sewer authorities, isolated businessmen and concerned citizens can be easily steamrolled when creating treatment facilities. Doing so, however, may well be to the detriment of all concerned. An example concerning sewerage sludge disposal is presented to support that conclusion.

Donovan, John F. 1993. Getting the Sludge Rule On Line. *BioCycle,* April 1993. **#4**.

Dorr, D. 2000. O'Fallon Gets Into Organic Fertilizer Supplement Business. *St. Louis Post-Dispatch, St. Charles County Post*. 4. July 5. **#4, disposal, Class A, lack of information.**

Douglas, Mary. 1992. Risk and Danger (essay). *Risk and Blame: Essays in Cultural Theory.* Routledge, London and New York. **#2: risk, risk perception, risk understanding, NIMBY, the "other" fear of technology.** This essay focuses on the relationship between risk perception and the political component of decision making around hazardous waste. Outside of the probabilistic sense, risk is a politically laden topic, with demonstrable impacts that may, if the political interpretation of risk is carried to extremes, injure people or damage their environment. Therefore, risk analysis that excludes moral ideas and politics from consideration is senseless and potentially dangerous. The author argues that technological risks are not fear of technology or the fear of death and disaster, but fear of oppression by authority empowered by new technology. The author acknowledges that scientific/technical illiteracy has increased the chasm between technologists and the public, and she assigns technologists a special responsibility to explain risk in a context that can be understood by that public.

Dowd, Scot E., Charles P. Gerba, Ian L. Pepper, and Sureah D. Pillai. 2000. Bioaerosol Transport Modeling and Risk Assessment in Relation to Biosolids Placement. *Journal of Environmental Quality,* 29:343-348. **#3. Aerosols, land application, Class B.** Annotated copy by Helane Shields, Alton, NH became important document for those opposed to biosolids land application in suggesting harm to neighbors from airborne contaminants.

Downing, B. 1997. From Septic Tanks To Ohio Farmland. *Akron Beacon Journal*. http://Wayne-Health.org/septage_1297.html. December 14. **#4, septage application.**

Draman, Grace A. 1994. The Beneficial Reuse of Biosolids: How Important is Public Perception? In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation. **#1 NIMBY. Bad management. Lack of trust.** Stresses need to address perception, "do it right" and involve local public. Recommends certification of biosolids managers. Calls for states to provide more public education and information. "Whether we like to admit it or not, public perception is *reality* especially for those groups or individuals emotionally involved with issues or projects that relate to the environment…. It is difficult.…to have an objective dialogue with them, because it is similar to an argument over religion."

Draman, Grace A. 1995. Public Perception is Key to Biosolids Acceptance. *BioCycle*, 36(9), 82-83. **#3: risk perception, acceptance, NIMBY.** The author makes the case that public perception is the key to biosolids recycling, and the basis for action within the industry to fund research into attitudes on environmental risk as it relates to biosolids. Outstanding problems regarding quality and practices must be addressed, and strict adherence to federal Part 503 regulations a necessity. “First, public education and awareness programs that reach all levels must go full steam ahead. Equally important is the performance of everyone involved with beneficial use projects – it must be done right from top to bottom.” “Perception is reality, and it will make the difference as to whether or not a project is successful.”

Durand, Robert. 2000. Supporting Biosolids Recycling, a talk at a biosolids compost application demonstration, Harvard Medical School, Boston, MA, May 3. "Like any new idea, biosolids need to be promoted…. We want … to move away from the use of landfills and incinerators as the disposal method of choice. Basically, we want to eliminate the concept of waste.”

Duroe, M.G. 1993. Multi-county Composting and Recycling Program. In *National Extension Compost Utilization Conference*, Minneapolis, MN: Minnesota Extension Service/ Cooperative Extension System. 149-153. **#2, using extension services to bring forth public education.**

Earth Justice. 2001. Unchecked Incinerator Pollution Underscores Pervasive Problem: Toxic Emissions From Many Categories Remain Uncontrolled. Press Release. Washington, D.C. July 20.

Eckhaus, Mel. 2000. Biosolids--The Farmer's View, an Opinion. Letter to PA House of Representatives by PA Farm Bureau representative reprinted by PA Dept. of Environmental Protection, http://www.dep.state.pa.us/dep. **#3. In support.** "Many public fears of the use of

WERF

biosolids arise over the potential existence of foreign substances and or harmful concentration of substances in the material….DEP's current regulatory program should be given a fair chance to be implemented, and use of biosolids under the program be judged on its scientific merit."

Egigian-Nichols, C., and C. Lekven. 1998. All New Biosolids Fact Sheets – 26 Flavors from Sacramento. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 535-542. **#2, land application, education program, positive outcome.** The Sacramento Regional County Sanitation District (SRCSD) operates a successful biosolids land application program that includes a continuous, aggressive public education and outreach effort. Part of the education and outreach program includes creation of information tools useful for marketing their biosolids to farmers and to the general public. SRCSD created 26 Fact Sheets covering the full range of typical questions asked about biosolids. These tools are targeted to sell a specific audience on the safe and reliable recycling of SRCSD biosolids. SRCSD developed 3 message points for the Fact Sheets including: 1) Biosolids recycling benefits the environment as a fertilizer and soil enricher. 2) Biosolids recycling is proven, safe, and reliable. 3) SRCSD expertly creates these biosolids using sound science, commitment to quality control, extensive monitoring, and regulatory compliance. The Fact Sheets were developed from a list of over 125 questions. SRCSD established the list of questions, the SRCSD message points were refined and re-refined, scientifically factual information needed to supply answers was researched from the literature, concluding in the writing of the Fact Sheets.

Ehrmann, John R. and Barbara L. Stinson. 1999. Joint Fact-Finding and the Use of Technical Experts. In Lawrence Susskind, Sarah McKearnan, and Jennifer Thomas-Larmer (eds.), *The Consensus Building Handbook: A Comprehensive Guide to Reaching Agreement.* Thousand Oaks, CA: Sage Publications. **#1. Public participation, science.** Guidance on how to do joint fact-finding.

EKO Compost. *Compost: A Short History of the Earth's Original Soil.* Maui, HI.

Englebow, Jill. 1992. Co-composting Controversy: County Recycler Sees Spot on Team For Sludge. *The Maui News.* May 31. **#2. Groundwater. Metals. Landfilling.** Waste diversion efforts mentioned in this article as a primary advantage to using biosolids as a resource.

Environmental Research Foundation. 1997. New U.S. Waste Policy, Pt. 2: Sewage Sludge. *Rachel’s Environment & Health Weekly* #561. August. http://www.monitor.net/rachel/r561.html. **#2.**

Environmental Working Group. 1998(a). Dumping Sewage Sludge on Organic Farms? Why USDA Should Just Say No. April 30. http://www.enviroweb.org/issues/sludge.

Environmental Working Group. 1998(b). Toxic Wastes "Recycled" as Fertilizer Threaten U.S. Farms and Food Supply: Dioxin, Lead, Mercury Spread on Crops as States Scramble to Protect Public Health. http://www.ewg.org/pub/home/reports/factoryfarming/fertpress.html **#4. Fertilizer.** Concerns about chemical fertilizers that include industrial by-products.

Enviroweb. 2000. The Sludge Hits the Fan. http://www.enviroweb.org/issues/sludge/sludge.html.

Epstein, George. 2000. *Epstein's the Key, p*olitical advertisement. *Laconia Citizen*, NH. **#4. Politics.**

European Union. 2000. Working Document on Sludge, 3rd Draft. Brussels. April 27.

Evans, Tim. 2002. Summary of Attitudes To Biosolids Recycling. Unpublished manuscript.

Evanylo, Greg. 1998. *Biosolids Land Use Ordinances Gaining Favor.* Virginia Cooperative Extension. January. http://www.ext.vt.edu/news/periodicals/cses/1998-01/1998-01-05.html #**2. Communication, information.** Helpful fact sheet, presented even-handedly.

Evanylo, G.K. 1999. *Agricultural Land Application of Biosolids in Virginia: Risks and Concerns.* Virginia Cooperative Extension. Publication 452-304. Available at http://www.ext.vt.edu/pubs/compost/452-304/452-304.html **#2. Communication, information.** Helpful fact sheet, presented even-handedly.

Fahey, Tom. 2000. Governor Candidates Tackle the Environment. *The Union Leader*. October 11. **Politics.**

Fanfare Communications. Waste Management Specialists and Environmental Engineers are Winning the Battle of Technology, but Losing the War of Public Opinion: Here's What You Can Do To Help Your Projects Win Public Acceptance. Fanfare Communications pamphlet.

Farrell, Molly. 2001. Site Monitoring and Odor Control at Co-composting Facility. *BioCycle.* July.

Finkel, A. M. 1995. Toward less misleading comparisons of uncertain risk: the example of Aflatoxin and Alar. *Environmental Health Perspectives.* 103-4:376.

Fischhoff, B. 1999. Why (Cancer) Risk Communication Can be Hard. *Journal of the National Cancer Institute Monographs*, 25, 7-13. **#1: Personal control, risk communication, risk understanding, science understanding.** Effective risk communication is made more difficult because the communicator must determine what is most worth saying and the receiver must integrate that message using only his or her fragmentary mental models of the processes creating and controlling the risks. One risk communication strategy is to use analytic methods for selecting information based on how critical it is to recipients' decision-making. A second strategy is to adapt messages to the cognitive processes of the recipients.

Fischhoff, M.G.M.B., A. Bostrom, L. Lave, and C.J. Atman. 1992. Communicating Risk to the Public. *Environmental Science and Technology* 26(11):2048-2056. **#2, risk communication.**

Fisher, A. 1991. Risk Communication Challenges. *Risk Analysis*, 11(2), 173-79**. #2: risk communication, risk understanding, public acceptance.** The author compares models of risk communication from two polar perspectives, informing versus empowering, and compares the characteristics of each end of the spectrum and the gradations between them. A gradated matrix of these two perspectives is presented, with descriptions that range from "telling them what has been decided" to "helping them interpret results and to use ways to affect the decisions." The author identifies the areas that need additional research (Note: the specific characteristics cited in this paper have been studied in more detail since 1991).

Fitzcharles, Margaret. 2000. Norco Woman Fights DEP Over Spread of Sewer Sludge. *The Mercury*, PA, September 7. **#3** "'I have sent Secretary (James) Seif at the DEP a very strong letter telling him I am holding him personally responsible not only for the health and lives of my husband and myself but for all of us who will have to breathe in the fumes, possible pathogens, chemical combinations, heavy metals, sulfur or chlorinated combinations that may blow in our direction,' said Mazze."

Fleming, M. 1998. Dairy Cows Dying; Farmers Sue City. *Waste News*. 16. November 30. **#4.**

Fondahl, Lauren. 1999. Biosolids Management in the Western Region. *BioCycle*. July. **#1. Pathogen. Metals. Class A. Class B. Land application. Landfilling. Incineration. Composting. Stockpiling. Local/regional ban or restrictions. Lack of oversight/enforcement. Profit motive. Someone else's biosolids are unacceptable.** Bans have caused POTWs costs to rise for increased composting and/or increased transportation. POTWs choose what is most cost-effective.

Forste, J.B. 1993. Gaining Public Acceptance for Biosolids. *Sewage Sludge: Land Utilization and the Environment*, Bloomington, MN: Soil Science Department and USDA-ARS, University of Minnesota. August 11-13. **#1, land application, gaining public acceptance.** Those of us involved in public acceptance efforts recognize that scientific data and information about risk assessment do not necessarily result in public acceptance for the projects we develop. We are told that: (1) perception equals reality (i.e., a perceived risk is just as real to the person concerned about it as it scientifically derived risk assessment), and (2) in decision-making, perception outweighs reality. We need to remember, however, that perceptions about many subjects can and do change with time and with accurate, credible communication efforts. The beneficial use of biosolids provides a case in point regarding risk perception. A 20-year compilation of extensive, detailed, scientific data has clearly established that the treated solids from municipal wastewater can safely be used on land in a variety of ways. The quality standards for such safe beneficial use are based on protective assumptions about the impact of biosolids on the environment, crops, animals, and humans. Why then does a negative perception about the use of this material persist? Part of the answer lies in lack of understanding – the result of a very common and natural human apprehension. The average citizen knows little or nothing about wastewater treatment, the pretreatment programs which protect the integrity of this process, and the biological and chemical composition of the treated solids. To develop a dialogue with communities where biosolids will be processed or used, it is important to establish the link between our national commitment to clean water and the necessity to manage the solids from wastewater treatment. The environmental issues that relate to municipal wastewater solids and treatment are very different from those involving hazardous wastes; these issues must be clarified to win public confidence and support for beneficial use projects.

Forste, Jane. 1995. Building a Biosolids Program: Elements of Success. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1. Fairness, communications.** "We always need to remember that the questions people ask which arise from genuine concern are valid and demand clearly understandable, open and honest responses."

Forste, Jane. 1997. In for the Long Term: Developing Message for Sustainable Biosolids Recycling. *Illuminating the Future*. Vancouver, WA. Northwest Biosolids Management Association 9th Annual Biosolids Management Conference. #**2.** Discusses message tracks that should be focused upon: environmental, agricultural (other beneficial use) and health and safety.

Forste, J. 2000. Bridging the Communications Gap: The EMS Approach. *14th Annual Residuals And Biosolids Management Conference,* Boston, MA. **#2.**

Forste, Jane and Pete Machno. 1992. Biosolids Management: A New Way of Looking at an Old Resource. *Water Environment* 6(2), Summer.

Forste, J.B., and P.S. Machno. 1994. Public Acceptance of Biosolids--What's In a Name? In *The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective*, Washington, D.C.: Water Environment Federation. 9-45–9-55. **#2, developing public materials to promote biosolids., word "biosolids." Many issues addressed.** A summary of the work of the Water Environment Federation (WEF) Biosolids Public Acceptance Task Force and the Powell-Tate recommendations, including a summary of survey results. "We have to 'sell' a material this is accompanied by a history of negative perception." Identifies obstacles: "embedded beliefs regarding biosolids, health and environmental concerns, the NIMBYism prevailing in many rural and suburban communities," mistrust of government regulations as inadequate, limited resources, possible perception of scientific obsolescence due to scarcity of recent studies, and basic lack of public interest particularly from those not impacted directly." Identifies opportunities to pursue: "biosolids are a resource, power of recycling message can position biosolids as a solution, good sound bites (e.g. 'improving water quality') provide a positive environmental goal to be extended to biosolids recycling, positioning as 'water quality professionals,' safety-related messages have high receptivity and biosolids recycling is a sensible solution, environmental groups' support should be attainable based on the environmentally friendly use of biosolids (understanding that these groups may not totally accept or agree with EPA regulations), the strong scientific support for the safety of biosolids recycling can answer public concerns, strong supporters of biosolids recycling exist among key audiences and can be used to recruit other support." Stresses the need to engage with key opinion makers--gatekeepers--and convey certain messages which are appropriate to their interests. Gatekeepers include academics/agricultural scientists, water quality professionals, public health officials, agricultural groups/farming representatives, environmentalists, regulatory officials, and the media. Messages include an environmental one ("Biosolids recycling benefits the environment."), an agricultural one ("Biosolids recycling on lan helps farmers and benefits crops."), and a health and safety one ("Biosolids have been thoroughly researched by top scientists at leading scientific institutions and found to be safe and beneficial to the environment.") Introduces the phrase "Biosolids Recycling: Beneficial Technology for a Better Environment" and a communication plan.

Foster's Daily Democrat. 1998. Sludge Question Smells Like Politics: Rubens Knows Which Way the Wind Blows. Editorial, February 27, p. 8. **#4. Politics.** "…by homing in on a handful of sludge horror stories and fanning the populist flames of fear, Rubens has created an interesting duality…" attracting liberal environmentalists to go with his conservative Republican background.

Fox, Chuck. 1999. EPA Sludge Standards are Tough. *USA Today*. October 7. #**3.** Rebuttal by USEPA Office of Water assistant administrator of previous *USA Today* story (see *USA Today*, 1999, below). "Thirty years ago, thousands of American cities dumped their raw sewage directly into our nation's rivers, lakes, and bays. What has happened since then is an American success story…." Regarding biosolids recycling: "The EPA sets tough health standards for all disposal options, and backs them up with strong enforcement actions that hold treatment plants accountable….the EPA is obligated to provide the public with educational information, based on the best science, about the safe recycling and disposal of sludge."

Fraser, Patrick. 2000. Deadly Dirt? *WSVN TV News*, FL. November 14. Sunbeam Television Corporation.

Frederick Schnieders Research.1998. Survey results summary presented to the Water Environment Federation. **#1. Public perception.** A short national survey of a small sample that tested knowledge of biosolids and the usefulness of various messages about biosolids recycling. Some of the questions from this survey were retested in the 2002 Biosolids Public Knowledge and Perception Survey discussed in this research report.

Freeman, D. 1995. Controlling Odors: Don’t Let Them Get The Drift. *World Wastes* 38(9):40. September. #**3, odors, landfill disposal, best management practices.**

Freudenberg, W.F. 1996. Risky Thinking: Irrational Fears About Risk and Society. *Annals of the American Academy of Political and Social Science*, 545, 44-63. #**1: acceptance, risk**

assessment, risk perception, technology (trust). Public concerns over the risks of new technology have grown dramatically, to the point that they sometimes dominate decision-making and impede installation of beneficial technologies. In the face of declining "real" risks, the simplistic tendency is to blame public ignorance or irrationality, and argue that decisions should be based on quantitative risk assessments, ignoring public concern. Such assertions reflect fundamental misunderstanding of the nature of technological societies, the reasons behind declining scientific credibility, and the actual limits of risk assessment. Scientific risk assessments have practical utility, but proposals for risk-based decision-making could lead not to increased credibility for specific technologies, but self-reinforcing losses of credibility for science and technology as a whole.

Gardner, G. 1997. *Recycling Organic Waste: From Urban Pollutant To Farm Resource.* Worldwatch paper #135. Washington, DC: Worldwatch Institute. **#1. Concerned citizens, enforcement, local soils/climate, best management practices, lack of trust, liability.** A prestigious environmental group lays out the rationale for recycling organic wastes but stresses concerns about current U.S. standards for the recycling of biosolids.

Gardner, G. 1998. Recycling Human Waste: Fertile Ground Or Toxic Legacy? *World Watch* 11(1):28-34. January/February. **#3, land application, 503 worries.**

General Physics Corp. Environmental Services Division. 1991. Data results: Revised bioaerosol monitoring program for the Washington Suburban Sanitary Commission. Montgomery County Regional Composting Facility. Silver Spring, MD.

Gerber, Steve, Aaron Lopresti, and Gary Martin. 1993. *Sludge.* Westlake Village, CA: Malibu Comics Entertainment, Inc.,1(1), October. First edition of the *Sludge* comic book series.

Gigliotti, I. 1991. An Assessment of Attitudes and Beliefs About Sewage Sludge Management Strategies in New York. HDRU Series #91-10. Ithaca, NY: Cornell University Department of Natural Resources. **#2. Public perception.**

Gilbert, Steve and Sue Hennig. 1996. Biosolids Long-Range Planning: Changing the Paradigm. *A Bridge to Sustainability*. Chelan, WA. Northwest Biosolids Management Association's 8th Annual Biosolids Management Conference. #**2.** Discussion of public meetings and how the public attendance at the meeting "may have nothing to do with acceptance or approval."

Global Citizen, The. 1999(a). Environmental Debates Have Science and Emotion on All Sides. http://iisd1.iisd.ca/pcdf/meadows/debates.htm. May 28.

Global Citizen, The. 1999(b). Sludge by Any Other Name Can Still be a Problem. http://iisd1.iisd.ca/pcdf/meadows/sludge.htm. May 28.

Goldfarb, W., U. Krogman, and C. Hopkins. 1999. Unsafe Sewage Sludge or Beneficial Biosolids?: Liability, Planning, and Management Issues Regarding the Land Application of Sewage Treatment Residuals. *Boston College Environmental Affairs Law Review*. 26:687. **#2, Politics, ban.**

Goldsmith, Thomas and Monica Whitaker. 2000. Sludge Facility Ex-workers Questioned. *Tennessean.com*. April 8. http://www.enviroweb.org/issues/sludge/.

Goldstein, N. 1999. Environmental management system initiative. *BioCycle* 40(9):74-75. **#2, environmental management systems, initiatives to increase public acceptance.**

Goldstein, Nora. 2000. National Overview of Biosolids Management. *BioCycle*, December. **#2. Odors, metals, pathogens, urbanization, media, regulatory climate, successful programs.** This annual survey provides the best current summary of biosolids management in the U.S. The survey of state biosolids regulatory program leaders asked about the "top pressures" on biosolids recycling programs: "Hands down, odors are the number one pressure on biosolids recycling programs in the United States….Concern about pathogens was cited as the number two pressure….Suburban sprawl--both in terms of encroaching neighbors and decreasing availability of sites for land application--took third place….Several states mentioned negative media coverage…. Six states noted that costs are a pressure on beneficial use….General public acceptance challenges were listed, as were negative public perception…." See also previous *BioCycle* biosolids management surveys.

Goldstein, Nora. 2001. National Biosolids Partnership EMS Update. *BioCycle:* 42(5): 57-60. May.

Gray, George, Kim Thompson, and Pamela Williams. 2002. Risks of Conventional and Organic Produce: Public and Scientific Perceptions. Harvard Center for Risk Analysis: http://www.hcra.harvard.edu/foodresearch.html#tradeoffs **#3. Risk perception. "**Survey research suggests that the public misperceives the relative risk of different hazards, including those related to food safety. Much of the research on food safety risk perception has focused on qualitative assessments of pesticide risk, with little attention to the magnitude of consumers' risk judgments in the context of multiple food safety risks. Few studies have attempted to characterize consumer's perceived risk reduction achieved through consumption of organic, rather than conventionally grown, produce. This project compares public perceptions about a range of foodborne risks, including those from exposure to pesticide residues, microbial pathogens, and natural toxins, to scientific perceptions of the risks. Consumers risk judgments are from a food safety survey administered to food shoppers in the Boston area while scientific assessments are based on a review of the published literature. Study results indicate that the public significantly overestimates foodborne risks and are misinformed about food safety issues and agricultural practices. Consumers' perceptions that substituting organic for conventionally grown produce may substantially reduce risks are not substantiated by the science. The study suggests the need for consumer education about the range of food safety issues and better data on differences in foodborne risks associated with alternative farming methods."

Greater Vancouver Regional District. 2000. *Issues on Biosolids: Report on Focus Groups and Triads.* December 4. **#1. Public perception**. Interesting focus group results about how people feel about biosolids products. Focus groups included both average public consumers and a selected group of people working in the turf, gardening, and landscaping business.

Greenwood, Gail. 1997. How to Get the News Hounds to Chase you Without Getting Bit. *Illuminating the Future*. Vancouver, WA. Northwest Biosolids Management Association's 9th Annual Biosolids Management Conference. #**2. Media campaign.** Workshop to develop skills in speaking with the media and how to get positive stories airtime.

Gregory, R., J. Flynn, and P. Slovic. 1995. Technological Stigma. *American Scientist*, 83, 220-23. **#1: technology acceptance or change, trust, risk or chemicals or radiation, hazard perception.** The Greek concept of stigma referred to the mark placed on an individual to signify infamy or disgrace, posing a risk to society. Stigma plays out socially in opposition to many technological activities, particularly related to chemicals or radiation, and in the courts. Lawsuits increasingly succeed in preventing siting of controversial facilities or are the basis of compensatory actions against technologies whose attendant risks degrade property value. It is not even necessary to demonstrate a risk is real, but compensation is being awarded on the basis of public perception and fear. Stigma goes beyond conceptions of hazards. Technology is being shunned because it is perceived as overturning a positive condition and, as such, represents an increasingly significant social factor in scientific and technological innovation. Stigma is closely correlated to amplification by the media.

Gregory, R., T.C., Brown, and J.L. Knetsch. 1996. Valuing Risks to the Environment. *Annals of the American Academy of Political and Social Science*, 545, 54-63. **#2: risk management, risk understanding, fairness, trust.** Increasing awareness of exposure to environmental risks has focused attention on measures that would give greater assurance that such risks are effectively managed and that their adverse consequences are mitigated. Such actions are made more difficult by the uncertainties of environmental changes, their oft-delayed impacts, the great importance attached to extremely small risks, and the lack of clear ways to measure the value of environmental losses. Recent behavior studies of people's time preferences, valuations of losses relative to gains, and risk perceptions are providing information that should lead to more effective risk management strategies. Valuation, however, is nearly always a contentious process, leading to claims and counterclaims regarding the motives of agencies and developers and fairness to the affected population.

Grey, Mark. 2000. Scenes From the Front Line: Skirting Bans and Forging Alliances. *Storms on the Horizon*. Ocean Shores, WA. Northwest Biosolids Management Association's 11th Annual Biosolids Management Conference. #**2. Local regional ban. Urbanization.** Discusses the state of biosolids applications in the state of California.

Grier, Chris. 1999. Proposed Plant's Potential Odor a Big Problem, Vice Mayor Says. *The Virginian-Pilot.* April 28.

Griswold, L. 2000. Valley counties fight use of sewage sludge. *The Fresno Bee*. September 4.

Group for the South Fork. 1995. *Composting; What's it to You, Composting & Recycling in East Hampton.* #**4. How the town of East Hampton initiates and starts a composting program.**

Guerra, Sarith and Tim Jones. 1992. Siting Solid Waste Facilities: Seven Case Studies. *MIS Report* 24(10). October.

Gusterson, H. 2000. How Not to Construct A Radioactive Waste Incinerator. *Science, Technology and Human Values*, 25(3), 332-51. **#2: risk perception, NIMBY, public acceptance, risk of nuclear power or radiation, trust of government.** Traces the evolution of risk perceptions in relation to existence of a radioactive incinerator. Analyzes the changes in attitudes toward the incinerator and the agency of activists in shaping those public perceptions. Author traces the evolution of "rhetorical strategies" that undermined official discourse on risk, although in a somewhat cynical manner that appears to dismiss the public's participation in a public process within their community.

Haag, Ed. 1992(a). Just Say No. *Dairy Today.* March, 82-83.

Haag, Ed. 1992(b). Sludge Under Suspicion. *Farm Journal.* 116 (6): 16-19. #**2. Metals, groundwater, sick cows.** One of two articles by Haag in a farming journals (see below). "Ultimately, the buck stops at the farmer's door….'I have no confidence in the current system of policing the stuff,' says Darrell Turner, who co-authored a 100-page manual on sludge application to farmland for Washington State's Department of Ecology."

Hadeed, Sam. 1999. Developing An Effective & Sustainable NBP Communications Strategy, presentation to *Reinvesting in Success*, a meeting of biosolids stakeholders and regional associations, Charlotte, NC. #**3. Communications.** Outlines potential communication tools and public acceptance strategies.

Hadeed, Sam. 2002(a). Guidance for Implementing Public Participation in EMS Planning (Part 9 in a Continuing Series). Washington, DC: National Biosolids Partnership (NBP). http://www.biosolids.org. **#1. Best management practices, public participation.** Overview of the recommendations for public outreach and participation provided in the NBP Environmental Management System (EMS) program guidance manuals.

Hadeed, Sam. 2002(b) Engaging the Public in EMS Planning (part 10 in a Continuing Series). Washington, DC: National Biosolids Partnership (NBP). http://biosolids.policy.net/proactive/newsroom/release.vtml?id=26521 **#1. Public participation.** Overview of the recommendations for public outreach and participation provided in the NBP Environmental Management System (EMS) program guidance manuals.

Haenel, Bob. 2002. The Public Pay Toilet: Concern About Sludge Dumping is Hitting the Fan Around the State. *The Herald-Coaster.* October 8, p. 2. Outrage at Synagro's litigious approach.

Hahn, A.J. 1993. Elements of an Extension Public Policy Education Program. In *National Extension Compost Utilization Conference*, Minneapolis, MN: Minnesota Extension Service/Cooperative Extension System. 119-124. **#3, public education.**

Hale, Robert. 2001. *Nature*. 412:140-141. **#3. Chemicals, Land application.** Report on measurements of brominated di-phenyl ethers (BDEs) in biosolids and fish; no cause and effect relationship is claimed by the author, but he implies a relationship, which triggered a defensive response from biosolids industry.

Hammit, James K. 2000. Evaluating Risk Communication: In Search of a Gold Standard. In: Cottam, Harvey, Pape, and Tait (eds.). *Foresight and Precaution*. Rotterdam: pp. 15-19.

Hammit, James K. and Pamela Williams. 2002. Risk Perceptions of Organic versus Conventional Foods and Willingness-to-Pay for Risk Reduction. Harvard Center for Risk Analysis: http://www.hcra.harvard.edu/foodresearch.html#tradeoffs. **#3. Risk perception.** "Research shows that consumers are very concerned about pesticide residues on food and are willing to pay a significant premium to purchase food they perceive to be less risky. However, data are limited on the magnitude of public risk perceptions and valuation for the range of food safety concerns. This study uses a survey of Boston food shoppers to explore consumers' perceived risks and willingness-to-pay for specific risk reductions associated with conventionally and organically grown produce. Survey results reveal that consumers perceive the consumption of fresh produce to be quite risky, especially when compared to other public health hazards. The public also believes that organically grown produce poses significantly less risk than conventionally grown. Survey respondents were willing to pay a price premium to reduce both consumer and nonconsumer risks, suggesting important altruistic values. Multiple regression analyses indicate a subset of factors that are predictive of high or low perceived risk and willingness to pay, including questions of trust, attitudes toward science and technology, sources of food safety information, and specific lifestyle characteristics and behaviors."

Hance, B.J., C. Chess, and P. Sandman. 1991. *Improving Dialogue with Communities*. Division of Science and Research, New Jersey Department of Environmental Protection and Energy.

Hance, B.J., C. Chess, and P. Sandman. 1990. *Industry Risk Communication Manual: Improving Dialogue with Communities*. Florida: Lewis Publishers.

Hanifin, Linda. 1992. Effective Communication Skills Fundamental to Total Quality Management. Presentation at WEF Human Resource Management Conference. September 19.

Hansen, Brian. Students, feds clash over EPA clean-up: Documents Suggest Conflict of Interest in Lowry Case. *Colorado Daily*, Boulder, CO. November 16.

Hansen, Renee. 1995. Hitting the Fan. *Snoqualmie Valley Reporter*. January 18. **#2. Pathogens. Metals. Nitrogen. Surface water. Ground water. Land application. Class B. NIMBY. Remote site.** Sold land that was too close to outraged citizens and bought land for I-90 restoration project.

Harding, Earle C. 2001. Laymanization: An Engineer's Guide to Public Relations. *Water Environment and Technology*. P. 45-48. April.

Harman, Alan. 1998. Applying effluent to land could be harmful alternative. *The Western Producer.* October 29. **#2. Groundwater. Surface water. Nitrogen. Land application. Best management practices.** Concerns stated in regards to biosolids use in Canberra, Australia.

Harrison, E. Z., M.B. McBride and D. R. Bouldin. 1999. Land Application of Sewage Sludges: An Appraisal of the U.S. Regulations. *International Journal of Environment and Pollution.* Vol. 11(1), 1 -36.

Harrison, E.Z., and T.L. Richard. 1992. Municipal Solid Waste Composting: Policy And Regulation. *Biomass & Bioenergy* 3(3-4):127-143. **#4, composting, contaminant standards.**

Harrison, Ellen Z. 2000. Desired Outcomes of Hearing, Comments to the U.S. House Committee on Science, March 22. **#3. Concerned, lack of trust, testing, chemicals, Part 503.** Recommendations on what could be done to improve biosolids programs and oversight in the U.S.

Harrison, Ellen Z., Murray McBride and David Bouldin. 1997 and 1999. *The Case for Caution: Recommendations for Land Application of Sewage Sludges and an Appraisal of the U.S. EPA's Part 503 Sludge Rules*. Cornell Waste Management Institute: August 1997 and February 1999. Available at http://www.cfe.cornell.edu/wmi/PDFS/LandApp.pdf. **#1.** The most thorough and comprehensive critique of current U.S. biosolids recycling policy. Cited widely by concerned citizens. "Current US federal regulations governing the land application of sewage sludges do not appear adequately protective of human health, agricultural productivity or ecological health. The risk assessment conducted by United States Environmental Protection Agency (US EPA) contains many gaps and non-conservative assumptions in establishing contaminant levels which are far less protective than those of many other nations. Current New York State (NYS) regulations are more protective than those of US EPA, but not as stringent as the recommendations of the authors. The potential for widespread use of sludge on agricultural and residential land, the persistence of many of the pollutants which may remain in soils for a very long time, and the difficulty of remediation call for a more cautious approach. In addition, reassessment of standards based on ecotoxicological impacts will need to be undertaken shortly when the US EPA-sponsored study being performed by Oak Ridge National Laboratory is completed. Soil, water and crop characteristics in NYS and other areas of the northeastern US raise particular concerns. Shallow acid soils, abundant precipitation and crops sensitive to phytotoxic metal inputs increase the need for caution. Federal regulations are the same for all soils, areas and uses, which is an unrealistic simplification. Based on their analyses, the authors do not suggest a prohibition of land application; but rather significantly more restrictive use. Recommendations are made for farmers and home gardeners electing to use sewage sludges and suggestions are made for policies and regulations which incorporate the more conservative assumptions expected to be more protective of human health and agricultural productivity. Limiting cumulative additions of pollutants to prevent soils from exceeding recommended maximum contaminant levels can be achieved by application of clean sludges or by application of lesser quantities of less high quality sludges. Additional testing of sludges is recommended. Caution is advised in application to pasture and forage as well as on home grounds where vegetables are grown or children have access. Further investigation is needed to assess risks to ground and surface water and to establish standards for additional contaminants." A section titled "Is Land Application Safe?" discusses the differences in perspectives and philosophies of various stakeholders involved or impacted by biosolids recycling programs.

Hartley, Troy W. 2001. *Public Perception & Participation in Water Reuse*. Alexandria, VA: Water Environment Research Foundation, National Water Research Institute (NWRI), American Water Works Association Research Foundation (AWWARF), WateReuse Foundation. August. **#1. Public participation, fairness, communications.** This project, parallel to the public perception and participation project on biosolids, came up with similar, independent findings regarding stakeholder involvement, fairness, respect, communications, need for information, and the need for motivation and commitment to these on the part of organizations.

Hartman, Charlotte. The National Sludge Alliance Calls on Congress to Halt the Land Disposal of Sewage Sludge. Letter to Congress. http://www.riles.org/NSA.htm, retrieved May 21, 2002.

Hassell, Leroy R., Sr. 2001. Virginia Supreme Court Opinion January 12. Reuben L. Blanton, et al. v. Amelia County, et al. Record No. 000277, from the Circuit Court of Amelia County. **#3. Local bans. Legal.** VA Supreme Court strikes down local county ban on biosolids recycling.

Hawaii Environment & Health News.1998. Paradise Sludged: Act Now!1(1), September http://www.hookele.com/hehn/98-09/actnow.html.

Hazen & Sawyer. 1995. Task 15.6 Final Public Participation Report, Volume 1. Concerning the New York biosolids management planning process.

Hegedus, Mike. 2000. The Marketing of Nature: The Nature of Marketing**.** Cleveland, OH: U.S. Composting Council's 10th Annual Conference. #**3. Methods of marketing compost (biosolids).**

Hellfach, Alwynne. 2000. Just Wash Your Hands and Don't Eat It. Letter to editor, *Argus-Champion*, NH. September 6. **Politics**.

Hellstrom, Thomas. 1994. Swedish Experience in Gaining Acceptance for the Use of Biosolids in Agriculture. Paper presented at the 1994 WEF Specialty Conference, *Biosolids Public Acceptance Digest*, Water Environment Federation, 1996. **#1. Metals. Politics.** Discusses "environmental worry" and how relative risk of "environmentally hazardous substances" is perceived by the public over time and after absorbing technical information. Worry increases as people receive initial information and then will decline if and when more information is absorbed. Discusses the self-perpetuating cycle of environmental worry in which the public loses and the politicians, researchers, product manufacturers, and the media gain. Critiques the Swedish Environmental Protection Board use of best available technology (BAT) regulation: "The official justification for applying BAT is that environmental control has to be carried out in accordance with the principle of caution (read: the principle of worry)." Recommends careful evaluation of risks and comparison to risks presented by other common practices.

Hench, David. 1998. Westbrook Group Fighting Sludge. *Portland Press Herald.* February 17.

Hendren, Lee. 1988(a). Sludge Plan Support Unanimous. *The Enquirer-Journal.* March 3.

Hendren, Lee. 1988(b). Waste Disposal Worries Mayors. *The Enquirer-Journal.* February 26.

Hennig, Sue. 1995. Biosolids Compost: A Collaborative Solution for Biosolids Public-Acceptance. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1. Education.** Discusses the importance of collaboration among local sponsors in getting projects started to educate public of biosolids recycling.

Henry, Charles. 1996. The New Book of Biosolids Management: Roles for Sustainability. *A Bridge to Sustainability*. Chelan, WA. Northwest Biosolids Management Association 8th Annual Biosolids Management Conference. #**2.** Discusses the changing climate biosolids is in.

Henry, Tom. 2002. Skeptics critical of use of sludge on farmlands. *Toledo Blade.* Toledo, OH. November 25. **Health impacts, public concerns.** Well-done article discussing the various perspectives on biosolids, including quotes from NViro and reference to the National Research Council report of July 2002.

Herkert, J.R. 1994. Ethical Risk Assessment: Valuing Public Perceptions. *IEEE Technology and Society Magazine*, 79, 4-10. **#1: environmental risk, public acceptance, technology acceptance, trust.** The ethical responsibilities of engineers and the need for workable solutions to technological controversies dictate that engineers be able to openly discuss technological risk with the public, which is at odds with the prevailing engineering culture. Engineers and other "experts" need substantive attitude changes with respect to acknowledging and explaining risk. These are both moral and practical issues. There are differing views of risk between the engineering community (risk is a quantitative component) and the public (risk is qualitative). The two views must be integrated, but it is not clear how effective the author's "transformation" of the engineering culture will be.

Hirshorn, Susan. 1992. Human Fertilizer Goes Out To Pasture. *Canadian Living.* February. **#2. Chemicals. Groundwater. Nitrogen. Nutrients. Odors. Pathogens. Phosphorus. Land application. Local bans. Profit motive/lower cost.** Reporting on how biosolids fertilization saves money. "Quebec forbids sludge use on land growing crops."

Hirst, E. 1984. Household Energy Conservation: A Review of the Federal Residential Conservation Service. *Public Administration Review,* 44, 421-430. #**3: acceptance, behavior, technology change.** The author reviews the Federal program to encourage energy conservation in homes, finding that the expenditure of tens of millions of dollars achieved little in the way of energy savings when compared to the potential for such savings. This was an important effort in recognizing that public agencies and others interested in advancing environmental protection through changes in public behaviors did not know much about what motivates people and what would create changes in behavior.

Hodson, C.O. 1996. Biosolids Management: Beneficial Use Comes of Age. *Pollution Engineering* 28(13):38-41. December. **#2, metals, pathogens, groundwater contamination, odors, composting, land application, urbanization, local/state delegation, public perception.** The most important issues facing the biosolids management industry today are costs, odors, and public perception. Of these, public perception has the biggest effect on the industry. Officially, "sludge" is a term affixed to the product that comes out of sewage treatment plants, and "biosolids" is what the processed end product is called. Still called sludge by some environmental professionals in the water and wastewater industries, biosolids is the official term for the sludge being marketed to the public. As the public grows more comfortable with biosolids and the practice of beneficial use and more states move toward delegation of the new regulations, the stigma originally carried with "sludge" gives way to a new age, a new name, and a new century.

Hodson, S. 1998. City Wants To Exclude Lawyers In Farm Lawsuit. www.augustachronicle.com November. #**4.**

Hoffman, Ian. 1988. Sludge: Friday Date for First Application. *The Enquirer-Journal.* May 15.

Horan, Jack. 1989. Sludge Shoveling a Niche as Fertilizer. *The Charlotte Observer.* July 24.

http://www.cfe.cornell.edu/wmi/Sludge/Beneficial.pdf

http://www.cfe.cornell.edu/wmi/Sludge/Characteristics.pdf

Hull, D. 1998. Parsons Farm owner wins round against County. *The Washington Post,* Prince William Extra section, p. V01. May 23.

Hunley, Jonathan. 2002. What's That SMELL? Fredericksburg: *The Free Lance-Star*. April 23.

Hunt, Patricia, and David W. Oerke. 1994. Institutions, Attitudes, and Opinions Impacting Acceptance of Biosolids Land Application Programs in Northeastern Colorado. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation, 1996. **#1. Land application. Urban/rural conflict. Importance of local supporters. Politics. Liability (bank concerns).** "About 85% of Colorado's biosolids (treated wastewater residuals are recycled by applying them to agricultural land. In years past, land application has not posed a significant public acceptance problem. But recent experiences by some wastewater treatment plants indicate a possible public opinion shift that may damage the efforts of responsible wastewater treatment plant operators to continue beneficial recycling land application programs. This paper describes the efforts of the Metro (Denver) Wastewater Reclamation District to assess the severity of the public acceptance problem. A central element of the paper is highlights from a public opinion study conducted in November 1993 to determine baseline conditions for acceptance of biosolids land application in northeastern Colorado."

Hyde, James. 2002. Communicating About Risk During Chaos Events. Presentation to the New England Water Environment Annual Conference. January 28. **#2. Risk communication.** Useful perspective on risk communications.

Inlow, Shawn K. 2000. George, Tackett Assail Use of Sludge. *The Progress,* July 17. **#3. Lack of trust, politics, profit motive, pathogens, concerned citizens.** Fall-out from the death of Tony Behun, Rush Township, PA. "'Sludge is not safe,' said Dr. Tackett….'It has never been proved to be safe. But there is a small group of people with the EPA that insist it is safe, and the sludge industry supports them because the sludge industry makes a lot of money by spreading it on the land.'"

International Association for Public Participation. 2000. *IAP2 Public Participation Toolbox.* From the Internet site http://www.iap2.org. **#1. Communications, public participation.** An excellent resource available online and in the WEF *Survival Guide* (see Wantland, 2002). Other useful information available from this website and organization.

Irvine, Lori and Anne Bonelli. 2000. Beneficial use of biosolids. *American City & County*. October 17. **#2. Public perception.** "Ultimately, the public perception of the safety and value of biosolids recycling will have a major impact on a community's ability to market biosolids usage and products."

Iskandar, Alex. 2000. Sludge--We All Make It, So It Has to Go Somewhere. Letter to the *Argus-Champion,* NH, August 2. **#4. Politics.**

Jefferson County, AL. 2000. Beltona Land Application Program. Videotape.

Johnson, B.B., and P. Slovic. 1995. Presenting Uncertainty in Health Risk Assessment: Initial Studies of its Effects on Risk Perception and Trust. *Risk Analysis*, 15(4), 485-94. **#1: risk perception, risk communication, risk assessment, trust**. It is unclear if discussing uncertainties in health risk assessments reduces citizens' perceptions of risk and increases their respect for the risk assessing agencies. Three studies tested between 180-272 focus grouped subjects with words and graphics to obtain a detailed response to these scenarios. The results, suggested that (1) people are unfamiliar with uncertainty in risk assessments and in science generally; (2) people may recognize uncertainty when it is presented simply; (3) graphics may help people recognize uncertainty; (4) reactions to the environmental problems in the stories seemed affected less by presentation of uncertainty than by general attitudes and perceptions toward risk, government, and authority; (5) agency discussions of uncertainty in risk estimates may signal both agency honesty (66%) and agency incompetence (34%) for some people; and (6) people seem to see lower risk estimates as less credible, perhaps because of a generalized distrust of government.

Johnson, Dawn. 1997. Golf club expansion begins. *The Similkameen Spotlight.* July 23. **#3. Dust. Trucking. Stockpile. Land application. Education.** Transportation to the golf course was an added bonus since it is right off of the highway from Vancouver.

Johnson, William E. 2002. Jurors express concern over sludge dumping. *Daily World.* St. Landry Parish, LA. November 24. **Public outrage.** News article noting public outrage over discovery that a site has been used for "sludge dumping" for 20 years. A clear example of the inevitable public upset created by keeping quiet about biosolids management programs.

Joiner, Lawrence. 2000. Nutrifor Provides Ultimate Recycling. *The Ashcroft Journal.* August 29. **#2. Nitrogen. Odor. Nutrients. Land application. Successful program. Private sector.** Joiner sharing his experiences with biosolids on his ranch - in support of biosolids.

Jolma, Dena Jones. 1994. *Attitudes Towards the Environment*. McFarland and Company, Jefferson, North Carolina. **#2: environmental attitudes, understanding.** This book compiles abstracts from a wide range of sources on public attitudes about the natural environment.

Jones, Robert E., and Riley E. Dunlap. 1992. The Social Bases of Environmental Concern: Have They Changed Over Time? *Rural Sociology*, 57(2), 28-47. **#1: environmental attitudes, public acceptance, trust of science.** Data from a series of national opinion surveys that track changes in environmental concern over an 18 year period by the National Opinion Research Center was analyzed to determine whether support for environmental issues had broadened to include a wider cross-section of Americans. Demographic variables included age, political ideology, education, residence at 16, current residence, political party, industrial sector, family income, gender, race, and occupational prestige. Analysis revealed that support for environmental spending remained stable despite fluctuations in economic, political, and environmental conditions. The highest support was found among young adults, the well educated, liberals, Democrats, those raised and living in urban areas, and those employed outside of industry. Provides background information on public attitudes towards the environment.

Joss, Glen. 2000. Nothing to do with the landfill. *The Ashcroft Journal.* August 22. **#2. Pathogens. Landfilling. Private Sector. Worker safety. Education.** Joss submitting response as an employee from Arrow Transportation. Defending the quality of biosolids.

Kamrin, Michael; Dolores J. Katz; and Martha L. Walter. 1995. *Reporting on Risk: A Journalist's Handbook on Environmental Risk Assessment*. Ann Arbor, MI: Michigan Sea Grant Program and the Foundation for American Communications. A shorter version of this handbook (posted in 2000) is available from FACSNET at http://www.facsnet.org/tools/ref_tutor/risk/index.php3. **#1. Risk communication, media.** A superb primer for reporters and others regarding how best to present risk information.

Kaufman, Susan and Douglas Haith. 1986. Probabilistic Analysis of Sludge Land Application. *Journal of Environmental Engineering*, December,112(6)1041-1053.

Kaufman, Susan S. and Douglas A. Haith, M. Date unknown. Probabilistic Analysis Of Sludge Land Application. National Science Foundation.

Kays, Jonathon, Gary Felton, and Eric Flamino. 1999. Claiming Victory From Spoils. *Water Environment & Technology*, May, pp. 42-48.

Kearney, R.J. 1997. California Biosolids Management, Will Opponents End Beneficial Use? In *Water Residuals and Biosolids Management Approaching the Year 2000,* Philadelphia, PA: WEF/AWWA Joint Conference. 16-35–16-39. #**3, opposition to land application with less restrictive waste discharge regulations based on many issues.**

Kelley, Bronwyn, Alan B. Cooper, and Larry J. Karnes. 1994. Direct Public Involvement to Develop a Residuals Management Plan in Sydney (Australia): North Head Sewage Treatment Plant Case History. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation, 1996. **#2. School educational programs. Community advisory groups.** "In 1991, thirty percent of all wastewater from the Sydney Water Board's service area (i.e. 315 ML per day) was treated at the North Head Sewage Treatment Plant. Twenty five tonnes of solids (30 percent of the influent load) were captured daily. Biosolids were incinerated with screenings, grit, and scum. Due to negative local perceptions of incineration, a decision was made in mid-1991 to evaluate other stabilisation alternatives. The Board was underway with long term strategic planning for residuals management, with implementation about year 2000. An interim residuals management plan was identified to evaluate chemical stabilisation. Public acceptance was the key to a successful interim plan. The proposal recommended initial chemical stabilization followed by a thermal drying facility. A full scale trial of chemical stabilization of biosolids and other residuals began in 1992 identifying the impacts on the public and defining concerns. Public input and the findings of various surveys allowed chemical stabilisation to be accepted as a short-term management practice provided that the Board actively move to implement thermal drying of biosolids as a medium term solution with long term solutions also to follow as part of the overall strategic plan."

Kelly, Brian. 1999. The Biosolids Boogeyman. *Snoqualmie Valley Record*. May 27. **#2. Rural. Concerned citizen involvement.** Discusses use of biosolids in rural town. "Gravel pit opponents claim that use of biosolids on the Grouse Ridge site will make North Bend residents 'test rats in a mad scientist's experiment.'"

Kelowna, City of. *Biosolids Recycling: Beneficial technology for a better environment.* **#3**.

Kelsey, T.W., and L. Singletary. 1996. When Composting Meets Suburbia. *BioCycle* 37(7):66-67. #**3, odors, noise, composting, urbanization.**

Kenny, Catherine. 1995. Ready to blow the biosolids. *The Issaquah Press*. September 13. **#4.**

Keremeos Review, The. 1999(a). Biosolids Answers Needed. February 25. **#3. Groundwater. Surface water. Land application. Lack of public information. Education.**

Keremeos Review, The. 1999(b). Pollution Would Be Hard To Prove. February 11.#**2. Groundwater. Surface water. Land application. Class A. NIMBY. Possible ticking bomb.** Significant opposition to these land applications in Cawston, BC.

Keremeos Review, The. 2000. Permit Given in '99. October 12. **#2. Groundwater. Land application. Successful program. Education.** Concerned individuals were sent copies of the permits and no appeals were submitted. Farmer states support for beneficial and environmentally sound use of biosolids fertilization rather than using chemical fertilizer.

Kern County Biosolids Ordinance Adoption Process. www.co.kern.ca.us/rma/bsurgenc.htm.

Kim, W. Chan and Renee Mauborgne. 2003. Fair Process: Managing in the Knowledge Environment. *Motivating People*, January, pp. 127 -136.

Kimantas, John. 2000. *Waste Not, Want Not*. September 11. **#2. Odor. Nutrients. Land application. Profit motive/lower costs. Regulatory climate. Politics.**

King 5 Investigation: Grounds for Concern. 2000. Seattle: KING-TV. November 20. http://king5.com/detailtopstory.html?StoryID=9137.

King County Department of Natural Resources. 1996. *Green Valley Project Update.* **#3**

King County, Washington. 2000. Biosolids recyling program. http://dnr.metrokc.gov/WTD/biosolids/BMP1.html. **#3.** Descriptions of one of the nation's leading and most successful biosolids recycling programs, retrieved November 27, 2000.

King5.com. 2000. King5 Investigation: Grounds for Concern. wysiwyg://206/http://www.king5.com/detailtopstory.html?StoryID=9137. November 20.

Kirk, Ken and Albert Gray. 2000. Letter to Marilyn Fingerhut, Ph.D., Chief of Staff, National Institute for Occupational Safety and Health (NIOSH), October 31. American Metropolitan Sewerage Agencies and Water Environment Federation response to NIOSH HID #10 regarding Class B biosolids workers.

Kliewer, T. 1999. Firm's Bid To Spread Treated Sludge On Farm Worries Waller County. *The Houston Chronicle, Star Edition*. 13. May 17. #**2, land application, lack of public information, groundwater, odors, perceived appearance.**

Koenig, Rich, Dean Miner, and Kerry Goodrich. *Land Application of Biosolids: A Guide for Farmers.* Utah State University Extension. http://extension.usu.edu/publica/agpubs/biosolids.htm.

Kohn, S., and D. Lewis. 1999. Note on the AP Wire Concerning a Press Conference at the National Press Club on March 23. March 19.

Krauss, G.D., and A.L. Page. 1997. Wastewater, Sludge and Food Crops. *BioCycle*. 38(2):74-82. February. #**1, public perception, 503, concerns, perceived/real risks, need for community risk.** Key summary article on the results of the National Research Council (NRC) review of the federal biosolids management regulatory program (see National Research Council, below) by two of the participants on the NRC review panel. "After 17 months of study that included several field visits and a workshop on land application, the NRC released a report in March 1996 ("Use of Reclaimed Water and Sludge in Food Crop Production") that confirmed properly treated and managed municipal wastewater effluents and sludge can be safely and effectively used in food crop production…. The committee found no documented reports of outbreaks of infectious disease associated with exposure to adequately treated and properly distributed reclaimed water or sludge applied to agricultural land. Still, the committee concluded that general acceptance of using sludge on cropland will depend on the ability of municipal authorities and private contractors not only to comply with government regulations but also to provide well managed and reliable waste treatment and beneficial use programs that are responsive to community concerns."

Krogmann, Uta and Ellen Z. Harrison. 1998. Understanding the difference: Why European and U.S. sludge standards differ. Paper presented at AAAS Conference, February, 1998, Philadelphia. http://www.cfe.cornell.edu/wmi/Sludge/AAAS/Overview.html). **#2 Risk assessment versus precautionary principle.** "For all contaminants except lead, the US EPA standards for land application of sewage sludges are significantly less stringent than standards in northern and central European countries. The cumulative pollutant loading allowed under EPA rules would result in contaminant levels approximately an order of magnitude higher than those allowed under rules in northern and central Europe. A significant fraction of European sludges are able to meet the standards and are thus being applied to land. Regulations in the US versus countries such as Denmark, Germany, the Netherlands. Sweden and Switzerland are based on different philosophies. The US regulations are based on a risk assessment which evaluates the potential risk to humans, other animals, and plants from selected pollutants in sewage sludge (14 pathways). The standard for a contaminant is set at the limit generated by the pathway resulting in the lowest concentration that represented an acceptable risk according to the assessment. Many European regulations are based on precautionary limits in which in the long-run a net balance between the input and output of pollutants in the soil is sought. Recognizing the persistence of inorganic contaminants, the goal is to prevent the accumulation of inorganic contaminants above levels in uncontaminated agricultural soils. Even when a similar risk assessment approach is taken (e.g. Netherlands soil intervention values), much lower pollutant limits result from different assumptions and policy choices. In the long-run these different approaches could result in much higher pollutant concentrations in US agricultural soils than in European soils."

Krogmann, Uta, William Goldfarb, Virginia Gibson, and Lisa S. Boyles. 2001. Land Application: An Extension Perspective. Water Environment Federation.

Kuchenrither, Dick. 1992. Draft Responses Received to Date to NRDC/EDF Questions. November 9.

Kunkle, Fredrick. 2001. Sludge-Spreading Raising Concern Over Health Fears. *The Washington Post.* August 23.

Land Recycling and Resource Management. 2000. New Jersey Biosolids Recycling Programs. http://www.lrrm.com/library/nj.html. **#4** Land application company promotes biosolids recycling.

Land Resource Recycling Management. 1997. Biosolids Fact Sheet: Beneficial Use of Biosolids in New Jersey. http://www.lrrm.com/library/nj.html.

Land Resource Recycling Management, Inc. 2000. Biosolids Fact Sheet: Beneficial Uses of Biosolids in New Jersey. http://www.lrrm.com/library/nj.html. November 27.

Lang, Mark E. 1993. Public Education of Biosolids Management in Vermont. In *Biosolids Public Acceptance-Digest*, Alexandria, VA: Water Environment Federation. **#2. Educational materials.** Overview of a cooperative effort to develop educational materials, regulatory review, and public outreach to address the declining rate of biosolids recycling in this small northeastern state.

Lang, M. 2000. The Biosolids Message. In *Proceedings from 14th Annual Residuals and Biosolids Management Conference*, Boston, MA: Water Environment Federation. February 27-29. **#2.** Since passage of the Clean Water Act in 1972, we have made significant advances

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in wastewater treatment that have dramatically impacted the quality of our Nation's water. These wastewater treatment improvements, which include the implementation of pretreatment programs, have allowed our water reclamation facilities to not only enhance water quality but to produce biosolids. Biosolids can be used in a number of programs to provide nutrients and organics to our soils. To be successful in using biosolids, we need to educate the public regarding the benefits of the material and address any concerns they may have. "The Biosolids Message" has been developed to serve as a base in developing information for use with the public. The message summarizes our advances in wastewater treatment from prior to the Clean Water Act through the 1990s. It describes the trend in biosolids characteristics and highlights the positive impacts that pretreatment programs have had on our ability to produce a beneficial product. The message summarizes the land application risk assessment that was performed in the development of the 40 CFR Part 503 Regulations and compares the US EPA's regulations to the Canadian fertilizer standards. The message provides information regarding the use of biosolids on a national and regional basis. The message also summarizes the value of biosolids to the agricultural community.

Lang, M.E., and R.A. Jager. 1996. The Impacts of the Public's Perception on Land Application Programs Implemented Under the 503 Regulations. In *10th Annual Residuals and Biosolids Management Conference: 10 Years of Progress and a Look Toward the Future*, Denver, CO. 4-31–4-35. August. **#2, health, environmental/site mismanagement, perceptions, land application, lack of oversight, trust.** Following promulgation of the 40 CFR Part 503 Regulations, the State of New Hampshire decided not to regulate wastewater solids and have programs regulated directly by US EPA Region I. The State of New Hampshire eliminated regulatory oversight of biosolids management programs, maintaining that such oversight would be unnecessary since the responsibility has been transferred to Region I. The New Hampshire Department of Environmental Services (DES) continued their effort to promote beneficial use by providing public outreach programs regarding biosolids issues and permitting septage land application sites that remain under State jurisdiction. This approach had a negative impact on the public's perception of land application programs. A number of communities placed a moratorium on biosolids use within their boundaries. In addition, a number of complaints were filed with DES and members of the State legislature. The public's perception resulted in the State adopting emergency rules on November 12, 1995 and final rules on March 19, 1996. The rules relate primarily to the management practices associated with biosolids and septage use.

Lang, Mark E., Carolyn A. Jenkins, and W. Dale Albert. 1995. Biosolids Regulations in the Northeastern United States, unpublished paper. **#4**

Lawson, Lisa. 1998. Cawston opposes biosolids. *The Similkameen Spotlight.* October 6. **#2. Groundwater. Land application. Local soils/climate/natural conditions. Education.** Concerned citizen involvement. Concerns regarding application of biosolids to area that is prone to flooding.

Laylo, Bob. 2000. *Lehigh Coal Pulls Request to Spread Sludge*. PA:*Lehigh Valley News*. October 25.

Laylo, Bob. 2000. Lehigh Coal Pulls Request to Spread Sludge: Company's Plan to Reclaim Mine Land With Waste Drew Protests. *Lehigh Valley News.* October 25.

Leach, John D., Steve Hoss, and Craig Gautreaux. 1990. Good Management Practices in Sludge Land Application. City of Lafayette, LA.

League of Women Voters Education Fund. 1976. *Municipal Sludge: What Shall We Do With It?* Publication No. 627. #**2, land application, composting, many possibilities.**

Leany, Kathryn, and Alan Cooper. 1992. A Public Involvement Program to Turn Around Negative Public Opinion of the Sydney (Australia) Water Board. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation. **#3.** "This paper summarizes the public involvement processes required by legislation in New South Wales, and describes the Water Board's recent experience intrying to turn around negative public opinion of the Board."

Leavitt, Terry. 1998. Symposium Discusses the Pros and Cons of Sludge Use. *Carroll County Independent*. September 2. New Hampshire.

Leeder, Jessica. 2002. Human Fertilizer Poses Cancer Risk: Study. *National Post.* July 31. Report on David Lewis's work in major Canadian publication.

Leege, P.B. 1993. Composting Infrastructure in the United States. In *Science and Engineering of Composting: Design, Environmental, Microbiological, and Utilization Aspects*. Wooster, OH: Ohio State University, H.A.J. Hoitink and H.M. Kenner (eds.). Also In *Proceedings of an International Composting Research Symposium*, Columbus, OH. March 1992. #**2, increasing public information, education with composting, products.**

Lees, P.S.J., and M.S. Tockman. 1987. Evaluation of possible public health impact of WSSC Site II sewage sludge composting operations. Johns Hopkins University School of Hygiene and Public Health, Baltimore, MD.

Lenhart, Jennifer. 2002. Waste Not, Says Maker of New Fertilizer. *The Washington Post*. March 17.

Lennon, J. Mark. 1998. New Hampshire's Approaching Solid Waste Crisis. Presentation to NEBRA First Annual Meeting & Conference, May 1998. **#4 Landfilling**. Discusses the limits of landfill space in NH.

Leonard, Peggy, Doug Schindler, Roberta King and Ken Konigsmark. 2000. Restoring Mountain Slopes and Forests with Biosolids in the Washington Cascades. Golden, CO: Mining, Forest & Land Restoration Symposium/ Workshop. #**3**.

Lester, James P. and Ann O'M. Bowman, eds. 1983. *The Politics of Hazardous Waste Management.* Duke University Press, Durham, North Carolina. **#3: hazards, risk management, NIMBY, government trust.** An early work that describes the deterioration of public trust generally and, more specifically, surrounding famous hazardous waste spills and processing facilities.

Lewis, David L. 2000(a). Letter regarding trace gaseous organic amines from biosolids land application. **#4. Chemicals, aerosols.**

Lewis, David L. 2000(b). Political Science at its Worst: The 503 Sludge Rule: Why EPA Regulations Have Everything to do with Elections and Nothing to do with Protecting Public Health and the Environment. http://www.whistleblowers.org/statements.htm#state2. **#2. Lack of trust.**

Lewis, D.L., S. Shepherd, D.K. Gattie, S. Sanchez, and M. Novak. 2000. Enhanced Susceptibility to Infection from Exposure to Gases Emitted by Sewage Sludge: A Case Study. In *Biosolids Management in the 21st Century Conference*, College Park, MD. 152-159. Available at http://members.aol.com/LewisDaveL/Proceedings.htm. #**2, land application, Class B, pathogens/chemicals allegedly caused sickness in New Hampshire.**

Published on the Internet regarding a possible cause of the death of Shayne Conner, Greenland, NH. Response by Wheelabrator, below. For response, see Wheelabrator (below).

Lewis, David and David Gattie. 2002. Pathogen Risks from Applying Sewage Sludge to Land. *Environmental Science and Technology*, July 1, pp. 287-293.

Lewis, David, David Gattie, Marc Novak, Susan Sanchez, and Charles Pumphrey. 2002. Interactions of Pathogens and Irritant Chemicals in Land-Applied Sewage Sludges (Biosolids). *BMC Public Health* 2:11, June 28. **#1. Pathogens**, **Class B, chemicals.** Describes potential health impacts amongst neighbors to Class B biosolids land application sites and hypothesizes how health impacts may be caused by air emissions from biosolids. A significant and controversial paper.

Libby, John. 1995. Brain Viruses on the Prairie! A Biosolids Siting Tragicomedy. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1. Concerned citizen involvement. Education. Lack of trust.** A Health Inspector' s perspective on dealing with public concerns. "It is important that the county take a role in risk communication with its citizens. Misinformation can quickly spread and cause a maelstrom for county regulators and politicians."

Lieberman, Adam J. and Simona Kwon. 1997. 3rd edition, revised June 1998. *Facts Versus Fears: a Review of the Greatest Unfounded Health Scares of Recent Times*. New York: American Council on Science and Health, Inc.

Lindsay, B.E., H. Zhou, and J.M. Halstead. 2000. Factors Influencing Resident Attitudes Regarding The Land Application Of Biosolids. *American Journal of Alternative Agriculture* 15(2):88-95. #**1, media accuracy, socioeconomics do not play into issues, dissemination of accurate information is key.** Residential household owners were surveyed in two different New Hampshire communities that varied in terms of population size, degree of rurality, and per capita income, each with no activities in land application of biosolids. Logit models were developed and logistic regression analyses were carried out for each community. The empirical results suggest that the perception by residents of the potential economic benefits and negative impacts from land application of biosolids can be very influential in achieving public acceptance. From a policymaker's viewpoint, this suggests the need for sound educational programs that explicitly describe the economic benefits, negative impacts, and potential risks that typically occur with land application of biosolids. Supportive studies are needed to complement the educational programs. These measures will allow residents to weigh the relative benefits and costs to determine their positions on this approach to management of biosolids and to discount emotional judgements and misinformation. The media seeks to ensure that newspaper, magazine, and television reports are accurate and taken from reliable sources. Survey results suggest that the less volume of information presented by the media, the more supportive residents are of land application. Therefore, with such sensitivity by respondents to quantity of information, it is imperative that media outlets place high priority on the quality and accuracy of materials presented. Socioeconomic characteristics of the respondents did not influence attitudes toward acceptance or rejection of biosolids application, thus eliminating the difficulty that social stratification could cause in achieving acceptance.

Lindstrom, Carl. 2K Interview with Carl Lindstrom, http://safesoil.com/iview.htm, retrieved December 5, 2000.

Living on Earth. 2000. News: National Organic Standard. Boston:World Media Foundation. March 24.

Living on Earth. 2000. Transcript of radio show, broadcast March 24. http://www.loe.org/archives/000324.htm.

Lloyd, Jillian. 1998. Special Report: A Trooper, A Dump, and a Tale of Doubt. *The Christian Science Monitor*. June 10. About plans for the Denver Metro wastewater facility to accept treated groundwater from the Lowry Landfill and concerns that it may contain radioactive waste.

Lloyd, Jillian. 2000. USA in Fight Over Toxic Landfill, Round 1 Goes to Citizens. *The Christian Science Monitor*. May 8. http://www.csmonitor.com/durable/2000/05/08/fp2s2-csm.shtml. **#2. Citizen concern, risk.** About Lowry Landfill, Denver area, relates to Denver biosolids recycling program.

Logan, T.J. 1995. Gaining Public Acceptance for Beneficial Use of Biosolids. *BioCycle*. 36(12): 61-64. #**1, history, metals, pathogens, risk, education, successful program, Class B, lack of public information/data.** Article cites successful projects, progression of biosolids development and recommendations. Use of research as public acceptance mechanism. “Fear is highest when the public only has enough information to know that a risk exists but not enough to understand the extent of that risk, or that management controls are in place to limit them.”

Logan, T.J. 1997. Balancing Benefits and Risks In Biosolids. *BioCycle* 38(11):52-57. **#2, metals, chemicals, odor, vectors, land application, poor oversight, NIMBY, lack of public information.**

Logan, T.J., C.L. Henry, J.L. Schnoor, M. Overcash, and D.C. McAvoy. 1999. An Assessment Of Health and Environmental Risks of Trace Elements and Toxic Organics in Land-Applied Municipal Solid Waste Compost. *Compost Science & Utilization* 7(3):38-53. #**4, land application, compost, municipal solid waste, heavy metals, scientific research.** This study applied the risk assessment methodology developed by USEPA for establishing regulatory contaminant limits and loading rates for municipal biosolids to MSW compost. Literature data on trace element and organics composition of MSW compost were evaluated relative to levels of the same compounds in biosolids. In addition, data from several laboratory, greenhouse, and field studies with MSW compost were used to determine parameter values for MSW compost for the 503 risk assessment algorithms.

Logsdon, Gene. 1987. Cultural Attitudes and Waste Disposal. *BioCycle*, March. **#2.** Early interview with researcher Terry Logan of Ohio State University. "As for landspreading sludge in the U.S., it will no doubt increase. It is no longer a controversial issue in the newspapers which is a good sign people are accepting it. The lesson for us who believe in it as the better way to dispose of sludge is that selling the public is a continuous process. You have to maintain high standards."

Logsdon, G. 1992. How Does Society Learn About Sludge Safety? *BioCycle* 33(5):68-70. May. **#1, educational issues about building public acceptance.** "Much philosophizing took place in the biosolids fraternity after *Farm Journal* magazine published an article in its April, 1992 issue which was decidedly negative about the application of sludge to farm land….Most scientists who have spent their lives studying sludge are convinced that the…article was, to put it mildly, not researched well enough, and that many of its claims were unsubstantiated if not downright erroneous….But rather than being angry, sludge scientists seem to feel a bit helpless and more than a little dejected….There is no doubt among sludge scientists in general that their long and arduous efforts to convince society of the safety of sludge has been set back a few years….says John Walker, soil scientist at EPA headquarters in

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Washington, "This kind of journalism is quite common now and the trouble is that when a particular news story is disproved by scientific data, that data doesn't get equal play in the press. We all remember when headlined stories reported that football players were getting arthritis because of playing on fields fertilized with composted sludge. When a blue-ribbon team of scientists disproved the story, their report got very little coverage'…. But how do you go about teaching a subject of great complexity (i.e. the impossibility of zero risk) to a public culturally brainwashed into believing that excrement disappears when the toilet is flushed; who is ecologically illiterate…. Looming over this challenge is another formidable drawback. The scientists who understand the problem are either not particularly adept at communicating to lay people or do not usually get the opportunity to do so….." Suggestions: "Quit using the word 'sludge….' In life there is no such thing as zero risk….'Presence does not equal hazard….' In interpreting research, the public and particularly the journalist must understand the researcher's goals and parameters in any particular study, point out Naylor who claims: 'A toxicological study growing lettuce on pure sludge is valid for toxicological purposes, but will give results that do not apply to what happens in an approved, real life field application.' The public needs to understand that what we are dealing with is a natural biological process, say Jane Forste…Contaminated, the treatment process would crash of its own accord. Stress the overwhelming benefits of sludge to soils and the environment rather than dwelling on scientific minutiae of one in a billion chances of contamination….Don't assume that only 'the man in the street' is 'ignorant.' …due to the history of the way regulations in waste handling have come into being, in many states, permitting for sludge application is handled in the same regulatory way (and in fact by the same people) as for hazardous waste sites and landfills. This obviously leads to a negative attitude about sludge…. Basic to all the suggestions above is the necessity to correct what John Walker and others refer to as a cultural problem in our society: that human excrement is vile and dirty stuff."

Logsdon, G. 1993. Beneficial Biosolids. *BioCycle*. 43(2):42-44. #**2, trace metals, N, P, S, organic matter.** Washington man who speaks to citizens about his personal successes with biosolids application on his land. He never uses the word "sludge." Spends much of his time familiarizing municipal officials with farmers' attitudes and how to make a biosolids program to suit the farmers' needs. His biggest accomplishment is allaying the concerns of officials over whether applying biosolids to farmland really works.

Logsdon, G. 1995(?) *The Contrary Farmer.* CA: Real Goods. **#3. Metals.** "Unfortunately, organic farming organizations, after much debate, have disapproved the use of pre-treated, composted sludge on certified organic farms. To me this was a stupid move which I think springs from our silly fear of our own excrement. For ten years I have followed this debate and as a writer have worked closely with the leading sludge scientists. True, in earlier times, PCB-contaminated sludge was a remote possibility (though even then, ton upon ton of sludge was applied to Ohio farmlands with no problems), but with modern pretreatment and constant monitoring, sludge is, as USDA Scientist Dr. Rufus Chaney says, as safe as any soil amendment or fertilizer can be….Of course the Chinese would smile at this debate. They have been using human excrement on their garden-farms for forty centuries" (p. 41-42).

Loken, Lorraine. 1994. A National Strategy for Public Acceptance of Biosolids. *Conveying the Message.* Chelan, WA. Northwest Biosolids Management Association's 6th Annual Biosolids Management Conference. **#1. Media campaign.** Mentions how the product is played down and process is primary focus. It also discusses seven biosolids communicators whom the general public relies on.

Long, Kimberly. 2002. Tour Group Finds City of Brotherly Love Loves to Promote Sewage-Sludge Recycling. *The News Item.* September 3. **#1. Communication, public outreach.** Enthusiastic news coverage of Philadelphia's biosolids composting operation generated by having a public tour (the value of a tour).

Lono, Maile. 2000. Sustainable Resource Display. *Biosolids Bulletin*. Northwest Biosolids Management Association. June. #**2. Class A. Education.** Discusses the creation of a display regarding the beneficial and practical applications of various recyclable materials.

Lopez, Elizabeth. 1995. Discovery Park Sludge Treatment To Help Restore Native Plant Life. *The Seattle Times*. August 4. **#2. Pathogens. Land application. Class B.** Educating public of beneficial use and safety.

Lovell, Barbara, Mike Toombs, Murray Blackie, and John Schliehauf. 1996. Factsheet: *Land Application of Sewage Biosolids for Crop Production*. Ontario, Canada: Ministry of Agriculture, Food and Rural Affairs. April.

Lubchenko, Jane. 1998. Entering the Century of the Environment: A New Socila Contract for Science. *Science,* 279, pp. 491-497.

Lucey, Anne. 2001. Kerry Council to Query Use of Sludge from Plant. *The Irish Times*. December 18.

Lue-Hing, Cecil. 2001. Risks From Toxicants and Pathogens in Biosolids Fertilizers. Comments to the National Research Council, Public Meeting, March 14.

Lyman, Rick. 1998. For Some, Texas Town Is Too Popular as Waste Disposal Site. *New York Times*, September 2, 1998. #**3.** Sierra Blanca.

Machno, Pete. 1990. Sludge Name Change. Memo to AMSA Sludge Management Committee. July 11.

Machno, P.S. 1996. Biosolids 2000: Are We Letting Our Guard Down on Public Acceptance? In *10th Annual Residuals and Biosolids Management Conference: 10 Years of Progress and a Look Toward the Future*, Denver, CO. 4-21–4-27. August. #**2, public acceptance.**

Machno, Peter. 2000. National Biosolids Partnership Environmental Management System Overview. *14th Annual Residuals and Biosolids Management Conference,* Boston, MA. Alexadria, VA: Water Environment Federation.

Machno, Peter, Bob O'Dette, Jane Forste, et al. 1996. "Recycling and Acceptance." Water Environment & Technology 8 (2):40-43. #**2.**

Machno, P.S., and J. Forste. 1997(a). Biosolids 2000, Public Acceptance of Biosolids Recycling. In *Water Residuals and Biosolids Management Approaching the Year 2000*, Philadelphia, PA: WEF/AWWA Joint Conference. 4-1–4-9. #**2, public acceptance, NIMBY, odors, public education.** Public acceptance of biosolids recycling is a significant issue facing biosolids managers in the 1990s. With the cessation of ocean disposal in the United States, Australia, and the European community, a major cost-effective alternative is land application. Land application often involves working in communities other than those where biosolids originate. Interaction with neighbors requires biosolids managers to adopt new communications skills. In 1990, the Water Environment Federation adopted "biosolids" as the new term to describe treated solids from a wastewater treatment facility that can be recycled beneficially. Biosolids is a much more accurate term than "sewage sludge" to describe a product that has been treated, is regulated, and can be used as a fertilizer. Biosolids managers and organizations worldwide recognize that public acceptance is essential for any successful biosolids recycling program. The Biosolids 2000 Program was developed to articulate the goal of making biosolids recycling publicly acceptable throughout the globe by the year 2000.

Machno, Peter S. and Jane Forste. 1997(b). Biosolids 2000: Public Acceptance of Biosolids Recycling. *Keystone Water Quality Manager.* Pennsylvania Water Environment Association. September- October.

Maddocks, Susan. 1995. Fear's Scent Remains Over Sludge. *Portsmouth Herald,* NH. December. **#4. Concerned citizens.** Discusses Shayne Conner death in Greenland, NH.

Mahin, Tom, Richard Pope, and Charles McGinley. 2000, When Is Smell a Nuisance? An Overview of Different Approaches Taken Around the World In Setting Odor-Control Measures. *Water Environment and Technology,* May. Alexandria, VA: Water Environment Federation.

Mahr, Joe. 2000. Cash-Strapped Farmers Leery of Sludge Warnings. *The Blade,* Toledo, OH. www.toledoblade.com. **#3. Pathogens, Class B, land application, best management practices, concerned citizens.** Discusses the NIOSH HID #10 (see below),

Main, F., and T. Randall. 2000. Farms Linked To Disease. www.suntimes.com/output/news/sludg18.html. January 18.

Maine Waste Water Control Association. 1999. Biosolids Position Paper. Submitted at the NEWEA Congressional Briefing, March.

Mann, A. 1999. Environment: Fight Over Sludge Starts To Get Dirty. *Time* 154(13):26. September 27. **#3.** One of the first mentions of biosolids controversy in a national general interest news magazine.

Mann, A. 1999. Follow-up: More Sludge Slinging: How Safe is That Dump? *Time* 154(14):36. October 4.

Manty, Dale. 2002. Public Outreach and Co-Learning. Presentation to the WEFTEC 2002 conference, Chicago, IL, September 29. **#2. Public participation.** Details years of experience (291 outreach projects) with working with communities “co-learning” (learning together) about management of hazardous substances or wastes around superfund or other hazardous materials sites. “Co-learning allows academics [project managers and other technical experts] to learn from communities [and] communities to learn from academics.” More information at http://www.toscprogram.org or http://www.hsrc.org.

Marchione, Marilynn. 1997. Human Waste May be Crypto Culprit; Study Suggests Source of Outbreak Wasn't Cattle. *Milwaukee Journal Sentinel*. October 18. http://www.jsonline.com/news/dec98/1204crypt.asp.

Martin, Lucy L. 2002. Sludge Piles in Whitefield to be Hauled Away. *Lincoln (ME) County News.* 127: 36, September 5. **#2. Concerned citizens, odor.** An example of a negotiated agreement amongst stakeholders, created through extensive interaction.

Maryland Department of the Environment. 1998. *Sewage Sludge Utilization in Maryland*, fact sheet.

Maschal, Richard. 1992. ‘Sludge Queen’ Hailed for Not Wasting Waste. *The Charlotte Observer.* September 21.

Mason, Eleanor. 1997. Fisherman's Farm Gets Green Light to Spread Sludge! *New England Country Folks*. June 23.

Massachusetts Water Resources Authority. 1998. *Facts About Sludge Processing.* Boston: MWRA.

Massachusetts Water Resources Authority. 1998?. *Down the Drain.* Boston: MWRA. #4. Education. A grade school curriculum on wastewater treatment, including a unit on use of fertilizer, especially Bay State heat-dried pellets produced by MWRA.

Massachusetts Water Resources Authority. 1999. *Bay State Fertilizer.* Brochure.

Massad, Jason. 2002. Growing Question: Are Biosolids Safe? Sludge Concern Spreads. *Vacaville Reporter.* California. August 24.

Matthews, Peter. 1997. Transatlantic Comparison of Biosolids Practices. Anglian Water Services, UK. **#2. Public perception, trust, perception of science, risk.** Compares European and American standards for biosolids recycling and discusses the precautionary principle versus risk assessment and attempts to define sustainability in biosolids management. "One quite normal response from the public is that if, in a debate about risk management, one scientist says level 5 and another says levels 10, the perceived third party view is that they do not know what they are talking about, so let us restrict the activities to level 1 until agreement can be reached. The problem is that even if the right answer proves to be level 10 in due course, it is usually very hard to relax legislation. So the precautionary principle is looking for practices which will lead not to controlled acceptable effect, but to no observed effect. The activity must be harmless…. The biggest immediate threat to the sustainability of operations in both the US and EU is public acceptance, so problems like bad smells can be more threatening than some of the concepts relating to metals…. It may be that quality assurance systems such as ISO 9000 and environmental management systems such as ISO 14000 will not only sustain public confidence but assist managers in maintaining sustainable operations. The elements of sustainable policy for agricultural use are proposed as: Set soil quality criteria which ensure safe use in perpetuity…, ensure that these criteria are achieved in a period of more than 50 years of biosolids application, the biosolids application is safe in health terms, the practice is acceptable to the public and customers, the operation should be affordable, and it should score highly on eco audit systems.

Maui News, *The.* 1998. EPA Gives Thumbs Up to Co-Composting Facility, Calls Product Exceptional. November 2. **#3.** Reports EKO Compost's product as "exceptional quality" with support from the mayor.

Mayer, Roger. 1999. Mayer Defends Biosolids. *The Keremeos Review.* February 18. **#2. Groundwater. Nutrients. Land application. Lack of trust. University involvement. Regulatory climate. Education.** Farmer states his case on why he chose biosolids as the beneficial resource he believes it is.

Mazmanian, Daniel and David Morell. The NIMBY Syndrome: Facility Siting and the Failure of Democratic Discourse. In Norman Vig and Michael Draft, eds., *Environmental Policy in the 90s*. CQ Press, Washington, D.C. **#2: NIMBY, trust, technology, public acceptance.** One in a series of articles that examines instances of siting public and private facilities, some of which present environmental risks. The siting issues in most instances, be they for landfills, mental institutions, prisons, or other facilities, follow a familiar trajectory which most often fails as the result of agency reluctance to share information, pre-existing public sensitivity, or media interference. The failure of traditional democratic discourse is, some authors argue, a direct result of declining trust in government.

McAvoy, Gregory E. 1999. *Controlling Technocracy: Citizen Rationality and the NIMBY Syndrome.* Georgetown University Press, Washington, D.C. **#2: NIMBY, trust of science and government, technology change, personal control.** Over the past fifty years we have witnessed a dramatic development in the state's administrative capacity and a commitment to use that capacity to solve social problems. At the same time, opportunities for citizens to express their policy preferences through elections, public hearings, open meeting laws, referenda, and public opinion polls have increased, setting the states and citizens on a collision course. This book tracks the NIMBY syndrome along a solid waste landfill development in Minnesota, and concludes with a discussion of research that supports the author's analysis of the Minnesota example. He concludes that resistance to new technology or to facilities is not the result of disagreements over technology itself, but that resistance to technological change is more a response to loss of control, respect, or justice or to incomplete or inept communication.

McBride, M. B. 1995. Toxic Metal Accumulation from Agricultural Use of Sludge: Are USEPA Regulations Protective? *Journal of Environmental Quality*, 24:5-18. **#3. Metals, land application, Class B.** A significant paper by a Cornell soil scientist that is widely cited by those concerned about the allowable levels of trace metals in U.S. biosolids.

McCance, M. 1998. Board Bans Sludge Use In County. *Richmond Suburban Newspapers*. June 20-26.

McConnell, D. Hew. 1994. GVRD takes issue with comments on Delta sewage plant. *South Delta Today*. December 11. **#2. Metals. Water Reuse. Concerned citizen involvement. Education.** McConnell submitted the article as public outreach and invitation to contact GVRD for more information.

McDaniels, T.L., L.J. Axelrod, N.S., Cavanagh, and P. Slovic. 1997. Perception of Ecological Risk to Water Environments. *Risk Analysis*, 17(3), 341-51. **#1: environmental risk, risk perception, water resources, trust of experts, personal control.** There are significant differences between expert and lay perceptions of risk. The characteristic perceptions of human health risks are expressed in a psychometric paradigm expressed through surveys. There are several key areas in which experts and lay populations differ in their risk perceptions, offering key issues in ecological risk management efforts for water resources. Underlying factors include ecological impact, human benefits, controllability, and knowledge.

McDougall, Ruth, Michael D. Van Ham, and Mary Jane Douglas. 2002. *Best Management Practices Guidelines for the Land Application of Managed Organic Matter in British Columbia*. **#3. Best management practices.** These thorough guidelines supplement new provincial regulations in British Columbia.

McKenna, Brian. The Scoop on Lansing's Poop. http://lansing.com/health/index.html, retrieved September 12, 2001.

McKenzie-Mohr, Doug. 1996. *Promoting a Sustainable Future: An Introduction to Community-Based Social Marketing*. National Round Table on the Environment and the Economy, Ontario (CN) Ministry of Environment and Energy. **#1: acceptance, behavior, trust, technology acceptance.** This booklet gives a layman's tour of the literature concerning behavior change as it relates to environmental practices. It identifies specific behavior change tools and works as a companion to a web site that displays examples of how these tools can be applied. As a guide to understanding the tools of behavior change, it is very easy to read and extrapolate to environmental issues other than recycling. (McKenzie-Mohr, Doug and William Smith. 1999. *Fostering Sustainable Behavior*. British Columbia: New Society Publishers. expands upon these themes.)

McKinney, D.E., T. Immerso, S. Fangmann, and C. Koch. 1990. NIMBY and the Ocean Dumping Ban Act of 1988. In *The Water Pollution Control Federation Specialty Conference*

Series, The Status of Municipal Sludge Management for the 1990's. New Orleans, LA: The Water Pollution Control Federation. 90-92. #**3, various applications, public concern over amount of time and input.**

McNaughton, Samuel J. 1999. What is Good Science? *Natural Resources Journal*, Spring. American Bar Association. "Good science can be identified readily by applying four tests, each of which can be unequivocally answered by a single yes or no. Those tests deal with procedure, performance, duplication, and peer scrutiny."

Meadows, Donella. 1997. In the Great Sludge War, Spreading Comes Out Ahead: Done Well, It Makes Ecological Sense. *Concord Monitor.* February.

Mendenhall, Trille C. 1990(a). From NIMBY to YIMBY: Public Acceptance Strategies for Sludge Utilization. *BioCycle.* October.

Mendenhall, Trille C. 1990(b). Public Information Concerns & Management. Charlotte, NC: Charlotte-Mecklenburg Utility Department.

Mendenhall, Trille C. 1990(c). Public Acceptance Strategies for Sludge Utilization. *BioCycle*. 31(10): 34-37. October.

Mendenhall, Trille C. 1991(a). A Municipal Perspective. *National Association of Professional Environmental Communicators* 2(4). December.

Mendenhall, Trille C. 1991(b). Strategic Planning for Residuals (Sludge) Management. Presentation at BioCycle Southeast Conference, Raleigh, NC. November 20.

Mendenhall, T.C. 1991(c). Environmental Communication: Strategy and Tactics. *AWWA/WPCF Joint Residuals Management Conference "Residuals Management After 1991."* Durham, NC: American Water Works Association and Water Pollution Control Federation. August 11-14. **#2, educating public is primary priority**, **environmental communication**. What is environmental communication? Why is it important? Public opinion is more important than ever before and the impact of environmentalism has been significant. I am sure most people believe they are environmentalists and certainly professionals in the wastewater industry are protectors of the environment. (An environmentalist is defined as a person who seeks to protect the natural environment, as from air and water pollution, wasteful use of resources, and excessive human encroachments.) Just doing a good job in protecting the environment is not enough. You may know you are doing a great job but how can the public know? To increase public confidence, we must continually tell them what we do and how we do it.

Mendenhall, Trille. 1992. Public Acceptance of Biosolids--Biosolids Managers' Perspective. In *Biosolids Public Acceptance-Digest*, Alexandria, VA: Water Environment Federation. **#2.** Communications. "Public opinion is more important than ever before and the impact of environmentalism has been significant. Generally, most people believe they are environmentalists…. To increase public acceptance and confidence, we must continually tell then what we do and how do it….Communication should be receiver-centered, not send-centered."

Mendenhall, Trille C. 1993. Gaining Acceptance for Beneficial Use. Presentation at the USEPA/AMSA Public Workshop on New Federal Sewage Sludge Regulations, Atlanta, GA. June 18.

Mendenhall, Trille C. 1995. How to Get and Maintain Public Acceptance of a Biosolids Utilization Program. Presentation at "The Effective Use of Lime for the Treatment and Disposal of Municipal Bio-Residuals" Conference, Baltimore, MD. December 12.

Merrimack, NH. 2000. *Merrimack: The Town and the River.* Videotape. 38 minutes. **#3. Education, best management practices.**

Merriman, Ed. 1991. Farmers, Public Warned of Sludge Danger. *The Capital Press*, WA. July 19:1. **#3. Metals, groundwater.** One of several news articles following the claims by the Ray and Linda Zander of harm to their cows from biosolids applied to a neighboring farm in northern Washington state.

Merritte, Marc. 1998. Linda Lingle: No Friend of the Environment. *Hawaii Environment & Health News*, 1(1), September http://www.hookele.com/hehn/98-09/nofriend.htm.

Metropolitan Denver Sewage Disposal District. Late 1990s. Metrogro: A Product of the Metropolitan Denver Sewage Disposal District. **#4.** Product description.

Metropolitan Water Reclamation District of Greater Chicago, 1995. Website description of biosolids program. http://www.mwrdgc.dst.il.us

Metropolitan Water Reclamation District of Greater Chicago. 1999(a). Land Application of Sewage Sludge: Papers and Publications by the R&D Department, and Research Funded by the District - A Bibliography, 1968 -1998, Rpt. #99-11.

Metropolitan Water Reclamation District of Greater Chicago. 1999(b). Improvements in the Quality of Sewage Sludge at the Metropolitan Water Reclamation District of Greater Chicago, Rpt. #99-20.

Metropolitan Water Reclamation District of Greater Chicago. 1999(c). Effect of Time After Cessation of Biosolids Applications on the Concentration of Cadmium, Copper, Nickel, and Zinc in Soil, Leaves and Grain of Corn, Rpt. #99-23.

Metropolitan Water Reclamation District of Greater Chicago. 1999(d). Environmental Protection System Report for Fulton County, Illinois, May 1999, Rpt #99-18.

Michigan Water Environment Association. 1997. Biosolids: Nutrient-Rich Organic Product of Wastewater Treatment. Folder and fact sheets distributed by the state environmental agency.

Miller, Dale. 1996. A Potential Disaster. Reader's Forum Column. *Coos County Democrat—Lancaster, NH*. 1-A. November 13.

Miller, G.M., B.A. Janonis, and J.A. Billica. 1996. Soft Engineering: Management of Public Concerns in a Potentially Controversial Biosolids Project. In *10th Annual Residuals and Biosolids Management Conference: 10 Years of Progress and a Look Toward the Future*, Denver, CO. 4-15–4-20. August. **#1, groundwater, overgrazing the land, land application, methods to achieve public consent.** Any large public works project can raise concerns from the citizens it serves. Biosolids projects in particular tend to evoke strong emotions and even opposition from the public. Fort Collins, Colorado set out to purchase and use rangeland for the beneficial use of biosolids, knowing that the land purchase and subsequent activities could be controversial. Fort Collins developed and implemented a systematic approach to obtain public consent for the project. This approach involved identifying the potentially affected individuals, forming a citizens' advisory board, performing research studies in response to citizen concerns, and maintaining a commitment to be responsive to the citizens. The result has been an ever-growing support for the project, increased credibility for the City, and a stronger bond between the City and the agricultural community. This paper outlines the underlying philosophy of the Fort Collins approach, gives an overview of the biosolids project and the public input process, and provides real-life examples of its successes and failures.

Milwaukee Metropolitan Sewerage District (MMSD), 1995. Website: http://www.milorganite.com

Minnich, Jerry, Marjorie Hunt, and the Editors of Organic Gardening Magazine.1979. *The Rodale Guide to Composting.* Emmaus, PA: Rodale Press. **#2 Organic. Compost. Land application. Concerned citizens.** "The recent history of sludge seems to be one of missed opportunities….There are two reasons you should be informed about the health and safety of using sludge. The first is that as a gardener, homesteader, or farmer, you may want to use some of this valuable soil builder and fertilizer on your garden, in your fields, or in your compost pile….The second reason we should be informed is that a public battle is shaping up over sludge use, a battle which carries over into all compost practice. As composters, we will have to have informed answers for those who try to scare us back to chemical fertilizers by using public health arguments…."

Missouri Extension. 1996. Safety and Benefits of Biosolids. http://muextension.missouri.edu/xplor/waterq/wq0427.htm. **#3. Pathogens, metals, chemicals, land application, education.**

Mittelstaedt, Martin. 1999(a). Guidelines Would Likely Increase. *The Globe and Mail.* January 20. **#3. Metals. Pathogens. Land application. Regulatory climate. Politics.**

Mittelstaedt, Martin. 1999(b). Sewage Sludge Gaining Acceptance As Farm Fertilizer. *The Globe and Mail.* January 20. **#2. Surface water. Nutrients. Metals. Pathogens. Phosphorus. Land application. Profit motive/lower costs.** Outlines major concerns with biosolids, but also mentions environmental and economic benefits.

Montague, P. 1999. Excrement Happens. *The Ecologist* 29(4):267-269. July. **#3, concerned citizens.**

Moore, Michael. 1994(?) New York City Sludge Train. *TV Nation.*

Moore, Michael D. and Karen Ingrid Strearns.2001. Developing an Environmental Management System. *BioCycle.* 42(5): 61-66. May.

Moote, Nancy. 1998. Construction Aggregates Honored for Environmental Initiatives. *Coast Independent* 4(23). June 8.

Moran, Tim. 1996. Atwater Cited for Poisoned Hay: 13 Cows Poisoned by Hay Fertilized with Sewage Sludge. *Modesto Bee Online*, CA. **#3. Nitrate.** News report on claim of dead cows due to high nitrate in hay grown with biosolids in Modesto, CA.

Motavalli, Jim. 1999. The 20/20 Vision Thing: The Green Group for Busy People. *E Magazine.* March-April. **#3. Concerned citizens. Organic rule.** About the group 20/20 Vision: "Erika Chan, the group's director of special projects, points to a series of success stories for the group…. Certainly, 20/20's letters were a significant percentage of the 200,000 Agriculture Secretary Dan Glickman received in opposition to his agency's proposed organic standards, which were tainted with genetically-engineered products, sewage sludge and irradiation."

Mulvihill, Keith. 2001. Long-Lasting Pollutant Found in Fertilizer, Fish. *Reuters.,* July 11. News story about Robert Hale's work on BDEs (see Hale, 2001).

Muse, J.K., C.C. Mitchell, Jr., and G.L. Mullins. 1991. Land Application of Sludge. Environmental Education Series. Extension Environmental Education, Auburn University, Alabama. February.

Musselman, Ned, Lawrence Welling, Sandy Newman and David Sharp. 1980. *I*nformation Programs Affect Atttitudes Toward Sewage Sludge Use in Agriculture. U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory. July.

National Biosolids Partnership. 1999(a). Code of Good Practice. *1999-2000 Annual Report.* Alexandria, VA: National Biosolids Partnership. **#2.** "The Code of Good Practice is a broad framework of goals and commitments to guide the production, management, transportation, storage, and use or disposal of biosolids. Code subscribers and EMS participants pledge to uphold the following principles of conduct: Comply with all Applicable Regulatory Requirements, Provide a Quality Biosolids Product, Develop an EMS for Biosolids, Provide Quality Monitoring. Require Good Housekeeping Practices, Develop Contingency and Emergency Response Plans, Commit to Sustainable Management Practices and Operations, Prepare and Implement Preventive Maintenance Plans, Seek Continual Improvement of all aspects of Biosolids Management."

National Biosolids Partnership and Regional Associations. 1999(b). Communications System for the National Biosolids Partnership and Regional/Local Biosolids Groups. Suggestions from the "Re-Investing in Success" Workshop , Charlotte, NC. August 20.

National Biosolids Partnership. 1999(c). *Improving Biosolids Management Programs and Increasing Public Support through an Environmental Management System*. #**1, environmental management systems, good practice with biosolids, increasing public support.**

National Biosolids Partnership. 2000(a). *1999 – 2000 Annual Report*. **#2, EMS process.**

National Biosolids Partnership. 2000(b). *National Manual of Good Practice for Biosolids.* Alexandria, VA. **#1. Land application, composting, heat drying, odors, public participation.** This manual provides guidance for developing an Environmental Management System (EMS) for biosolids and was developed as part of the National Biosolids Partnership EMS program. The first substantive chapter is "Public Acceptance," indicating the importance placed on this topic. "Building in the infrastructure to gain and maintain public acceptance is just as crucial as having all the screens, dewatering presses, field equipment and other mechanical components necessary to treat wastewater and manage solids. Too often, however, public acceptance doesn't enter the picture until there is a problem with the biosolids management program…. First and foremost is a well run operation." Goes on to encourage careful tracking and record-keeping, proactive odor management planning, and careful development of communication and public input. Also outlines the environmental and community benefits that should be stressed.

National Biosolids Partnership. 2001. *2000-2001 Annual Report.* Alexandria, VA: National Biosolids Partnership. www.biosolids.org.

National Biosolids Partnership. 2002(a). *Third Party Verification Auditor Guidance*. April, 2002. **#2. Public participation, communications.** Includes some good discussion about what robust proactive public outreach and participation should be within the EMS program.

National Biosolids Partnership. 2002(b). *Elements of an Environmental Management System (EMS) for Biosolids*, final interim draft, May 1, 2002. **#2.** One of the NBP EMS core documents.

National Coalition for Dialogue & Deliberation. http://thataway.org/ncdd/index.htm "The National Coalition for Dialogue & Deliberation is a Coalition of Organizations and Individuals who are committed to strengthening and uniting the growing dialogue and deliberation community."

National Institute for Occupational Safety and Health (NIOSH). 2000. *Workers Exposed to Class B Biosolids*. Hazard ID #10. Morgantown, WV: NIOSH. This "hazard ID" was rather critical of biosolids recycling and was criticized for ignoring literature on the health of wastewater treatment workers and biosolids. It was subsequently replaced by the following publication.

National Institute for Occupational Safety and Health (NIOSH). 2002. *Guidance For Controlling Potential Risks To Workers Exposed to Class B Biosolids.* Replaced the NIOSH Hazard ID #10 (see above). **#1. Health, risk.** A useful analysis of potential risks of working with Class B biosolids that may contain viable pathogens. Includes recommendations for reducing risks.

National Research Council. 1989. *Improving Risk Communication*. Washington, DC: National Academy Press.

National Research Council, 1993. *Issues in Risk Assessment*. Washington, DC: National Academy of Sciences.

National Research Council, 1996. *Understanding Risk: Informing Decisions in a Democratic Society*. Washington, DC: National Academy of Sciences**. #1. Risk, public participation.** "Risk characterization should be a decision-driven activity, directed toward informing choices and solving problems….Coping with a risk situation requires a broad understanding of the relevant losses, harms, or consequences to the interested and affected parties….Risk characterization is the outcome of an analytic-deliberative process. Its success depends critically on systematic analysis that is appropriate to the problem, responds to the needs of the interested and affected parties, and treats uncertainties of importance to the decision problem in a comprehensible way. Success also depends on deliberations that formulate the decision problem, guide analysis to improve decision participants' understanding, seek the meaning of analytic findings and uncertainties, and improve the ability of interested and affected parties to participate effectively in the risk decision process. The process must have an appropriately diverse participation of representation of the spectrum of interested and affected parties, of decision makers, and of specialists in risk analysis, at each step….The analytic-deliberative process leading to a risk characterization should include early and explicit attention to problem formulation; representation of the spectrum of interested and affected parties at this early stage is imperative. The analytic-deliberative process should be mutual and recursive. Analysis and deliberation are complementary and must be integrated throughout the process leading to risk characterization: deliberation frames analysis, analysis informs deliberation, and the process benefits from feedback between the two…. Structuring an effective analytic-deliberative process for informing a risk decision is not a matter for a recipe. Every step involves judgement, and the right choices are situation dependent. Still, it is possible to identify objectives that also serve as criteria for judging success: getting the science right,…getting the right science,…getting the right participation,…getting the participation right,…developing an accurate, balanced, and informative synthesis…. Those responsible for a risk characterization should begin by developing a provisional diagnosis of the decision situation so that they can better match the analytic-deliberative process leading to the characterization to the needs of the decision, particularly in terms of level and intensity of effort and representation of parties…. Each organization responsible for making risk decisions should work to build organizational capability to conform to the principles of sound risk characterization. At a minimum, it should pay attention to organizational changes and staff training efforts that might be required, to ways of improving practice by learning from experience, and to both costs and benefits in terms of the organization's mission and budget…."

National Research Council. 2001. Study of Public Participation in Environmental Assessment and Decision Making. Summary Notes from Planning Meeting. July 20.

National Research Council. 2002. *Biosolids Applied to Land: Advancing Standards and Practice*. Washington, DC: National Academy Press. Prepublication Copy, July. **#1. Pathogens, Class B, air emissions, health effects.** This second major review by the National Academy of Sciences of the federal EPA biosolids program created considerable debate as it found no documented failure of the Part 503 protecting public health and the environment, but did suggest the rule's science needed updating and studies of potential health effects are necessary.

National Research Council.1996. *Use of Reclaimed Water and Sludge in Food Crop Production,* Washington DC: National Academy Press. **#1. Metals, pathogens, chemicals, nutrients, odors, enforcement, lack of trust.** Extensive peer review of the U.S. EPA 40 CFR Part 503 biosolids rule and risk assessment. "Public concerns fall into several categories. One category consists of 'nuisance' risks to community quality of life and property values, such as odors, traffic, and the attraction of vermin to sludge application sites. Another category of concern has to do with protection of nearby natural resources of high value, such as wellwater, other water supplies, and fish….The POTW and cognizant officials must provide the public with assurances that meet such concerns. Studies have shown the importance of bringing the public into the decision-making process at an early stage for this purpose….The operators of municipal wastewater treatment facilities and the parties using sludge and wastewater should implement visible, stringent management and self-regulation measures, including monitoring and reliable reporting by farmers, and should support vigilant enforcement of appropriate regulations by local or state agencies… The municipal utility should carry out demonstration programs for public education, and to verify the effectiveness of management and self-regulatory systems. In addition, the utility should be prepared to indemnify farmers against potential liabilities when farmers' financing by banks or other lenders may hinge on this assurance…..Program credibility may be improved and public concern reduced if federal, state, and municipal regulators clearly assign authority to local governments for responding to any reports of adverse consequences related to beneficial use of sludge…. The public should be aware that state and local units of government have the necessary regulatory authority to take corrective actions against parties who have violated rules and guidance."

National Sludge Alliance. 1997(a). NSA Fact Sheet 104: EPA's Reckless Endangerment of Public Health. February 10. http://www.enviroweb.org/issues/sludge/nsa/nsa104.html.

National Sludge Alliance. 1997(b). NSA Fact Sheet 107: The Sludge Gets Deeper. March 10. http://www.enviroweb.org/issues/sludge/

National Sludge Alliance. 1997(c). Public Facts 113: Is it Toxic Sludge or Cow Manure Poisoning Our Food Supply. May 7. http://www.enviroweb.org/issues/sludge/.

National Sludge Alliance. 1997(d). Caution: EPA Scientist at Work. NSA Fact Sheet 111. April 16. #**3, land application adjacent to Zander farm, opposition.** There are many such fact sheets.

National Sludge Alliance. 1997(e). EPA's Reckless Endangerment of Public Health. February 10. http://www.enviroweb.org/issues/sludge/nsa/nsa104.html.

National Sludge Alliance. 1997(f). Is It Toxic Sludge or Cow Manure Poisoning Our Food Supply? May 7. http://www.enviroweb.org/issues/sludge.

National Sludge Alliance. 1997(g). The Sludge Gets Deeper. March 10 http://www.enviroweb.org/issues/sludge.

National Sludge Alliance. 2000(a). NSA Fact Sheet 122: Catch 22 – The Plight of the Farmer Who Accepts Sludge. http://www.enviroweb.org/issues/sludge/nsa/nsa122.html.

National Sludge Alliance. 2000(b). NSA Public Fact Sheet 123: The Terrible Truth. http://www.enviroweb.org/issues/sludge/nsa/nsa123.html.

National Sludge Alliance. 2000(c). Catch 22-The Plight of the Farmer Who Accepts Sludge. http://www.enviroweb.org/issues/sludge/nsa/nsa122.html. Retrieved December 5.

National Small Flows Clearinghouse. 1998. Managing Biosolids in Small Communities. *Pipeline.* Vol 9, No. 4, Fall 1998. **#2. Education.** Provides basic background information on biosolids management options. Recommends more education on the topic.

National Whistleblower Center. 2002. Scientific Freedom Under Attack: An Analysis of the Synagro Technologies, Inc. "White Paper" Regarding Dr. David Lewis. January 24. (Available at: http://www.whistleblowers.org/sludgereplyfinal.htm) **#2. Concerned citizen, science.** Part of a strong debate on the theories of Dr. David Lewis and the responses from EPA and industry.

National Wilderness Institute. 1999. EPA Decisions Driven by Politics: Agency Responsible for Any Harmful Health Effects of Sludge Says NWI. http://www.nwi.org/PressReleases/23March99.html. March 23.

National Wind Coordinating Committee. 2002. *Permitting of Wind Energy Facilities, A Handbook*. National Wind Coordinating Committee: http://www.nationalwind.org . August. **#1. Public participation. NIMBY.** An example of a public participation approach in another environmental field that includes the need to site facilities (wind farms) in rural communities. More information: RESOLVE, 1255 23rd Street NW, Suite 275,Washington, DC 20037; phone (888) 764-WIND, (202) 944-2300; fax (202) 338-1264; e-mail: nwcc@resolv.org.

National Wilderness Institute. 1999. News Release: EPA Decisions Driven by Politics: Agency Responsible for any armful Health Effects of Sludge Says NWI. March 23.

Natural Life. 2000. Sludge on Your Supper Table. http://enviroweb.org/issues/sludge, retrieved December 5.

Nature's Blend Organic Fertilizers. 2000. Advertising brochure. Warren, OH.

Naylor, L.M. 2000. Survival and Success Strategies at In-Vessel Facilities. *BioCycle* 41(8):62-65. #**3, education tool, composting.**

Nelson, Arlyn. 1993. Community Decision Making: Deciding on an Option. National Extension Compost Utilization Conference, Minneapolis, MN**. #3: risk understanding, public acceptance, public perception, public relations.** Case study of county decision-making process surrounding a solid waste landfill; traces the erosion of political support and funding for a limited solution to a municipal solid waste (MSW) disposal problem.

Nesmith, Jeff. 1996. Turmoil at EPA. *The Atlanta Journal-Constitution, Saturday Reader.* July 27. **#3. Lack of trust, chemicals.** David Lewis criticism of EPA science, including accusations of "sludge magic" in the development of the 40 CFR Part 503 rule.

Neville, Angela. 2000. Fertile ground. *Environmental Protection.* September. #**2.** Provides an overall look at biosolids recycling (process, dioxins, regulations, EMS, bans, etc.).

New England Biosolids and Residuals Association (NEBRA). 1999(a). Questions and Answers. http://www.nebiosolids.org

New England Biosolids and Residuals Association. 1999(b). Communications System for the National Biosolids Partnership and Regional/Local Groups: Suggestions from the

Reinvesting in Success Workshop, Charlotte, NC. **#3. Education. Communication.** Provides recommendations to the National Biosolids Partnership on stakeholder needs and potential tools and projects, such as a national website, for addressing those needs.

New England Biosolids and Residuals Association (NEBRA). 2001. Were Biosolids Involved in the Death of a Greenland, New Hampshire Man? Information Update. Available at http://www.nebiosolids.org/scienceof.html.

New England Biosolids and Residuals Association. 2000. News story. www.nebiosolids.org.

New England Fertilizer Company. 1999. *Complete Biosolids Management Services.* Brochure.

New England Interstate Water Pollution Control Commission. 1994. Sludge, a.k.a. Biosolids! *Water Connection*, 11(2), Fall. **#2. Education, liability, odors.** A collection of articles from New England biosolids management experts. John Donovan regarding public concerns: "Successful public acceptance programs generally have a few things in common: they promote early public involvement; they freely provide scientific information and testimony from independent sources; they provide opportunities for exchange of views and questions; and they explain safeguards, standards, and benefits of the proposed programs." USEPA's John Walker and Farm Credit Bank's Roger Allbee on liability: "Although there has been significant research on the beneficial use of biosolids, and history has demonstrated in the United States and other regions of the world that high quality residuals can be a beneficial soil additive and plant nutrient when properly applied, concerns still exist. One reason for this, of course, is the origin of biosolids. Another reason is a general lack of understanding on the part of the public about advancements in biosolids technologies and the resulting better quality materials that are safer and more suitable for land application. In addition, some people are concerned that the acceptable environmental standards of today might change in the future, subjecting property owners to either increased cleanup costs or property devaluation." Andrew Carpenter on public education: "Talk about history, discuss the issues, be a good neighbor, sort out myth and reality."

New England Interstate Water Pollution Control Commission. 1995. *Land Application of Biosolids*. Fact Sheet prepared by NEIWPCC's Residuals Workgroup. October. #**2, biosolids, adherence to 503s, public outreach/education.** "The New England states, New York, NEIWPCC, and EPA believe that when managed and applied properly, biosolids can be valuable resources….Many communities have discovered viable, safe, and environmentally sound options for the beneficial use of their biosolids….In choosing an option, communities must consider cost, odor control, and siting issues."

New England Interstate Water Pollution Control Commission. 1995. *Sludge or Biosolids*. Fact Sheet prepared by NEIWPCC's Residuals Workgroup. October. **#2, gets information to the public in a concise and technical manner.**

New England Interstate Water Pollution Control. 1995. *Sewage Sludge Incineration* (brochure). October.

New Hampshire Comparative Risk Project. 1997. Report of Ranked Environmental Risks in New Hampshire, Concord, NH. **#4. Concerned citizens, risk communication.** 50+ NH environment and public health stakeholders evaluated and ranked perceived risks in order of actual risk; "sludge management" was close to last on the list (considered relatively low risk).

New Hampshire Greens. 1997. Position Statement: Stop the Sludge. August 18. http://home.earthlink.net/~rhenderson/grsludge.html

New Hampshire Water Supply and Pollution Control Commission. 1978. Land Application of Wastewater Sludge at Somersworth, NH. November. "Generally, reception towards land application of wastewater sludge at the site in Somersworth was favorable…. Municipal agencies received only a few complaints about mild odor from nearby residents, and the problems lasted less than a week. Residents are often requesting sludge for their gardens and lawns, although all such use of fresh sludge is presently not allowed…for bacteriological reasons. When other interests were approached with proposals for land application of sludge, an attitude of skepticism was common."

New Hampshire, University of. 1998. Landspreading of Sludge in New Hampshire, Report of the UNH Sludge Task Force. **#3. Metals, concerned citizens, pathogens, chemicals, groundwater.** This is an evaluation of biosolids recycling by a variety of scientists with a variety of experience and knowledge.

New U.S. Waste Strategy, Pt. 2: Sewage Sludge. 1997. *Rachel's Environment & Health Weekly* #561. August 28, 1997. http://www.monitor.net/rachel/r561.html

New Waves. 1992. TWC Proposes Tough New Rules to Deal with West Texas Sludge Project. 5(3), October. http://twri.tamu.edu/twripubs/NewWaves/v5n3/news-5.html

New York City Department of Environmental Protection, Biosolids Citizen Advisory Committee. 1998-2000. Minutes of Meetings.

New York City Department of Environmental Protection. 2003. Tips for Preparing a Public Participation Plan Pursuant to the New York State Department of Environmental Conservation Commissioner Policy-29, Environmental Justice and Permitting.. Issued December 4. **#3. Public participation.** Some helpful very basic guidelines on developing public participation programs around environmental programs.

New York State Department of Environmental Conservation.1997. *A Technical Review of 'The Case for Caution,'* document finalized and made available as part of rulemaking process in 2002. **#2.**

Newton, C. 1995. Public Acceptance: The Key to Surviving the Coming Backlash. In *4th Annual Joint WEF & AWWA Conference, Biosolids and Residuals Management,* Kansas City, MO. 5-5–5-6. July. #**1, land application, beneficial use, public acceptance.** "The 1994 election was not only a message from Americans to their elected representatives, it signaled the onset of a long overdue period of introspective examination of citizens' social compact with their government. With environmental do's and don'ts intruding on virtually every minute of a person's daily activities, it is no wonder that people are re-examining their commitment to a pollution-free world. And while many continue to label themselves as environmentalists, skepticism and questioning of this commitment is growing as the need for personal sacrifice mounts. This yin and yang – a desire for a better environment tempered by reluctance to personally pay for it – defines a generation."

Nichols, Alan B. Cartoon Series Dramatizes Environmental Challenge. About *Captain Planet* cartoon, which included a critical slant on "sludge."

Nichols, Alan B. 1992. How to Get the Best from Your Public Education Program: Getting the Public Involved in Utility Projects. *Water Environment & Technology.* August.

Norman, Roni. 1995. Reader objects to Nutrifor Treatments. *The Similkameen Spotlight*. September 13. **#2. Odor/vector attrn. Land application. Local ban. Media campaign. Lack of public information. Lack of trust.** Concern already has roots in poor perception of GVRD. Resident encourages other concerned individuals to respond to regulatory officials and to stop further applications.

Northwest Biosolids Management Association (NBMA). 1998(a). *Biosolids Recycling: Recognizing a Resource.* Fact Sheets, video. **#2.** Excellent video and fact sheets providing introduction to biosolids recycling in the Northwest U.S. Video also discusses importance of NBMA.

Northwest Biosolids Management Association and U.S. Environmental Protection Agency. 1998(b). *Final Report: Cooperative Agreement.* **#1.** Discusses different aspects of biosolids program development. Discusses specific roadblocks and aids in creating a successful biosolids project.

Northwest Biosolids Management Association. 1997-1998. *Literature Reviews.* **#4. Nutrients, metals, chemicals.** Literature reviews developed at the University of Washington, for NBMA, of technical papers regarding biosolids and incineration, metals, microbes, nitrogen, organics, poplars, runoff, soil physical properties, and wildlife.

Northwest Biosolids Management Association. 1999. *The Results of the Marketing Assessment for Biosolids.* April. #**1.** Uncovers some key elements to making a biosolids project a success as well as outlining some obstacles.

NViro. *Today's Biosolids and Residuals Technologies.* Videotape.

O'Dette, R.G. 1994. The Beneficial Use of Biosolids: We're Getting There! In *The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective*, Washington, D.C.: Water Environment Federation. 9-1–9-12. #**3, metals, dioxin, Round 2 of 503 regulations.**

O'Dette, R.G., and G.A. Draman. 1998. Success Stories in Biosolids Recycling. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 549-553. #**3, land application, composting, liability, Class A.**

Oerke, D.W., J.H. Rickermann, F. Bebler, and P. Heppler. 1998. What Happened When Neighbors Moved Next Door – A Successful Approach to Public Involvement in Biosolids Management Decisions in Boulder, Colorado. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 555-561. #**1, toxicity, general siting issues, land application, citizen outcry and mechanism to work out a plan for the City.** The City of Boulder, Colorado has been land applying Class B biosolids within 10 miles of their wastewater treatment plant (WWTP) since 1980. Their land application program has received many awards for their management of biosolids over the past several years. In their inventory of application sites was a very large tract of dryland wheat acreage within 4 miles of the WWTP. The City was transporting and applying approximately 75% of the City's annual production of biosolids to this site since 1985 without concern or complaints from the public. In 1990, the City reviewed the land application program in light of increasing development pressure in Boulder County for suitable agricultural land for biosolids application. The conclusion of the study showed that the City should purchase agricultural land for long-term application of biosolids. The City determined that the substantial tract of dryland wheat 4 miles from the WWTP was the most cost-effective alternative for the long-term future. The first parcel available to purchase was an 80-acre tract in 1991. This purchase was completed with little to no interest from the community at any public meetings held by the City regarding the Class B land application program. Several land parcels became procurable in late 1994. During the first public meeting presenting the plan to make these additional land purchases for the existing Class B program, staff was only able to introduce the first seven minutes of the planned addenda before the community became outraged – 15 people attended. One week later, the City scheduled another public meeting to further discuss the planned purchase. More than 300 people attended this meeting with the same upheaval and anger as the first meeting. Two weeks later, the City staff again attempted to explain the process and land application of biosolids to more than 550 citizens with only "mob rule" mentality. The media had a field day at the City's expense. A small group of citizens, which moved to Boulder from a different region of the Country, mobilized and became very organized with both funding and resources to oppose and demand that the City of Boulder's Class B land application program be stopped in the controversial area. The City staff voluntarily halted land application within the County and moved the biosolids land application program 60 miles away to another county in eastern Colorado. The City developed a new plan to evaluate the long-term final use of biosolids, with participation from a citizen study review group (SRG) consisting of representatives from the community, City of Boulder staff, and the consultant. The group evaluated the fiscal and community impacts, environmental compatibility, reliability, flexibility, site requirements and end-use market potential for Class A and Class B biosolids management alternatives. This paper focused on lessons learned from these public acceptance problems and the right way to include citizens and city staff in a positive "team approach" to build a consensus on the selection of a biosolids management plan. Special attention was given to how the citizens group was formed, the goals that were established for the group, how meetings were facilitated, and how input from all group members was solicited to ensure consensus and "buy-in" to the study conclusions.

Ohio Farm Bureau Development Corporation, Ohio State University, and USEPA. 1985. *Demonstration of Acceptable Systems for Land Disposal of Sewage Sludge.* Cinncinatti: USEPA Water Engineering Research Laboratory. **#3. Land application, pathogens, metals.** The Ohio farm study comparing the health of residents of 47 farms that received sludge compared with residents of 46 farms that did not receive sludge.

Okun, Melva. 1999. Human Health Issues Associated with the Hog Industry. Environmental Resource Program, School of Public Health, the University of North Carolina at Chapel Hill January. http://checc.sph.unc.edu/rooms/library/docs/hogs/hogs_hhealth.html.

Olson, Robert. 1995. Sustainability as a Social Vision. *Journal of Social Sciences*: 51(4), 15-36. **#3: environmental attitudes, science, trust.** The author states that there is evidence that traditional images of the future are becoming less believable and that, as a society, we are becoming less hopeful about the future. He cites influences that shaped modern societies and discusses ways to explore the requirements for reaching a sustainable future, assumptions about the prospects for growth, and alternative scenarios of a sustainable future. Reflecting upon the available scenarios for the future, he concludes that societies in the North will have to consume far fewer resources and use them more efficiently or suffer an ecological holocaust.

Operations Forum. 1994. Beneficial Use of Biosolids. November, pp.8-12. The EPA biosolids awards were established to encourage development of cost-effective and environmentally safe biosolids management practices that recycle nutrients and improve soil conditions. This year's awards were presented to large and small operating projects, research activities, and three specially recognized programs.

Oppel, Richard et al. 1992. Congratulations to CMUD. Editorial in *The Charlotte Observer.* September 24.

Organic Consumers Association. Drugs Are Accumulating in Sewage Sludge, Surface Waters and Drinking Waters. http://purefood.org/toxic/drugsinwater.cfm, retrieved December 5, 2000.

Orlando, L. 1997. The Sewage Scam – Should Sludge Fertilize Your Vegetables? *Dollars and Sense* 211:34-37. May/June. http://www.riles.org/paper2.htm. #**2. Concerned citizens, lack of trust.**

Orlando, Laura. 1999(a). Something Stinks in the EPA. ReSource Institute for Low Entropy Systems http://www.riles.org/musings23.htm. September 24.

Orlando, Laura. 1999(b). Toxic Avengers: The EPA is Pushing Hazardous Sludge as Fertilizer. The Locals are Fighting Back. *In These Times*. February 21. http://www.riles.org/library.htm.

Ott, P.E. and R. Randy. 2000. Six Years and Still Going, Onondaga County's 10 Year Biosolids Privatization Program. In *14th Annual Residuals and Biosolids Management Conference.* Water Environment Federation. February/March.

Outwater, Alice. 1996. *Water, A Natural History.* New York: Basic Books. **#3. Chemicals, metals.** The perspective of a water quality engineer who worked at Boston's biosolids management program: "As soon as a city starts recycling its sludge, the industrial-discharge permit system tightens up….With municipal-sludge quality reports from around the country piled on my desk, I began to realize that industries themselves are no longer directly dumping much down the sewers….Sludge doesn't lie. And most city sludge is remarkably clean."

Ozawa, Connie P. and Lawrence E. Susskind. 1984. Mediating Science-Intensive Public Policy Disputes. Presented at the annual meeting of the Association for Public Policy Analysis and Management, October 18-20.

Page, A. L. and A. C. Chang. 1994. Overview of the Past 25 Years: Technical Perspective, in Clapp, C. E., W. E. Larson, and R. H. Dowdy (eds.): *Sewage Sludge: Land Utilization and the Environment.* Madison, WI: Soil Science Society of America Miscellaneous Publication.

Palazzo, A.J., and I.K. Iskandar. 1993. Use of Sewage Sludge on Park and Recreational Lands. *Sewage Sludge: Land Utilization and the Environment*, Bloomington, MN: Soil Science Department and USDA-ARS, University of Minnesota. August 11-13. **#4, land application on public lands.**

Palmer, D.W., and C.G. Shimp. 1995. New Jersey Wastewater Authority Buys Farmland For Biosolids Disposal. *Water Engineering & Management* 142(7):37. July. #**4, on-site disposal, biosolids as fertilizer, land application, groundwater not an issue, best management practices.**

Passi, Peter. 2000. Companies to Manage Wood Resources on Minnesota Land. *Duluth News-Tribune.* http://www.penweb.org/issues/sludge/tailingspoplars.html.

Passi, Peter. Companies to Manage Wood Resources on Minnesota Land. *Duluth News-Tribune*. http://www.penweb.org/ssues/sludge/tailingspoplars.html, retrieved December 5.

Pavey, R. 1998(a). Dairy Farmers Suffering. www.augustachronicle.com/stories/111598/met_cows2.Shtml. November 15.

Pavey, R. 1998(b). Sludge Raising a Stink. www.augustachronicle.com/stories/111598/met_cows1.Shtml. November 15.

Pavey, R. 1998(c). Dairy Farms File Lawsuits Against County. www.augustachronicle.com. November. #**3, land application to grow grazing material for cattle, negative media story, led to further investigations, lack of enforcement, bad management.**

Pavey, R. 1998(d). State to Audit Wastewater Plant In Toxin Case. www.augustachronicle.com. November.

Pavey, R. 1998(e). Wastewater Plant In Disrepair. www.augustachronicle.com.. November.

Pearce, Robert. 1997. www.nosludge.org. Palmdale, CA. **#3. Opposed. Urban/rural conflict.** "Tell the city of Los Angeles to keep their sewage to themselves."

Pearlman, Stephen and Steve Frank. 2001. Winning Trust Through Open, Honest Communication Helps Reduce Neighbors' Fears of Biosolids. *15th Annual Residuals and Biosolids Management Conference, San Diego, CA.* Water Environment Federation conference. **#1. Independent monitoring, third-party review, outrage, public concern, addressing technical issues.** Describes the application of public participation and communications concepts, including those of Peter Sandman, to a difficult biosolids recycling public acceptance problem, including public concern over the acceptance by Denver Metro of Lowry Landfill treated groundwater about which there have been concerns about radioactivity.

Pearlman, Stephen, Duane E. Humble, and Stephan D. Frank. 2000. Independent Biosolids Monitoring Plan Paves the Way for Cooperation Between Skeptical Neighbors and Wastewater Agency. *14th Annual Residuals and Biosolids Management Conference, Boston, MA.* Water Environment Federation conference. **#2. Independent monitoring, third-party review.**

Pellow, D.N. 1999. Framing Emerging Environmental Movement Tactics: Mobilizing Consensus, Demobilizing Conflict. *Sociological Forum*, 14(4), 659-683. **#2: Personal control, acceptance, framing, environmental justice, trust of government or corporation.** A study of an emerging environmental decision-making model of social movements that moves beyond traditional adversarial approaches toward "consensus building." The model advocated by the author allows activists equal power with industrialists and state actors in environmental policy making. There are instances when challengers actually engage in collaborative framing with their adversaries. Literature on frame analysis is growing, and does not presume that activists reject oppositional framing altogether, but may draw on a mixture of confrontation and negotiation in this form of collective action that places them in a decision making role. The author points to four frames: (1) political economic [a diagnostic frame used by environmentalists to identify the source of their problems]; (2) environmental justice [activists articulate their demands]; (3) collaborative [in which activists engage and jointly struggle with their opponents]; and (4) tactical [consensus building decision making, or "CBDM"]. The author suggests that environmentalists are becoming more sophisticated in their efforts to protect local communities and natural resources and that CBDM is becoming, more often, a tool for both sides to utilize.

PENnet. Assorted messages on web site www.penweb.org/pennet.html. **#3. Concerned citizens.**

Pennsylvania Department of Environmental Protection. 1999. *Land Application of Biosolids Workbook.* Commonwealth of Pennsylvania Department of Environmental Protection Bureau of Water Quality Protection. September. **#3. Training. Land application.** Includes tips for involving the public and addressing public concerns during each step of a land application program.

Pennsylvania Department of Environmental Protection. 1999. *Teaching About Biosolids*. **#2. Education, risk perception.** "A curricular supplement designed to assist educators and middle school students in meeting several of the newly proposed state standards in Environment and Ecology and in understanding biosolids and their use."

Pennsylvania Department of Environmental Protection. 2000. Regulation and Beneficial Use of Biosolids. Internet website: http://www.dep.state.pa.us/dep/biosolids/toc.htm. **#2. Education.** Good presentation of information.

Pennsylvania Environmental Network. 1999?. The Power to Protect! Flyer encouraging local ordinances for additional testing and bonding of biosolids land application programs in PA. http://www.penweb.org.

Pennsylvania Environmental Network. 2001. Why We Are Opposed to the Land Application of Sewage Sludge. Received via email. July. Reprinted in Appendix B.

Pennsylvania State University. 1985. NEC-28. *Criteria and Recommendations for Land Application of Sludges in the Northeast.* Bulletin 851. **#4. Metals, pathogens, nutrients.** "This bulletin informs public officials and private citizens about the benefits and hazards of land spreading of sludges in the Northeast."

Pennsylvania State University. 1999. Land Application of Sewage Sludge in Pennsylvania: Use of Biosolids in Crop Production. Cooperative Extension fact sheet. **#2. Communications, information.**

Penticton Herald, The. 1992. Princeton Picks Sludge Over Contaminated Soil. October 21. #**3. Trucking. Land application. Politics.** Lost government funding to study mine tailings since town rejected contaminated Expo soil.

People Against Power's Sludge (PAPS). 1999. Letter to local citizens regarding land application of biosolids permitting in Rush Township, PA. **#4. Concerned citizens.** "Let us be heard loud and clear. We say no to sludge!"

Peot, Chris and Dan Thompson. 1996. Compost use in wetland restoration. *BioCycle*. January. **#1. Wildlife impacts.** City staff went out and met with neighborhood leaders and created a citizen support group for the project. Neighbors unanimously voted for the biosolids project.

Perciasepe, Robert, Assistant Administrator, USEPA.1997. Letter to Ellen Z. Harrison, Cornell Waste Management Institute, October, 1997.

Perkes, C. 1999. Tractor Company Sues to Block Composting Firm; It's the Second Legal Action Filed by Pacific Tractor in an Effort to Halt Expansion of Inland Empire Composting in Colton. *The Press-Enterprise*, Local section, p. B03. March 30. Riverside,CA.

Peters, R.G., V.T. Covello, and D.B. McCallum. 1997. The Determinants of Trust and Credibility in Environmental Risk Communication: An Empirical Study. *Risk Analysis*, 17(1), 43-54. **#1: trust, credibility, risk communication, risk perception.** This article identifies the specific characteristics that are necessary for public acceptance – it should be more widely read. Several theories have been postulated regarding how the public develops perceptions of trust and credibility in environmental risk communications. There is strong evidence to show that trust and credibility are key components of environmental risk communication. The development of trust and credibility depends on three factors: perceptions of knowledge and expertise; perceptions of openness and honesty; and perceptions of concern and care. Researchers found the following: (1) for industry, increases in public perceptions of concern and care will increase their sense of trust and credibility; (2) for government, increased public perceptions of commitment will increase perceptions of trust and credibility; (3) for citizen groups, an increase in public perceptions of knowledge and expertise results in increased perceptions of trust and credibility. In summary, defying a negative stereotype is one key to improving perceptions of trust and credibility.

Peterson, Niels. 1994. Human Waste Mixed For Park. *The Western Press.* March 16. #**2. Odor. Pathogens. Nutrients. Land application. Regulatory climate. Profit motive/lower cost.** Council member says, "It may be perceived positively, but God help you if it smells."

Physicians for Social Responsibility. 1994. Putting the Lid on Dioxin: A National Policy on Dioxin. http://www.psrus.org/diox6.htm.

Pick, C. 1996. Bouncing Back From a Public Nuisance Setback. *BioCycle* 37(9):58-61. **#1, odor, public health, composting, NIMBY, concerned citizen.** The topic of public health as it relates to composting is complex and involves a multitude of concepts, including politics, science, emotion, perception, composting methodology, regulation, fear, and more. The apparent contradictions between these themes are what make the public health issue so challenging to manage. However, it is imperative that composting site operators, both private and public, and the industry in general be prepared to face this issue and manage it productively.

Pilisuk, M. and C. Acredolo. 1988. Fear of Technological Hazards: One Concern or Many? *Social Behavior*, 3, 17-24. **#2: technology trust, hazards, environmental justice.** A survey of three Northern California communities assessed levels of concern about ten potential dangers of technology. A factor analysis showed a single underlying dimension accounting for at least half of the variance among the diverse concerns. This overall level of concern, while high across all groups, was raised among women, minorities and less educated and poorer income people more highly than among others. Concern was also higher among liberals and those indicating a greater involvement in religion. Level of concern did not vary, however, as a function of having children in the home, exposure to television and radio news, or participation in political action. (Note: subsequent studies have displayed significantly elevated levels of concern among women with small children in the home).

Pokorny B., R. Prabhu, C. McDougall, R. Bauch. 2004. Local Stakeholders' Participation in Developing Criteria and Indicators for Sustainable Forest Management. *Journal of Forestry*, 102 (1), 35-40. Abstract: Criteria and indicators (C&I) for sustainable forest management are important tools to improve the quality of forest management. In most cases they have been developed by experts, but the participation of stakeholders is essential if the C&I are to be locally relevant and practicable. We asked four stakeholder groups to apply a set of C&I to a forest management unit in the eastern Amazon basin. The study confirmed the importance of involving stakeholders and demonstrated that effective efforts begin with well-defined and clearly understandable C&I. Stakeholders were better able to apply and adapt measurable verifiers than the more abstract indicators and criteria. Intensive communication about personal experiences and subjective interpretations is necessary to prevent misunderstandings and misinterpretations. Our study also confirmed the general practical applicability of C&I and revealed their potential as instruments of communication and learning.

Pollan, Michael. 2001. The Year in Ideas: - An Encyclopedia of Innovations, Conceptual Leaps, Harebrained Schemes, Cultural Tremors & Windsight Reckonings That Made the Difference in 2001: The Precautionary Principle. *New York Times Magazine.* December 9**. #2.** Good summation of this principle.

Pooley, Julie Ann and Moira O'Connor. 2000. Environmental Education and Attitudes: Emotions and Beliefs Are What is Needed. *Environment and Behavior*, 32(5), 711-724. **#1: environmental education, behavior, public acceptance.** The main focus of environmental education programs has been to change environmental behavior through increasing environmental knowledge. Because many environmental studies have failed to successfully apply attitude theory in researching environmental attitudes, the present study investigated the cognitive and affective bases of environmental attitudes to indicate that it is what people feel and believe about the environment that determines their attitudes toward it. The findings suggest that, environmental educators interested in changing environmental attitudes need to target emotions and beliefs, rather than knowledge, as sources of information on which to base their environmental programs (*Ed. note*: this analysis is consistent with research summarized by McKenzie-Mohr).

Portland, City of (Maine). 2000. *Invitation to Tour of Madison Farms.* April 20. #4

Portland, OR, City of. 1999. Media Guide: Biosolids Media Training. City of Portland and OR Department of Environmental Quality. **#2. Media campaign.** Example of efforts by utilities and biosolids managers to manage media stories.

Powell, Douglas. 1996. An Introduction to Risk Communication and the Perception of Risk. Unpublished manuscript, University of Guelph, Ontario, Canada. **#1. Risk, communication.** An excellent primer.

Powell, T. 1998. Officials Silent on Future of Wetlands. www.augustachronicle.com. November.

Powell-Tate. 1993. *Communications Plan on Biosolids.* Prepared for the Water Environment Federation. **#1.** Includes identification and surveys of gatekeepers, recommendations for positive biosolids messages.

PR Watch.1995. A R.O.S.E. by Any Other Name… *PR Watch*, 3rd Quarter. **#3. The word 'biosolids.'**

PR Watch. 1999(a). Flack Attack. www.prwatch.org **#3.** An advocacy group challenges American Council on Science and Health for being "right wing" and industry funded, thus producing tainted science. ACSH responds.

PR Watch. 1999(b). Sandman's Cagey Tactics (letter to PR Watch) www.prwatch.org. **#3.** PR Watch and readers attack Peter Sandman's model of public outrage; "outrage can be good; hold on to it."

Priesnitz, Wendy. 1997. The Real Dirt on Sewage Sludge. *Natural Life Magazine* #58. http://www.life.ca/nl/58/sludge.html, retrieved December 5, 2000.

Providence Journal. 2002. Internal Review Faults EPA Over Safety of Recycled Sewage. February 7.

Pure Food Campaign. 1997(a). Federal Sludge-Labeling Bill. April 22. http://www.purefood.org/sludge.html.

Pure Food Campaign. 1997(b). Toxic Sludge as Fertilizer. *The Seattle Times.* November 23. http://www.purefood.org/Toxic/toxicSludge.html.

Pure Food Campaign. 2000(a). Drugs Are Accumulating in Sewage Sludge, Surface Waters, and Drinking Water. http://www.purefood.org/toxic/drugsinwater.cfm.

Pure Food Campaign. 2000(b). Toxic Wastes 'Recycled' as Fertilizer Threaten U.S. Farms and Food Supply. http://www.purefood.org/Sludge/toxicFert.htm. Retrieved December 5,2000.

Quirk, Mark. 1997. So What's all the Stink About? *Foster's Daily Democrat*. June 10. New Hampshire.

Race, Michael. 1997(a). Debate Rages Over Sludge as a Fertilizer. Lebanon County, PA: *Lebanon Daily News*. December 14.

Race, Michael. 1997(b). Sludge Issues, Lebanon County, PA. *The Lebanon Daily News.* December 14.

Racey, P.K. 1991. Plain Talk – Putting the Risks of Land Application Into Perspective for the Public. *AWWA/WPCF Joint Residuals Management Conference "Residuals Management After 1991."* Durham, NC: American Water Works Association and Water Pollution Control

Federation. August 11-14. #**2, public acceptance, land application, community sensitivities.** Early discussion of BioGro's approach to public acceptance of land application, which was characterized by: (1) participation in the wastewater treatment industry and (2) concern for the sensitivities of the communities where projects are located. As a result of the community acceptance and outreach efforts described in this paper, BioGro received a 1990 U.S. EPA Special Award for the beneficial use of sludge.

Rachel's Environment & Health Weekly. 1997. Sewage Sludge, A New U.S. Waste Policy Emerges, Parts 1 and 2, August 21 and 28. **#1. Metals, chemicals, pathogens, many issues.** Significant critique of federal biosolids recycling policy.

Rachel's Environment & Health Weekly. 2000. June 22. Quotes from C. Daughton and C. Ternes: Pharmaceuticals and Personal Care Products [PPCPs] in the Environment: Agents of Subtle Change, in Environmental Health Perspectives, 107: 6, December 1999, 907-938. #**3. Chemicals.** Raises the issue of consumer product chemicals impacting the environment: "…almost nothing is known about their movement in the environment….The primary source for terrestrial exposure is probably from disposal of biosolids (sludge)….Theoretically, is sewage sludge applied to crop lands could be taken up by plants."

Rainey, M. 1998. Working Out Approval Of Biosolids Land Application. *BioCycle* 39(5):66-69. **#1, land application, odors, lack of public information, lack of trust in regulators, septage.** A thoughtful discussion of how local town leaders and citizens can be constructively involved in learning about, helping plan, and implementing biosolids land application programs. "Many people believe ownership of a septic system removes them from involvement in the biosolids controversy, but, if their septage goes to a POTW, they are contributors."

Rampton, S. 1998. Let Them Eat Nutri-cake: Merriam-Webster Thinks Our "Biosolids" Don't Stink. *Harper's Magazine* 297(1782):48. November. **#2. The words biosolids v. sludge.**

Randall, Tom. 2000. A Death in the Night, Yet EPA Maintains Breathing Dried Human Waste is Safe. *Environment News.* June. #**3. Concerned citizens, pathogens.** Shayne Conner, Greenland, NH death case.

Raver, Anne. 2001. A Land Rush for Compost in the City. *The New York Times*. June 17.

Raymond, Lyle, Ken Cobb and Clifford Scherer. (1993) Winning When You Have Lost: Cutting Your Losses with Host Community Benefits. Cornell University Waste Management Institute Fact Sheet #5. Reprinted in NYSBA Law Studies, Vol. XVIII, No. 2, Special Edition.

Ready, Carol and Dan Sturgill. 1993. Beyond a Public Meeting, the Evolution of the Boulder Park Project. *Entering a New Era*. Alderbrook, WA. Northwest Biosolids Management Association Annual Biosolids Management Conference. 18. #**1.** Discusses how the process of educating the farmers on biosolids applications was a great way for the public to see local sponsorship and support of these biosolids applications.

Reardon, David J. and Joseph G. Haworth. 1999. How to Give a Really Lousy Presentation: Part 2. Water Environment Federation: 72nd Annual Technical Conference and Exposition. **#1. Communications**. Recommendations for effective public speaking presentations by water quality professionals.

Reardon, Kate. 1998. Public Works Scientist Instrumental In Getting Word Into Dictionary. *The Herald*. July 25. #**2.** "Words imply different values. This (biosolids) is a totally different product (than sludge) that has gone through a natural process."

Reed, Chris. 2000. Kern Tiring of O.C. Sludge. *The Orange County Register, Sunday*. July 16. **#3. Liability.** History and development of Kern County biosolids ban. Discussing the estimated increase in cost of $3.20 per customer that would occur if Orange County, CA biosolids had to be trucked to Arizona or Nevada, a Kern farmer says 'We're billions of dollars at risk,…we don't think [$3.20 a year] is exorbitant.'"

Rembert, T.C. 1998. Strategic Retreat on Organics. *E Magazine: The Environmental Magazine* 9(4):27. July/August. #**4, organic foods market, land application, biosolids.**

Renn, Ortwin, Thomas Webler, and Branden B. Johnson, Summer 1991, "Public Participation in Hazard Management: The Use of Citizen Panels in the U.S." *RISK -- Issues in Health & Safety*, 197-226. **#1. Public participation.** Explains the citizen panel process and its theoretical underpinnings. The analytical methods of the case study are not clear, although it draws some interesting conclusions that are consistent with this line of risk communication. The panel design did not resolve conflicts about values or lead to citizen acceptance, although it did increase mutual understanding among government, stakeholders, citizens, and technical experts. Suggests that the issues of greatest concern to the citizens around the New Jersey site were less about health consequences or odor and most about the long term impact that sludge application would have on the viability of farming and the rural landscape of the town. The authors argue that, for citizen panels to work, they need variability of feasible options; an equitable burden-sharing arrangement; randomly selected citizens (in stark contrast to the use of representatives from interest groups perspective); citizens with personal experiences that lead to feeling confident about learning and discussing the issues; and an openness of the sponsoring agency to seriously consider the panel's recommendations.

Renn, Ortwin, Thomas Webler, and Peter Wiedemann. 1995. *Fairness and Competence in Citizen Participation: Evaluating Models for Environmental Discourse.* Boston: Kluwer Academic Publishers. **#1. Public participation, communication.** A comprehensive evaluation of a variety of currently-used models for involving the public in environmental public policy decision-making, including citizen advisory committees, planning cells, citizens juries, the Varresbecker Bach participatory process, regulatory negotiation, mediation, compensation and voluntary siting of noxious facilities, and Dutch study groups. Each model is discussed by an advocate and a critic. Based on a 1992 workshop in Morschach, Germany that addressed the questions "How can environmental policies be designed in a way that achieves both effective protection of nature and an adequate representation of public values? In other words, how can we make the environmental decision process competent and fair?"

ReSource Institute for Low Entropy Systems. 1998(a). Email correspondence about sludge between Jim Chisholm, chair of the Environmental Committee of the Canadian Union of Public Employees Loc. 79 and Laura Orlando, director of the ReSource Institute. April 1. http://www.riles.org/musings5.htm.

ReSource Institute for Low Entropy Systems, The. 1998(b). The EPA's Slight of Hand: Laundering Radioactive Sludge in Denver. August 28. http://www.enviroweb.org/issues/sludge/.

Resource Recycling Systems, Inc. 2000. *Biosolids Composting Overview*. One-page fact sheet.

Rich, Richard C., Michael Edelstein, William K. Hallman, and Abraham H. Wandersman, 1995, Citizen Participation and Empowerment: The Case of Local Environmental Hazards. *American Journal of Community Psychology*, 23(5):657-. **#2. Personal control, empowerment.** Environmental hazards carry threats of physical and financial harm, disruption of social networks, and loss of personal control, which in turn can fundamentally disempower individuals and communities since established mechanisms for collective action (local government, civic groups, etc.) are often unable to respond effectively to the threat. Empowerment is a mechanism by which people, organizations, and communities gain mastery over their affairs. Empowerment at the individual level (psychological empowerment) has three dimensions: 1) intrapersonal - perceived personal capacity to influence social and political systems; 2) interactional - knowledge and skills to master social and political systems; and 3) behavioral - actions that influence social and political systems. An empowered community is one that initiates efforts to improve the community, responds to threats to quality of life, and provides opportunities for citizen participation. An empowering organization facilitates confidence and competencies of individual members and empowered organizations influence their environment. Participating in decision making can be empowering or disempowering, depending on the nature and outcome of the experience. If governments fail to respond to citizens' concerns or use technical experts to discredit those concerns, citizens may feel abandoned by the one institution that was supposed to be under their control and protecting their interests. Paradoxically, all the conditions of disempowerment can be the seeds of empowerment, promoting an "enabling response." As a result of people's isolation from others in the community and the inability to rely on traditional institutions, they may develop a sense of common purpose among themselves and create new institutions specifically to meet the challenges. The communities response to local hazards is shaped by interaction of two broad factors: 1) community's capacity for responding to the problem, as determined by a combination of individual characteristics and social institutions; and 2) capacity of formal institutions for responding to citizens and involving them in decision making. Individuals and communities may be empowered or disempowered by the experience, regardless of whether or not the hazard is removed. Reactive empowerment (capacity acquired in response to a threat) is different from proactive empowerment that facilitates the pursuit of chosen and desired activities. There are four forms of empowerment; it is possible to achieve some forms without achieving the others and because different forms have very different implications for actual power relationships. All four forms are necessary for community empowerment. Formal empowerment is created when institutions (governments, businesses) provide mechanisms for the public to influence decisions which interact with the characteristics of the affected citizens and their social institutions in such a way as to create real opportunities for citizens to be involved in decision making. Intrapersonal empowerment is a feeling of personal competence in a given situation. Instrumental empowerment refers to the individual's actual capacity for participating in and influencing a decision making process, as determined by the interaction of such factors as relevant knowledge, material resources, and persuasive ability with formal opportunities and legal standing to participate. Substantive empowerment refers to the ability to reach decisions that solve problems or produce desired outcomes, and it requires that citizens and formal institutions work together to reach decisions.

Richardson, Carolyn. 2001. How To Build Strategic Collaborations, With the Residuals Issue As A Case Study. *WEF/AWWA/CWEA Joint Residuals and Biosolids Management Conference*. February 21.

Richert, E. 1999. Taking the Offensive Against Sprawl. *BioCycle* 40(11):66-67. #**3, urban sprawl, odors, land application.**

Riviere, Peter. 1997. Sludge Spreading Goes Well With No Odors. *The Caledonian-Record*. June 2. New Hampshire.

Robb, D.J. 1998(a). Compost shutdown awaits December 2, Richfield Township gets order for closure. *The Plain Dealer*, Metro section, p. 1B. November 5. Ohio.

Robb, D.J. 1998(b). Richfield Compost Firm Bids To Reopen. *The Plain Dealer,* Metro section, p. 1B. December 5. Ohio.

Rockefeller, Abby A. 1999. Civilization & Sludge: Notes on the History of the Management of Human Excreta. *Current World Leaders*, Vol. 39, No. 6. Also available at www.riles.org/paper1a.htm. **#2**. **Chemicals, metals, nutrients, risk, lack of trust. "**Some of the major environmental organizations--including the Environmental Defense Fund (EDF) and the National Resources Defense Council (NRDC)--struck a deal with the EPA, which agreed to shut down ocean dumping if they would join in promoting land application as the long-term solution to the disposition of sludge. Both EDF and NRDC were among the signers of the "consent decree," the legal document mandating land application in place of ocean dumping. To many in these organizations, this must have seemed a very good arrangement: in one fell swoop it ended a poisonous process (ocean dumping) and, it seemed, began a very good one. Wasn't this a promise to "recycle"? Wasn't it "sewage farming" at last? ….The claim that "biosolids" are beneficial is based on the presence in the sewage sludge of nutrients deriving from human excreta. But the benefit of this content compared to the dangers of the toxic matter in it is a key point in the debate about land application of sludge. It is the view of this writer that the menace of toxic and otherwise non-life-compatible substances that can be found in sludge so greatly outweigh the potential nutrient benefit as to make that potential benefit an irrelevance…. The real significance of all this--of the names and numbers, of the long list of "anecdotes" about human illness, about cows and horses dying after eating hay grown on sludge and of people who live next to agricultural lands to which sludge has been applied developing strange illnesses--lies in the unknowability of it all: what goes down the drains is unpredictable; what goes into the sewer--from hour to hour, from week to week, from month to month--is unpredictable; what is extracted from the wastewater can neither be predicted nor monitored to an extent even remotely adequate. And no system of regulations can be either designed or enforced in such a way as to protect life chains from the potential of devastation by the constituents of sludge."

Rocky Mountain Water Environment Association. *Recycling Completes the Cycle.* Videotape.

Rocky Mountain Water Environment Association. 1995. *Guide to Dealing With the Media.* **#1. Media, public participation, trust.** "The central question in any public policy debate is whether the public debate is maturing in a positive way and moving toward your position….Public policy is like concrete. It is very pliable as it is poured from the concrete truck into the form. Once it is in the form, it is still pliable within the walls of the form. Once it starts to set up, however, it is very difficult to move. After it has hardened, it is impossible to destroy except with a jackhammer, piece by piece. In many cases, a better solution is to pour new concrete on top of the old to correct a deficiency. Therefore, in many public policy debate in which you intend to influence the outcome, it is important to commit adequate resources in the early stages of the debate, for this is where the outcome is most flexible and can be most influenced. In some cases, the debate will continue for years (as in the case of biosolids public acceptance)…. Although you do not have complete control of the public debate, you do have control over the messages that are delivered and how they are delivered. The effective delivery of these messages is the primary topic of this training."

Rocky Mountain Water Environment Association. 1996. Biosolids Factsheets. RMWEA Biosolids Committee.Topics: Biosolids Benefits to Farmers, Rangeland Application, Soil Compaction Issues, Conservation Compliance, Agricultural Site Restrictions, Public Access

Restrictions, Liability Issues, Surface Water Contamination, pH Changes and Salinity Concerns, Using Biosolids Compost in a Home Environment, Will Biosolids Cause AIDS?, Biosolids versus Septage.

Rodgers, S. 1994. The Role of Local Government in Land Application of Biosolids Programs. In *The Management of Water and Wastewater Solids for the 21st Century: A Global Perspective*, Washington, D.C.: Water Environment Federation. 9-73–9-80. #**2, land application, local government, achieving public acceptance.**

Rodriguez, L. and J.W. Peterson. 1996. Sludge Under Suspicion: Explaining Perceptions of Risks from Relatively “Unknown” Technology. *Journal of Applied Communication*, 80: 12-25. **#1. Public perception, risk perception, risk communication.** A good example of a survey looking at many of the same interests and concepts as the survey conducted for this project, with similar findings. “Factors such as knowledge about the technology and trust in technology-generating institutions influenced people's decisions about the acceptability of applying treated sludge on Iowa's agricultural lands. Responding to a questionnaire mailed statewide, 700 respondents answered questions about three dimensions of acceptability of this practice: potential for individual use, potential for family use, and attitude toward a ban. Risk message characteristics, respondent's background, knowledge, and attitudes were tested as predictor variables through multiple regression. The findings provided support for normative/value types of decision making when it comes to less controversial, poorly understood risk topics such as sludge application in farms. Although knowledge of the topic correlated with support for the technology, trust factors were more powerful predictors. These results suggested that effective risk communication may be more a problem of ensuring trust than it is an issue of explaining risk/benefit analysis in lay terms. History of safe use and industry/regulator integrity were likely to impress the nonexpert far more than improved technical presentations.”

Ropeik, David and George Gray. 2002. Risk. Harvard Center for Risk Analysis. **#3. Risk perception, risk management**. Presents statistical and scientific risk analysis of commonly perceived risks.

Rosenbaum, Walter. 1983. The Politics of Public Participation in Hazardous Waste Management. *The Politics of Hazardous Waste Management*, Duke University Press, Durham, NC. **#3: risk perception, risk management, public acceptance, public participation.** Citizen groups have increasingly gained access to the public decision making process around hazardous waste management issues, often by utilizing funds provided by USEPA’s “Toxic Substances Control Act.” Funding direct public participation was considered a reasonable manner of giving “equal time” to arguments made by citizen groups that were outspent and ostensibly overrun by technical arguments. The author traces the evolution of hazardous waste policies in light of increased citizen involvement. He observes that the venue for conflict and direct participation is now moving toward the state level, with the possibility that state agencies may be frozen and immobilized by the onslaught of an aroused and possibly ignorant public that demands government action inconsistent with sound technical handling of hazardous waste issues. The author advocates creation of many different opportunities for citizen participation in crucial phases in hazardous waste policy formulation.

Rosenfeld, Paul. 2000. The Answer is Blowing in the Wind: Options for Odor Control. *Storms on the Horizon*. Ocean Shores, WA. Northwest Biosolids Management Association 11th Annual Biosolids Management Conference. #**2. Odor.** "Perception very often defines public acceptance and for biosolids, perception is often directly related to what we smell instead of what we read or see or hear."

Ross & Associates Environmental Consulting. 2000. *Recommendation to the National Biosolids Partnership on a Biosolids EMS Third Party Verification Program*. Alexandria, VA: National Biosolids Partnership.

Rowe, G. and L.J. Frewer. 2000. Public Participation Methods: A Framework for Evaluation. *Science, Technology & Human Values*, 25(1), 3-29. **#1: risk evaluation, public acceptance, risk understanding.** There are a variety of public participation models that aim to consult and involve the public, ranging from the public hearing to the consensus conference. Because of the lack of appropriate benchmarks for evaluation, there is a general lack of empirical data on the quality of these methods. Authors suggest a number of theoretical evaluation criteria essential for effective public participation. They are of two types: acceptance criteria (representativeness, independence, early involvement, influence, transparency), which concern features of a method that make it acceptable to the wider public, and process criteria (resource accessibility, task definition, structured decision making, cost-effectiveness), which concern features of the process that are liable to ensure that it takes place in an effective manner. Authors express need for more research into these criteria and their applicability to the public participation models, the effectiveness of which are significantly influenced by contextual and environmental factors.

Rubens, Jim. 2000. NH Sludge Regulations Are Lax. *Valley News,* August 16. **#4 Class A, class B, groundwater, opposed.**

Rubin, Dr. Alan B. 1998. Statement before the Kern County Biosolids Ordinance Advisory Committee in Bakersfield California. December 1. #**2. Lack of trust. Urbanization.**

Rynk, R., M. van de Kamp, G.B. Willson, M.E. Singley, T.L. Richard, J.J. Kolega, F.R. Gouin, L. Laliberty, Jr., D. Kay, D.W. Murphy, H.A.J. Hoitink, and W.F. Brinton. 1992. *On-farm Composting Handbook*. Ithaca, NY: Northeast Regional Agricultural Engineering Service. **#3, composting issues (nutrient management, odor control), benefits.**

Rynk, Robert. 2000. Fires At Composting Facilities: Cause and Conditions, Part 1. *BioCycle*. 41(1): 54-58. January.

Sacramento Regional Wastewater Treatment Plant - Biosolids Program. *Biosolids Kids News.* **#2.** Creating a fun way of teaching kids about biosolids with games and language they can relate to.

Sacramento Regional Wastewater Treatment Plant - Biosolids Program. 1999. Biosolids Fact Sheets. #**1.** Likely the most thorough set of informational fact sheets covering various concerns/issues with biosolids (26 fact sheets).

Sacramento Superior Court. 2001. Sacramento Superior Court WRIT: Central Delta Water Agency, et. al. vs. State Water Resources Control Board. July 20.

Safesoil.com. 2000(a). 2K Interview with Carl Lindstrom. http://www.safesoil.com/iview.htm.

Safesoil.com. 2000(b). Sludge on Farmland Case Studies. http://safesoil.com/case.htm.

Safesoil.com. 2000(c). Threats to Sustainable Agriculture Through Agro-sludging. http://safesoil.com/.

Sahagun, Louis. 2001. Plan Would Bury Sewage Deep Below L.A. Harbor. *Los Angelos Times*. September 12.

Sala, Luis; Carlos Nieto; Francesca Camps, and; Joseph Maria Pages. 1998. Building biosolids acceptance. *BioCycle*, Vol. 39, Issue 6, p. 80.

Sandman, P. M. 1987(a). Communicating Risks: Some Basics. *Health and Environment Digest,* Vol. 1, No. 11, 3-4.

Sandman, P. M. 1987(b). Risk Communication: Facing Public Outrage. *EPA Journal*, Vol. 13, No. 9, 21-22.

Sandman, P.M., P.M. Miller, B.B. Johnson, and N.D. Weinstein. 1993. Agency Communication, Community Outrage, and Perception of Risk: Three Simulation Experiments. *Risk Analysis*, 13(6), 585-97**. #1: risk communication, risk perception, public acceptance, hazards, outrage.** Three studies were conducted with hypothetical news stories to compare the effects on reader risk perceptions of two situations: when agency communication behavior was reported to be responsive to citizens' risk concerns versus when the agency was reported to be unresponsive. In the first two experiments, news stories of public meetings filled with distrust and controversy led to a greater perceived risk than news stories reporting no distrust or controversy, even though the risk information was held constant. This effect appeared clearly when the differences in meeting tone were extreme and subjects made their rating on the basis of recall, but it was much weaker when the differences were more moderate and subjects were able to go back over the news stories to separate risk information from conflict information. In a third experiment, news stories about the cleanup of a spill varied the seriousness of the spill, the amount of technical information in the story, and the agency behavior and resulting community outrage. The outrage manipulation significantly affected both affective and cognitive components of perceived risk, but not hypothetical behavioral intentions. Seriousness and technical detail had very little effect on the perception of risk.

Sandman, P. M. 2000. Dealing With Outrage: A Key Communication Tool for Biosolids Professionals, Handbook. Workshop at *14th Annual Residuals and Biosolids Management Specialty Conference.* Water Environment Federation.

Sandman, Peter M.: www.psandman.com

Sarber, K. 1994. How to Strategize for Successful Project Development. *BioCycle* 35(4):32-35. **#1, land application, facility siting, public education, environmental campaign.** The strategies used for influencing voter support in political campaigns are increasingly being adapted by specialized professionals in developing environmental projects. Environmental campaign professionals approach project development with the same sensitivities to the media, the public, and the political dynamics as do their political consultant counterparts. Political campaign techniques that can be used for developing biosolids or recycling projects include public polling and tracking information, demographic identification, direct mail and video outreach, media imaging and shaping, grassroots coalition building, press crisis management, and a cadre of other activities. Specialized environmental campaigns are characterized by these types of proactive positioning tactics and are meant to create positive momentum for a project. These types of campaigns can overcome predictable obstacles to project sitings as seen in the recent successes of out-of-state biosolids land application programs and the siting of a pelletization facility in an urban setting.

Sasser, Larry. 1993. Exceptional Quality Biosolids: The Key to Public Acceptance. *Entering a New Era*. Alderbrook, WA. Northwest Biosolids Management Association Annual Biosolids Management Conference. 12. **#1. Biosolids quality.** This paper discusses shifting to Exceptional Quality for biosolids acceptance. "If the practice of beneficial use of biosolids by land application is to find sufficient public and elected official acceptance to allow siting in some difficult situations, it may be necessary to change the character of the material being applied."

Scharp, Michael. 2000. Why Colorado Farmers Want New York City Biosolids. *BioCycle*. July, 71-80. **#1.** "Ultimately, it's the performance of the biosolids that builds the end user demand….Getting to that point requires a high quality product delivered by a program that covers all the bases."

Scharp, Michael. 2001. The Nuts and Bolts of a Successful Land Application Project: NYC Biosolids in Colorado. WEF Joint Residuals and Biosolids Management Conference, San Diego, CA.

Schecter, M.T.; Spitzer, W.O. and Hutcheon, M.E. 1989. Cancer Downwind From Sour Gas Refineries: The Perception and the Reality. *Environmental Health Perspectives*, 79: 283-290.

Scherer, Clifford W. and Napoleon K. Juanillo Jr. (1990). Public Opinion About Proposed Host Community Benefits. Presented at the First United States Conference on Municipal Solid Waste Management; Solutions for the 90s sponsored by the U.S. Environmental Protection Agency, Washington, D.C., June 13-16.

Scherer, Clifford, W. 1991. Groundwater and Public Policy: Communicating Water Quality Risk Issues to the Public. A PA Soil and Water Conservation Society, Groundwater and Public Policy Series leaflet. http://hermes.ecn.purdue.edu/cgi/convwqtest?wq-17.pa.ascii. Follows the principles of Sandman, discussing levels of public outrage with regard to different imaginary events with potential impacts on groundwater quality. Notes the impact of public participation in decision-making and degree and quality of information shared. . "The best evidence we have does suggest the direction for long-term success: An open, informed, democratic process of decision-making, while more cumbersome than closed, expert decision-making, will be most likely to succeed inn designing effective policies that citizens will support to meet the emerging problems of groundwater protection."

Scherer, Clifford W. 1992(a). Communicating Water Quality Risk Issues to the Public. No. 17 Groundwater and Public Policy Series, Groundwater Policy Education Project funded by W.K. Kellogg Foundation in cooperation with the Farm Foundation; Cooperative Extension, Soil and Water Conservation Society and the Freshwater Foundation. **#3. Communications.**

Scherer, Clifford W. 1992(b). The Proposed Van Buren Landfill: A study of public concern and opinion. Final Report, Department of Communication, Cornell University, Ithaca, New York.

Scherer, Clifford W. 1993(a). Communication, Scientific Risk and Public Decision-Making. Proceedings from the National Extension Compost Utilization Conference, Minneapolis, Minnesota.

Scherer, Clifford W. 1993(b). *Public Participation: Risk and Waste Management*. National Extension Compost Utilization Conference, Minneapolis, MN**. #2: risk perception, public acceptance, risk understanding.** Despite generalized public acceptance of recycling MSW and composting of organic wastes, there is significant site-specific opposition to landfilling and composting facilities. Decision-making strategies include: 1. Technically-based processes, 2. Public relations approaches, 3. Community participation approaches. The author argues for a broader basis of community participation in the analysis and resolution of siting issues, with direct public participation from the outset.

Scherer, Clifford W. 1998. Communication, Scientific Information and Risk Management--A Case Study. Cornell University, Community and Rural Development (CaRDI). As described in the CaRDI newsletter, Fall 1998, see http://www.cardi.cornell.edu/news/newsletter/1998fall.cfm): "Clifford Scherer, Associate Professor in the Department of Communication at Cornell, examined how elected leaders received information on which to base their decisions, and the extent to which this information relied on science. Scherer found that there was only limited misinformation about the technical issues. Rather than misinformation, the problem was more one of the community's limited access to multiple perspectives. Although elected leaders perceived that there was a high volume of science-based information, that volume represented a recycling of limited information from a limited number of sources. Communities facing environmental risk situations, Scherer concludes, clearly need to concentrate on bringing quality scientific and technical information into the public information arena. This will help communities avoid, or have a satisfactory resolution of, controversies."

Scherer, Clifford. 1999. Communication, Scientific Information and Risk Management: A Case Study. From Community Development Reports, Cornell Community and Rural Development Institute, 6(3), Winter.

Schiffman, Susan S., J.M. Walker, P. Dalton, T. S. Long, J. H. Raymer, D. Schusterman, and C. M. Williams. 2000. Potential Health Effects of Odor from Animal Operations, Wastewater Treatment, and Recycling of Byproducts. *Journal of Agromedicine,* 7 (1). **#3. Odors, health effects.** A paper that touched off considerable discussion due to its implication that malodors may cause health effects.

Scholler, D.C., and T. Battenfield. 1999. Public Acceptance a Key Part of a Successful Biosolids Reuse Program. In *WEF/AWWA Joint Residuals and Biosolids Management Conference: Strategic Networking for the 21st Century Conference Proceedings*, Charlotte, NC: WEF/AWWA. January 27-30. #**1, application of end product, educating public/become aware of product.** Public opinion and public acceptance can limit the success of a biosolids reuse program. The public must understand the value of biosolids and feel comfortable with the reuse of biosolids. The City of Houston operates a uniquely challenging biosolids management program due to the size and magnitude of its utility system. The City owns and operates 50 wastewater treatment facilities located throughout the City in a large geographical area. The service area contains over 105,221 hectares (260,000 acres) that includes a customer base of over 1.7 million citizens. The City's treatment plants together treat an average of 946,000 cubic meters per day (250 million gallons per day) of wastewater. From this flow, an average of 163 dry metric tons per day (180 dry tons per day) of biosolids are produced. Based on this complex and dispersed network of treatment plants, the City of Houston has developed an effective, award-winning, regional approach to processing and beneficial reuse of biosolids. Building on this regional framework, the City has developed a beneficial use program that features two alternate disposal pathways – distribution and marketing of heat-dried material and land application of lime stabilized or aerobically digested material. The City of Houston beneficially reuses almost 99 percent of the biosolids that are produced, and public acceptance plays a key role in the success of its program. The City has actively worked to promote biosolids and to improve public acceptance. Its efforts have included a utility bill insert, a public service informational video, a public service announcement for radio broadcast, a public service announcement for television broadcast, and participation in local lawn and garden trade shows. The City also has produced an informational video for presentation to civic associations, schools, garden clubs, etc. This proactive effort by the City of Houston has contributed to the success of its biosolids reuse program. "A number of key pathways to successful marketing in Texas have been identified. Critical elements include education of the end user, focus on biosolids as a recycled product, technical knowledge of market needs, consistent product quality, and organizational flexibility. Farmers are generally not aware of the benefits of using biosolids, but are very familiar and accept chemical fertilizers as a part of their operations."

Science and Health Network. 1998 “The Precautionary Principle--A Common Sense Way to Protect Public Health and the Environment,” Windsor, ND. **#2. Philosophical difference. Politics.** This principle represents an important conceptual framework within which many environmental groups are working; it places the burden of proof for the safety and benefit of any human action on the proponent of the action. This principle is cited as part of the underlying philosophy for lower biosolids trace metals limits within the European Community.

Scruton, D. 1991. Memorandum to George Dunsmore, Commissioner of Agriculture regarding “Ruane Farm, No. Clarendon, VT.” Vermont Department of Agriculture. June 27.

Seattle Times. 1997. Here Are Answers About Practice of Recycling Wastes. *The Seattle Times.* July 20.

Seif, James M. (DEP Secretary). 2000. Report on the Investigation into the Application of Biosolids at the Al Hamilton Mountain Top Mine Site and the Death of Tony Behun, Bureau of Investigations, Pennsylvania Department of Environmental Protection. Available on the PA DEP web site.

Sellew, Paul and Lorrie Loder. 2001. Composting and Public Acceptance. Water Environment Federation, Specialty Conference Paper.

Sewage Sludge Homepage. 2000. Sludge on Your Supper Table. http://www.enviroweb.org/issues/sludge/ **#3. Concerned citizens, metals.** Concern about Toronto biosolids recycling program.

Shaheen, Jeanne. 2000. A Proclamation: Biosolids Recycling Day, May 16, 2000. Concord, NH.

Shields, Helane. 1997. Shields Urges Voters to Petition for Articles to Ban the Use of Sludge to be Placed on Town Warrants. *Granite State News*, January 22. **#3. Concerned citizens, metals, land application.** Many claims about problems with "sludge." Effort for local bans.

Shields, Helane. 1998. Sludge on Farmland Case Studies. www.websida.com/danger/case.htm. January. **#3, silage from land-applied biosolids on farms, concerned citizen.**

Shimp, Gary F., Blake Childress, Mike Sweeney, Saeed Assef, and Derel Guthrie. 2002. A Solid Finish. *Water Environment & Technology*, February, pp. 40-48.

Shiralipour, A., and J. Zachary. 1993. *Compost Market Development: A Literature Review*. Prepared for the Santa Barbara County Solid Waste Management Division and the California Integrated Waste Management Board. October. #**4, composting, marketability.**

Sierra Club, Hawaii Chapter. 2000. Sewage Sludge Policy Statement. http://www.sierraclub.org/chapters/hi/info/policy/sludge.htm #**2. Concerned citizens.** "It shall be the policy of the Sierra Club, Hawaii Chapter, to seek an end to the disposal of toxic substances into sewage systems. Until that time, we oppose sewage sludge composting and the use of sewage sludge products as fertilizers and soil amendments."

Sierra Club, New Hampshire Chapter. 1999. Sewage Sludge in New Hampshire: Questions and Answers. Concord, NH: NH Sierra Club. **#3. Chemicals, pathogens, lack of enforcement/oversight, concerned citizens.** A two-page sheet that outlines the concerns in NH. "There are hundreds of sludge victims nationwide. People and livestock have been harmed, drinking water has been contaminated, land rendered unusable. Most of these cases are not 'documented' because of out of court settlements, because federal and state agencies often ignore complaints, or because complaints are not investigated adequately."

Sierra Club, New Hampshire Chapter. 2000. *Policy Driven Water Pollution: The Dangers of Using Sludge to Reclaim Gravel Pits in New Hampshire.* Concord, NH: Sierra Club/NH. **#3.**

Groundwater, opposed, nitrates, metals, chemicals, pathogens. "Cases are beginning to be documented of polluted wells, contaminated soil, damage and death to livestock, illness among wastewater treatment plant workers, and illness among people who have been exposed to sludge. There have been at least two deaths that have been linked to sludge spreading" (references Cherry, above). ""Federal sludge regulations are not scientifically defensible….Sierra Club vs. NEBRA on gravel pit sludging….Using sewage sludge and industrial paper mill sludge to reclaim New Hampshire gravel pits can not be defended on scientific grounds."

Sierra Club, Pennsylvania Chapter. 2000(a). Sewage Sludge Hits the Fan in Centre County, A Public Letter from Len Martin and PAPS: People Against Power Sludge. http://pennsylvania.sierraclub.org/ moshannon/fctryfrm.htm. 2000. **#2**. **Concerned citizens. Metals, chemicals, pathogens.** A long and thorough list of concerns about sludge use.

Sierra Club, Pennsylvania Chapter. 2000(b). Statement regarding *E. coli* contamination from manure at Walkerton, Ontario. http://pennsylvania.sierraclub.org/moshannon/fctryfrm.htm. **#4. Manure, bad management.** Biosolids were initially targeted for blame for these unfortunate deaths.

Sierra Club. 2001. EPA Sewage Sludge Rules Do Not Protect Health and the Environment- How Can You Learn More and Help? Sierra Club. March.

Sierra Club. 2002(a). National Sewage Sludge Guidance. Circulated by email delivery; copy available from NEBRA or at http://www.sierraclub.org

Sierra Club. 2002(b). News Release: Sierra Club Asks EPA to Protect Communities From Toxic Sewage Sludge. July 3.

Similkameen Spotlight, The. 1992. Novel Use of Treated Wastewater Sludge Proposed To Help Reclaim Nearby Mine Sites And Promote Plant Growth On Rangeland. September 9. #**2. Nutrients. Land application. Education. University involvement.** Research findings from the University of B.C. were utilized in communicating benefits of biosolids.

Similkameen Spotlight, The. 1997. Green Grass Attracts Cattle. June 11. **#3. Appearance. Wildlife impacts. Land application. Education.** Biosolids not mentioned in article, but is referring to the development in Princeton. Ironic that they now have a cattle issue.

Similkameen Spotlight, The. 1998(a). GVRD Reports Progress on Mine Reclamations. April 22. **#2. Dust. Nitrogen. Nutrients. Land application. Education. Media campaign.** *Similkameen Spotlight, The.* 1998(b). Symposium Showcased Princeton Project. September 22. **#2. Dust. Land application. Politics. Regulatory Climate.** Former regulatory inspector expressed his pleasure in the results of the project and all attendees at the Mine Reclamation Symposium were equally impressed.

Similkameen Spotlight, The. 1998(b). Mine reclamation projects on display as part of symposium. September 23. **#3. Dust. Land application. Education. Media campaign.** Media and demonstration areas were used as way to spread the news about the beneficial use of biosolids recycling.

Similkameen Spotlight, The. 2000. Mayer Inspects GVRD Project. October 17. **#3. Odor. Dust. Appearance. Land application. Education.** Discusses concerns about odor, but project managers made one-on-one efforts to address concerns (even delivered roses to local residents).

Simpson, T. W., S. M. Nagle, and G. D. McCart. 1984. Agricultural Use of Sewage Sludge: Questions & Answers. Virginia Tech pamphlet.

Singer, Eleanor and Phyllis M. Endreny. 2000? (retrieved from website 2003). Reporting on Risk: How the Mass Media Portray Accidents, Diseases, Disasters, and Other Hazards. Available at http://www.fplc.edu/risk/vol5/summer/singer.htm **#2. Media, risk perception.**

Singer, Raymond. 1999. Neurotoxicity from Municipal Sewage Sludge. http://members.aol.com/neurosite/sewage.htm.

Singer, Raymond. 2000?. Neurotoxicity from Municipal Sewage Sludge. An unusual article by a doctor that is cited by some opposed to biosolids.

Sjoberg, L. 2000) Factors in Risk Perception. *Risk Analysis*, 20(1), 1-11. **#2: risk perception, public acceptance, cultural theory, psychometric analysis.** Researchers have generated a number of models to explain public perception of risk, particularly as they relate to perceived risks of nuclear power, but none has taken hold as authoritative. There are, however, some generalized observations that can be made regarding public risk perception. Technical risk estimates are sometimes a factor in accounting for perceived risk, but in many important applications it is not. Heuristics (representativeness, availability, and anchoring) and biases account for only a minor portion of risk perception, and the influence of media are apparently not as significant in risk perception as had been believed. The psychometric model is widely supported, but explains only about 20% of variance in the data. Cultural theory (i.e. risk perception relates to generalized ideology) explains only 5-10% of the variance of perceived risk, and other value scales have also failed to explain the variance. The author proposes a model in which attitude, risk sensitivity, and specific fear are the variables, and which account for 30-40% of the variance. This model offers a different approach to the relationship between attitude and perceived risk.

Slovic, Paul; Baruch Fischhoff; and Sarah Lictenstein. 1980. Facts and Fears: Understanding Perceived Risk. In Richard C. Schwing and Walter A. Albbers Jr. (eds.) *Societal Risk Assessment: How Safe is Safe Enough?* New York: Plenum, 181-216.

Slovic, P., B. Fischhoff and S. Lichtenstein. 1990. Rating the Risks. *Environment*, 31, 5-20, 36-40.

Slovic, P. and Layman, M. 1991. Risk Perception , Trust and Nuclear Waste: Lessons from Yucca Mountain, *Environment*, 33(3), 6-9. **#1: risk perception, trust, nuclear waste, radiation, siting.** Reports that public fear of nuclear power has become a major obstacle to the US government's search for a suitable site for storing radioactive waste. Describes how the results of four recent surveys of public perceptions of the risks from nuclear waste storage may help industry officials understand and resolve the current impasse. The author states that industrialists, scientists, politicians, and the public are united only in their anger and frustration over the ways that environmental risks are currently managed. He then posits a generalized notion that nuclear power advocates can overcome public resistance only when they overcome public mistrust of technology, without stating how that may be accomplished. Without much data to support this notion, the author recommends “aggressive and competent government regulation, coupled with increased public involvement in the decision making process”.

Slovic, P. 1993. Perceived Risk, Trust, and Democracy: A Systems Perspective. *Risk Analysis*, 13, 675-682. **#2: risk perception, trust, environmental justice, fairness.** People are generally disturbed by uncertainty, and there is a tendency for non-technical individuals to perceive science and technology as fixed and certain. Therefore, the suggestion that risk assessment does not identify a fixed and immutable numerical expression of risk is very unsettling to the public. Descriptions of uncertainty in risk estimates may undercut any illusion of safety and may confuse people or even cause outrage.

Slovic, P. 1999. Trust, Emotion, Sex, Politics, and Science: Surveying the Risk-Assessment Battlefield. *Risk Analysis*, Vol. 19, #4. **#1. Risk perception, risk assessment, risk communication.** An important critique of the limitations of risk assessment and the need for stakeholder involvement in the risk assessment process.

Sludge on Farmland Case Studies. http://www.safesoil.com/case.htm, retrieved December 5, 2000.

Sludge. 1995. Washington Coalition Uses Education to Achieve Approval for Reuse Project. Vol. 20 Number 13. June 20. #**2. Safety. Land application. Concerned citizen involvement. Facility siting.** "The county worked through private citizens to introduce biosolids in eastern Washington. Instead of a group of governmental officials trying to convince the public of biosolids safety, individuals and firms from within communities explained the projects."

Sludge. 2000(a). California OKs Land Application Rules that are More Time and Cost Efficient. 25(18):175. **#3, land application, health effects, lower property values.** California's State Water Resources Control Board (SWRCB) adopted requirements August 17th for biosolid land application that will be more time- and cost-efficient and more environmentally restrictive than federal regulations, according to board staff.

Sludge. 2000(b). New Jersey Company Gets Approval to Apply Biosolids in Pennsylvania. 25(21):210. **#3, land application, suspicious citizens, contact list, heavy metals, odors.** A New Jersey business that spreads sludge onto farmland is hoping to fulfill its plans to apply its biosolids in Pennsylvania later this month. But many citizens and community leaders in western Pennsylvania are trying to prevent the application in the long term or at least regulate it more stringently.

Sludge. 2000(c). Judge Allows California County Ban On Application of Biosolids on Farms. 25(25), 242. Business Publishers, Inc. **#3.** Kern County.

Sludge. 2000(d). The Internet is Fueling the Debate. 25(8), 171. Business Publishers, Inc. **#3. Media, communications.** "While the ADA says there shouldn't be any dispute about flouridation, those opposing flouridation have been using the Web to put out their views."

Sludge. 2001(a). EPA Supports Management Programs to Help Meet Biosolids Regulations. Silver Spring, MD: Business Publisher's, Inc., 26(13):122, June 25.

Sludge. 2001(b). The Good and the Bad. Silver Spring, MD: Business Publisher's, Inc., 26(13):121. June 25.

Sludge. 2001(c). California Decisions Causing Changes to Biosolids' Generators, Haulers. Silver Spring, MD: Business Publisher's, Inc., 26(14):132. July 9.

Sludge. 2002. EPA Inspector Report Does Little to Settle Biosolids Disputes. Silver Spring, MD: Business Publisher's, Inc., 40(7):68. April 8.

Smith, Bill. 1991. Indians Threaten Blockade To Stop Sludge Dumping. *Victoria Times Colonist.* February 20. **#2. Odor. Land application. Local ban. Lack of trust. Education.** Native Indians felt betrayed that land application of biosolids made in their territory. "Another example of the white man putting his smelly burden on land housing native Indians."

Smith, C.T. and J.M. Carnus. 1997. Biosolids: Planning and Design. *The Forest Alternative.* Seattle, WA. Northwest Biosolids Management Association, University of Washington

College of Forest Resources, United States Environmental Protection Agency, and Georgia Department of Natural Resources. #**3. Urbanization.**

Smith, Gail. 1991. Sludge Seeks More Savory Image. *The Charlotte Observer.* April 17.

Smith-Heavenrich, Sue. 1998. Effects of Sludge on Crops and Livestock. *New England Country Folks,* February 23. **#3. Metals, pathogens,**

Smyth, J.R. 1994. Operation of a Privatized Solids Drying Facility at a Sensitive Site. In *Proceedings of the Water Environment Federation 67th Annual Conference & Exposition, WEFTEC '94,* Chicago, IL: Water Environment Federation. October 15-19. 609-620. #**2, odor, dust, affected neighbors.** The King County Department of Metropolitan Services (Metro) has entered into two contracts with a private vendor (PCL/SMI) for the construction and operation of municipal wastewater solids drying facilities. The first of these facilities has been successfully processing digested solids using indirect dryers at an off-site location since May 1993. The facility is currently drying and beneficially reusing an average of 18 to 23 dry metric tons (20 to 25 dry short tons) of digested solids per day. This paper discusses lessons learned from startup and operation of the off-site solids processing facility with a focus on mechanical and operational modifications implemented to minimize or eliminate impacts on the surrounding community. The facility suffered through an extended startup period characterized by equipment failures, odor production, and concerns regarding air emissions. However, by working with the community, developing a new contract that enabled the contractor to operate at a reduced capacity, and persistent effort and capital investment by the private contractor, the problems were effectively addressed. The facility now operates at 82.5 percent of the original design capacity with minimal impact on the adjacent community. Performance tests to further increase the contract capacity are anticipated. A 95 percent solids "Class A" granular product is produced and markets are being developed for use as a soil amendment.

Snyder, David, and Frederick Kunkle. 2001. Health Fears Over Sludge Spur Quest for Controls: EPA Stand Challenged After Suspicious Deaths. *Washington Post.* B01. August 6.

Social Issues Research Centre, in partnership with the Royal Society and the Royal Institution of Great Britain. 2001. *Guidelines on Science and Health Communication*. November, pp. 1-8**. #1. Fairness, communications, media relations.** An excellent guidance document explaining the roles and responsibilities of media/reporters and those providing information to the media (e.g. plant managers, biosolids managers).

Solomon, John. (a). EPA Cites Sludge Recycling Concerns. *The Burlington Free Press,* February 7.

Solomon, John. 2002(b). Internal Probe Cites EPA for Lack of Research. *The Union Leader.* February 7.

Sorber, Charles A. 1994. Biosolids: A Blueprint for Public Acceptance. In *Biosolids Public Acceptance-Digest,* Alexandria, VA: Water Environment Federation. 15-17. #2. Describes the Water Environment Federation/Powell-Tate plan for education and outreach regarding biosolids recycling. "It has been said that it takes 20 years to make an overnight success. Public acceptance of biosolids won't happen overnight, but it won't take 20 years, either. What it does require is sustained commitment…."

Stamp-Vincent, F.A. and M.J. 1999. Give us analysis. *The Keremeos Review*. April. **#2. Groundwater. Surface water. Class A. Class B. Local soils/climate/natural conditions. Education.** Presented concerns, but also thanked Braman for providing answers.

Stark, S.A. 1993. Building Acceptance. *BioCycle*. 34(4):78-80. #2, important concept, land application, increasing public knowledge.

Stauber, John and S. Rampton. 1995. *Toxic Sludge is Good For You*. Monroe, ME: Common Courage Press. **#1. Lack of trust, concerned citizens, politics, public relations.** A classic "exposé" of the public relations industry, including a chapter on the topic of the book's title: biosolids recycling. Critiques the Powell-Tate/Water Environment Federation efforts to improve public acceptance of biosolids (see Powell-Tate, above). Commonly cited and quoted (e.g. see Bleifuss, above).

Staudinger, Henry J. 1999. Land Application of Sludge (Biosolids), The Uncensored Story. A presentation to the Water Environment Federation seminar, Richmond, VA, November 4. http://www.safer-world.org/e/topics/sludge.htm . **#3 Concerned citizens, land application, lack of oversight/enforcement, liability, odors.** "I have been asked to address citizen concerns related to land application of sludge, and to focus on more than just the odor issue. My comments are based on personal experience, experiences of other victims, review of thousands of pages of scientific and permit documents, meeting with numerous experts, and unsuccessful efforts to interest the regulatory community to better address demonstrated sludge risks….Current permit policies and practices in Virginia are totally inadequate to protect public health and water quality where sludge is land applied.

Stevens, Jane E. 1998. Sludge-fest, Scientists Exchange Verbal Blows Over Risks of Recycled Sewage. *The Dallas Morning News*. March 23. **#1, biosolids safety, deals with both sides of issue.** One of the best popular press treatments of biosolids recycling concerns and responses to those concerns. It begins "at a major scientific meeting at which a shouting match erupted between Cornell University scientists and people in the business of selling biosolids – treated municipal sewage familiarly known as sludge. But the issue – raised during a gathering in Philadelphia of the American Association for the Advancement of Science – was not a debate between scientists expounding the truth and greedy businesses concerned with profits, as it appeared on the surface. The simmering disagreement recently erupted to involve the entire community of researchers who have been working for the past 25 years to find a safe way to enrich and replenish soils by recycling human byproducts."

Stier, Jeff. 2000. Facts Versus Fears: How Science Does or Does Not Influence Public Opinion and Policy. *14th Annual Residuals and Biosolids Management Conference.* Water Environment Federation.

Stoddard, Carolyn L. 2001. Hill Man Hopes to be the First to Obtain Biosolids Under New Rules. *The Telegram*, 12(34), June 7-13. New Hampshire.

Stowe, Gene. 1987(a). Mecklenburg Sludge Not Welcome, Union County Board Informs State. *The Charlotte Observer.* August 4.

Stowe, Gene. 1987(b). Union County to Consider Taking Sludge. *The Charlotte Observer.* July 31.

Stowe, Gene. 1988. Union County to Air Plan for Sludge. *The Charlotte Observer.* February 16.

Stowe, Gene. 1989. The Ever-Arguing Monroe, Charlotte-Mecklenberg, and Union County Governments Have Found Some Common Ground. *The Union Observer.* March 26.

Stowe, Stacey. 1999. Dealing With Odor From Plant. *New York Times, Connecticut Weekly,* December 12, 1999. **#4.** Reports on the fire that destroyed the Hartford, CT biosolids composting facility.

Student Environmental Action Coalition. 1999. Letter to the Editor: Lowry Landfill. University of Colorado, Boulder. http://ucsu.colorado.edu/~seac/index2.html.

Stukenberg, J.R., S. Carr, L.W. Jacobs, and S. B. 1993. *Final Report, Document Long-term Experience of Biosolids Land Application Programs*. Water Environment Research Foundation, Project 91-ISP-4. #**2.** Ten successful, long-term, biosolids reuse programs were evaluated. The programs ranged from agricultural to dedicated sites. Both of the dedicated sites [SMSD (Springfield, IL) and Albuquerque, NM] owned the land used. Some of these programs use their own land [HRSD (Virginia Beach, VA); Ag-Tech (Yuma, AZ); Raleigh, NC; and MWRDGC (Chicago, IL)], while others rely on private farmland [Port Huron, MI; MWRD (Denver, CO); Sparks, NV; and MMSD (Madison, WI)]. Most of the programs using only private farmland have considered the purchase of land for application purposes. In fact, the MWRD (Denver, CO) purchased 10,000 acres following the project team's site evaluation visit. The MWRD plans to use the land for application manage the entire program, including the farming. Typically, the biosolids generated by these publicly owned treatment works (POTWs) had metal concentrations below those specified as the Pollutant Concentrations in the 40 CFR Part 503 regulations. (Note: MWRDGC data evaluated in this study were above these limits, but the MWRDGC recently reported that metals concentrations have been reduced to below the limits through increased enforcement of pretreatment standards.) The trace element concentrations in the biosolids have shown a decreasing trend at all of the sites. Sampling protocols and analytical methodology varied among and within programs. The intensity of sampling and the number of parameters monitored varied widely. Differences in analytical procedures and laboratories used to make it difficult to compare different programs against one another as well as test results from earlier samples with more recent test results. Increased nitrate concentrations could be detected in groundwater near some biosolids application sites in humid climates. At SMSD (Springfield, IL) and Raleigh, NC, this appeared to be related to the unusually high biosolids applications, but at HRSD (Virginia Beach, VA), high nitrate levels were shown to exist prior to biosolids application. In a field study at MMSD (Madison, WI), increases in nitrate levels in groundwater under biosolids-amended fields were found to be similar to levels below manured or commercially fertilized fields. Accumulation of metals in the soil was observed. Where total metal concentrations were available, the applied metals could generally be accounted for in the top 12 inches of soil. Some increases in the concentration of metals, especially zinc and cadmium, were found in the plant tissue at some of the sites. Accumulation of nutrients in the soil was observed in some fields where loading rates exceeded the nutrient requirements of the crops grown. For example, significant increases in available phosphorous levels occurred at several sites. If long-term programs are to remain environmentally sound, over-application of phosphorous must be avoided. All of the programs have adopted a pro-active public relations stance by informing the media about activities of the program by holding farm and classroom demonstrations or by inviting the public to visit. Some programs, such as Ag-Tech, also have a concerted outreach effort directed at educating legislators and regulators. Those programs that have their normal activities visible to the community tend to have a greater degree of community involvement in governing how their program operates. Benefits from biosolids application to land included reduced fertilizer costs for farmers, reduced disposal costs for the POTWs, reduced water usage in arid climates, and reclamation of minespoil. Biosolids were generally applied for free. MWRD (Denver, CO) and MMSD (Madison, WI) currently charge a nominal fee for biosolids application, but both fees are still less than one-third the cost of commercial fertilizer nutrients. Ag-Tech reported a 26 percent reduction in the irrigation requirements of crops grown on biosolids-amended soils compared to unamended soils. No water usage comparison was available for any of the other programs. In general, the programs reported few technical problems, a fact that speaks well of the overall management and success of these long-term biosolids application programs. Most of the problems encountered concerned public opposition to some aspects of biosolids application to land.

Stulp, John R. 1995. Social, Political, and Educational Factors Involved in Facilitating Municipal Waste Utilization. In *Agricultural Utilization of Urban and Industrial By-Products,* American Society of Agronomy Special Publication no. 58, 1-9.

Sturgill, Dan. 1997. The Pathway to Becoming a Regional Site. *Illuminating the Future*. Vancouver, WA. Northwest Biosolids Management Association 9th Annual Biosolids Management Conference. #**2.** Provides suggestions on how to establish a successful regional site.

Successful Farming. 2000. What Do You Think About Applying Sewage Sludge? 98(2):26. February.

Sullivan, Dan. 1999. Toward Quality Biosolids Management: A Trainer's Manual. #**1.** Discusses how to develop a biosolids training course that is geared towards specific audiences (biosolids managers, farmers, public, etc.). Great public information section (Training Module 3) that discusses things such as what to know before siting an application area near neighbors.

Susskind, Lawrence. 1984. The Siting Puzzle: Balancing Economic and Environmental Gains and Losses. Presentation to the 13th Annual Conference of the Illinois Dept. of Environment and Natural Sciences, Sept. 13, 1984. **#1. NIMBY, siting.** An early clear explanation of the different levels of impacts on local residents of the siting of a facility that will have some negative local impacts. Discusses fairness and compensation of those most impacted.

Susskind, Lawrence and Patrick Field. 1996. *Dealing with an Angry Public: A Mutual Gains Approach to Rebuilding Trust and Improving Long Term Relationships*. New York: The Free Press. **#1. Trust, outrage, public participation.** An excellent book on the Mutual Gains Approach, risk communications, public participation.

Susskind, Lawrence, Sarah McKearnan, and Jennifer Thomas-Larmer (eds.). 1999. *The Consensus Building Handbook: A Comprehensive Guide to Reaching Agreement.* Thousand Oaks, CA: Sage Publications. **#1**.

Susskind, Lawrence, Paul Levy, and Jennifer Thomas-Larmer. 2000. *Negotiating Environmental Agreements: How to Avoid Escalating Confrontation, Needless Costs, and Unnecessary Litigation.* MIT-Harvard Public Disputes Program. Island Press. **#1. Conflict, consensus.** A primer on the mutual gains approach, including "negotiating as if relationships mattered."

Sustainable Agriculture Network. 2002. Meeting the Diverse Needs of Limited Resource Producers. Sustainable Agriculture Research and Education program, U.S. Department of Agriculture. http://www.sare.org/bulletin/limited-resource **#2, communication, information.** Provides examples of outreach and communication with farmers who have limited resources, ideas for how to work with resource-limited populations toward changing behavior.

Swedish Association of Food Processing Industries. 1999. Letter to the Swedish Department of the Environment re: the use of sewage sludge on farm land. http://www.safesoil.com/liletter.htm. September 6.

Swinwood, J.F., and T.E. Bates. Sludge Disinfection by Irradiation: A Canadian Approach to Recycling. *Specialty Conference on the Status of Municipal Sludge Management for the*

1990s, New Orleans, LA: Water Pollution Control Federation. #**4, public concerns and how irradiation alleviates them.**

Switzenbaum, M.S., L.H. Moss, E. Epstein, A.B. Pincince, and J.F. Donovan. 1997. *Defining Biosolids Stability: A Basis for Public and Regulatory Acceptance*, Project 94-REM-1. Alexandria, VA: Water Environment Research Foundation. **#3. Product quality, best management practices.** Provides information on treatment technologies that are key to producing marketable results, as well as information on biosolids stability criteria and recommendations for definitions of stability for various biosolids processes.

Synagro Technolgies, Inc. 1999. Advertising brochure.

Synagro Technologies, Inc. 1999. The Organic Waste Cycle. Pamphlet.

Tackett, Stanford L. 1994. Op-Ed: The Sewage Sludge Scam. *The Indiana, PA Gazette*, October 2. **#3. Profit motive, pathogens, metals, chemicals, lack of trust, concerned citizens.** Professor Emeritus Tackett of the Indiana University of PA Chemistry Department states "The land spreading program for sewage sludge is a scam of enormous proportions, driven mainly by money."

Tacoma, WA, City of. 2000. TAGRO Mix, product description. http://www.ci.tacoma.wa.us/biosolids/tagro.htm

Talbot, Margaret. 2002. Hysteria Hysteria. *New York Times Magazine*, June 2. **#2. Risk perception, environmental attitudes.** Discusses small outbreaks of itching, rashes, and other minor ailments at a variety of schools around the U.S. and the theory that many of the cases were “sympathetic,” psychogenically-developed. “Terms like psychogenic illness and hysteria have such a checkered history that even talking about them in connection with real people can quickly become a fraught pursuit. It was the ancient Greeks who first identified hysteria as the manifestation of physical symptoms with no discernible organic cause…. The smart and sensible feminist critique of hysteria -- a huge academic literature exists on the subject -- has led to a good deal of healthy skepticism about the diagnosis. But it has also made many people unduly suspicious, perhaps, of the very notion that the mind can generate symptoms that only the body manifests. And this may be all the more true when we consider this phenomenon among groups of people in the grip of unexplained symptoms…. More recently, a fear of environmental contamination has become the most common source of psychogenic illness, but this complicates matters still further since, after all, there is such a thing as a real environmental hazard. People who are ill with multiple-chemical sensitivity and chronic-fatigue syndrome -- syndromes that many doctors dispute the existence of -- reject any discussion of a psychological component to these ailments as ignorance or insensitivity. But none of this should blind us to the fact that well-documented outbreaks of mass psychogenic illness do occur -- and not all that rarely. Between 1973 and 1993, there were 70 reports of mass hysteria in medical journals; most took place in self-contained communities, like schools, barracks, and factories. Sixty percent of the incidents of epidemic hysteria written up in English-language journals this century occurred in schools. "I continue to be struck by how much more common mass psychogenic illness is than people generally think," says Timothy Jones, who was the lead author of an article in *The New England Journal of Medicine* two years ago in which he identified a psychogenic outbreak of nausea and dizziness among 170 students and staff members at a Tennessee high school. "I bet you there are a ton of cases when professionals back in their office are saying, 'This is what we think it is.' But maybe in only one out of 100 cases is it going to leave the office, and when it does it will be maybe two or three years later in a journal article that the local community is never going to read. Public health people are going to be extremely hesitant about labeling an illness as psychogenic. Because as soon as you say that aloud, people are telling you, 'You're not taking it seriously, you don't believe us, you missed something, you're covering something up.' It makes people really, really mad to hear that diagnosis. So a lot of times when mass psychogenic illness occurs, you don't hear about it as such. Public health people will continue to say, 'We're looking at all the possibilities and not finding anything, and we're waiting for the final results.' And privately, they sort of just hope it goes away and people stop asking about it." Part of the problem with making a diagnosis of mass hysteria is that it carries such a freight of pejorative associations. Ever since the Salem witch trials, it has been seen as the kind of phenomenon that occurs only in "backward" communities or among religious zealots…. Most cases of epidemic hysteria are characterized by symptoms like nausea, abdominal pain, dizziness and lightheadedness -- all of which can be produced or aggravated by anxiety and hyperventilation. But there are also several documented cases of rash as a psychogenic symptom…. It's true that in most cases of actual chemical spills or water contamination, environmental investigations do reveal something amiss. In an article for *Psychiatric Times*, Jones reviewed outbreaks of mass psychogenic illness and compared them with incidents of confirmed toxic exposures; he "was unable to identify any outbreaks of acute illness from toxic exposures, with minimal physical findings, where the cause was not quickly apparent to investigators….' Why, exactly, the idea of psychogenic illness should be so offensive is a little baffling. In many other areas of life and health, we recognize and even celebrate the mind-body connection: think of alternative therapies, yoga, the placebo effect, endless magazine articles about reducing stress to improve physical health, meditation, the power of positive thinking. Sympathy reactions to other people in physical distress are a rather touching phenomena, really, revealing us for the social and interconnected creatures that we are. Yawning, queasiness, malaise, vague "funny feelings" and certainly itching are suggestible symptoms for adults."

Tannen, Deborah. 1990. You Just Don't Understand: Women and Men in Conversation. NY: Ballentine. pp. 281-298. **#2**. **Communications**. A groundbreaking book about the differences between the communication styles of women and men. In general, girls and women learn early in life to communicate in ways that enhance relationships, whereas men learn to communicate in ways that establish hierarchies. Given that the wastewater treatment and biosolids management industries, including engineering, have been traditionally dominated by men, the perspective provided by Tannen's work may be helpful in understanding how to improve communications and public relationships.

Taylor, Stephen H. 2002. An Unwise Controversy: Organic vs. Conventional. *Weekly Market Bulletin*, Concord, NH: Department of Agriculture, Markets & Food. 81(9), May 8.

Tedder, Steve, Cindy Finan, A. R. Rubin, Frank Post, and Trille Mendenhall. 1991. Public Information Concerns and Management. *Land Application of Sludge and Residuals Guidance Manual.*

Tenenbaum, D. 1997. The Beauty of Biosolids. http://ehpnet1.niehs.nih.gov/docs/1997/105-1/focusbeauty.html. Environmental Health, Vol. 105, No. 1. January.

Terratec Environmental Ltd. 1998. Land Application of Sewage Biosolids for Crop Production. http://www.terratec.com.

Terratec Environmental Ltd. 2000. Why Recycle Biosolids. http://www.terratec.com/biosolid.htm.

Thompson, Dan. 1995. Wetland Restoration with Biosolids and Yard Debris: Changing the Paradigm from NIMBY to YIMBY. *The Biosolids Trilogy*. Silverdale, WA. Northwest Biosolids Management Association 7th Annual Biosolids Management Conference. #**1.** Discusses how it was an overwhelming success to go out and talk one on one with the neighbors surrounding the project. The City of Everett gained internal support for the project from community members and the project was passed. The city collaborated with the community on what important aspects should be incorporated into the project.

Thompson, D.C., and B. True. 1994. The Future of Biosolids Recycling in the Pacific Northwest: Roadblocks, Roles and Responsibilities. In *12th Annual Residuals and Biosolids Management Conference,* Bellevue, WA: Water Environment Federation. 229-239. #**2, northwest states, self-implementation, public involvement.**

Thompson, Dan, Carol Ready, and Tanya Moll. 1996. From Sludge Management to Biosolids Recycling*. BioCycle*, February 1996.

Thompson, Lorrine. 2001(a). Residents Wary of Plan for Sludge Treatment. *The Olympian.* March 5.

Thompson, Lorrine. 2001(b). Yelm Residents Slam Proposed Sludge Plant. *The Olympian.* March 7.

Thorud, David B. 1994. The Communication Puzzle: Putting the Pieces Together. *Conveying the Message.* Chelan, WA. Northwest Biosolids Management Association 6th Annual Biosolids Management Conference. #**1.** Discusses the importance of maintaining alliances with environmental organizations and how demonstration projects aid in overall biosolids development and the public's acceptance of it.

Toffey, Willam E. 1997. Educating the Wastewater Industry on How to Market Itself. Presentation to the Ohio Conference on Land Applied By-Products. Columbus, Ohio. November 17-18.

Toffey, William E. 1999. Making Heroes of Wastewater and Biosolids Operators. Presentation to the Minnesota 10th Annual Conference on Land Application of Biosolids, Residuals, and Effluents, February 18.

Toffey, William E. 2000(a). Risks of Not Building Public Support for Biosolids. *BioCycle*. 4(1):76. **#2.** “We are at risk of losing our programs and increasing costs of our programs because of our failure to communicate the benefits of biosolids.”

Toffey, William E. 2000(b). Gatekeepers:Who They Are? What They Think About Us? And What We Can Do About It? *14th Annual Residuals and Biosolids Management Conference, Boston, MA.* Water Environment Federation. **#1.** Suggests that gatekeepers are telling biosolids managers what to pay attention to: academics are encouraging support of further research, training, and development of outreach materials; water quality professionals are encouraging environmental management systems (EMS), training, and certification; public health officials are encouraging demonstration of best management practices, control of objectionable odors, attention to emerging health issues, and taking a firm stand in the public debate; agricultural institutions are supportive of biosolids recycling, but there is a need to work with them more; environmentalists encourage reduction of trace toxics in biosolids and embracing of the new environmental philosophies; regulatory officials encourage documenting compliance, standing up for biosolids, and industry self-regulation; and the media encourage openness and accessibility.

Toffey, William E. 2000(c). Having Fun with Biosolids: Examining New Ways to Communicate the Benefits of Biosolids. Unpublished comments to Biosolids Tek-Con, Atlantic City, New

Jersey, May 2000. #**2.** Ideas for better communications, public relations, marketing, and increasing public acceptance of biosolids from one of the nation's most creative thinkers on biosolids public acceptance issues.

Toffey, William E. 2000(d). Virtuous Biosolids: Earning Love for Biosolids Through Our Commitment to Virtuous Practices. Presentation to the Mining, Forest, & Land Restoration Symposium/Workshop, July 17.

Toffey, William E. 2000(e). Latex or Mylar Biosolids Balloons: MABA's Experience in Getting the New Biosolids Organization to Float. Mid-Atlantic Biosolids Association presentation to Ohio WEA Conference, December 1, 2000. **#2** "The tremendous breadth of responsibilities we in the biosolids/residuals business assume on technical, community, and research issues demands that we find better ways of getting these jobs done….MABA intends to be the local places to which biosolids technicians and managers--as well as regulators, the media, and the public--turn for information regarding the recycling of biosolids and other residuals."

Toffey, William E. 2002. Biosolids Good Practices: How Far Do We Go and How Do We Get There? Presentation to the Northwest Biosolids Management Association conference, September 23. **#2, best management practices.** Challenges biosolids managers to go further in demanding excellence in biosolids quality and programs.

Toffey, William E., Charles R. Miller, and L. Douglas Saylor. 1997. Two Decades of Mine Reclamation: Lessons Learned from One of the Nation's Largest Biosolids Beneficial Use Programs. From PDEP web site.

Toronto Works and Emergency Services. 1999. What Are Biosolids? Internet fact sheet.

Touart, Adrienne. 1997. Creating An Effective Biosolids Information Network. *BioCycle*. August. **#1.** How regional associations help facilitate technical expertise, information sharing and collaboration to increase public acceptance of biosolids.

Touart, A.P. 1998. Acceptance Strategies: Winning Biosolids Support. *BioCycle* 39(2):86-90. February. #**1, land application.** Preserving Pacific Northwest forests in the face of enormous growth pressures and using biosolids locally are being accomplished through the Biosolids Forestry Program initiated by the Mountains to Sound Greenway Trust (MTS). MTS works to preserve and protect the scenic, recreational, and historic character of the forestlands flanking I-90, which are under intense population pressure. The key to the program's success was linking biosolids to the much larger beneficial goal of preservation. Once the program was authorized to proceed, MTS decided to use a 20-acre state forest site along a high traffic road frequented by bikers and hikers just 20 miles east of Seattle for the first biosolids application. Implementation strategies included posting a sign at the site; inviting the news media, officials, and environmentalists to tour and witness the week-long application; and ensuring that all user groups were informed and comfortable with the project.

Trettin, L. and C. Musham. 2000. Is Trust a Realistic Goal of Environmental Risk Communication? *Environment & Behavior*, 32(3), 410-26**. #2: acceptance, trust, trust of government or science, risk communication.** Environmental risk communication often fails to overcome public distrust of government and industrial agencies. The role of trust in risk communication is discussed in context of nuclear power and hazardous waste storage facilities. Strategies of risk communication need not focus on building trust, but should focus on establishing procedures and standards that the public understands and accepts.

True, Brian. 1998. *Regional Biosolids Information Networks Report*, Report to the US Environmental Protection Agency.

Truini, Joe. 2001(a). NYC Drops Sludge Pact. *Waste News*. July 9.

Truini, Joe. 2001(b). Va. College Issues Compound Warning. *Waste News*, 7(7):13. August 6.

Tuler, Seth and Thomas Dietz (eds.). 2001. Factors Influencing the Success of Public Participation in Environmental Decision-Making: A Review of the Literature. July 10. **#1. Public Participation.** This is an unpublished literature review by two social scientists expert in the field of public participation.

Tuohy, J. 2000. 2 Mothers, 2 Deaths, Too Many Questions – Sickness Was in the Air, But Officials Wouldn't Blame Sludge. *USA Today, Final Edition*. 13D. July 13. #**2, pathogens, death, land application, Class B, liability, media.** A rare national newspaper story; considerable impact.

U.S. Composting Council. 2000. *Field Guide to Compost Use.* PDF document, www.uscc.org.

U.S. Composting Council. 2000. USCC Promotes STA Program to National Council of State Garden Clubs. *The Quarterly*, Amherst, OH: USCC, Summer. **#4. Education.** Outreach to garden clubs regarding Seal of Testing Assurance program.

U. S. Department of Agriculture Cooperative State Research Service. 1989. *Peer Review: Standards for the Disposal of Sewage Sludge U. S. EPA Proposed Rule 40 CFR Parts-257 and 503.*

U. S. Environmental Protection Agency. 1977. *Municipal Sludge Management: Environmental Factors*. [MCD-28] EPA430/9-77-004, October.

U. S. Environmental Protection Agency, 1980. *Information Programs Affect Attitudes Toward Sewage Sludge Use in Agriculture*. Municipal Environmental Research Laboratory, Cincinnati, OH: USEPA 600/2-80-103; July. **#2.** This is an Office Research and Development report developed by the Ohio Farm Bureau Development Corporation that examined the attitude of Ohio residents toward land application and the influence of educational meetings on these attitudes.

U. S. Environmental Protection Agency. 1981. *Institutional Constraints and Public Acceptance Barriers to Utilization of Municipal Wastewater and Sludge for Land Reclamation and Biomass Production*. Office of Water Program Operations (WH-547), Washington, DC: EPA430/9-81-013; July. **#2.** An early EPA report that includes a series of case study summaries (see also Bastian, Robert).

U. S. Environmental Protection Agency. 1983(a). *Land Application of Municipal Sludge Process Design Manual*. EPA-625/1-83-016, October.

U. S. Environmental Protection Agency. 1983(b). A Practical Technology: Land Application of Sludge: A Viable Alternative. USEPA pamphlet.

U.S. Environmental Protection Agency Environmental Response Team (ERT). *Biosolids Recycling: Restore, Reclaim, Remediate.* Videotape.

U.S. Environmental Protection Agency. 1986. *Working to Gain Public Acceptance of Sewage Sludge Composting and Use of Liquid and Dewatered Sludge on Land,* USEPA Office of Wastewater Management, March.

U.S. Environmental Protection Agency. 1989. EPA's Policy Promoting the Beneficial Use of Sewage Sludge *and* The New Proposed Technical Sludge Regulations. Office of Municipal Pollution Control (WH-595), Washington, DC. USEPA pamphlet.

U.S. Environmental Protection Agency. 1991. Beneficial Use of Sewage Sludge. Brochure. **#2. EPA policy, land application.** Quotes the June 12, 1984 49 Federal Register 24358 U.S. EPA policy on municipal sludge management: "The U.S. Environmental Protection Agency (EPA) will actively promote those municipal sludge management practices that provide fore the beneficial use of sludge while maintaining or improving environmental quality and protecting public health. To implement this policy, EPA will continue to issue regulations that protect public health and other environmental values. The Agenc will require states to establish and maintain programs to ensure that local governments utilize sludge management techniques that are consistent with Federal and state regulations and guidelines. Local communities will remain responsible for choosing among alternative programs; for planning, constructing, and operating facilities to meet their needs; and for ensuring the continuing availability of adequate and acceptable disposal or use capacity."

U.S. Environmental Protection Agency. 1992(a). 40 CFR 503 Use and Disposal of Sewage Sludge: Questions and Answers. USEPA Briefing Book. Region 10, Seattle, WA. December.

U.S. Environmental Protection Agency. 1992(b). EPA Workshop. *1992 Water Environment Federation Specialty Conference, The Future Direction of Municipal Sludge (Biosolids) Management: Where We Are and Where We're Going*, Portland, OR: Water Environment Federation. July 29. **#4,** review of proposed 503 rule as of 1992.

U.S. Environmental Protection Agency. 1994(a). *A Plain English Guide to the EPA Part 503 Biosolids Rule*, Washington, DC: USEPA Office of Wastewater Management.

U.S. Environmental Protection Agency. 1994(b). *Biosolids Recycling: Beneficial Technology for a Better Environment.* Office of Water (4204), Washington, DC: USEPA 832-R-94-009. **#3.** The short primer on biosolids recycling.

U.S. Environmental Protection Agency. 1994(c). *Composting Yard Trimmings and Municipal Solid Waste*. Office of Solid Waste and Emergency Response, Report No. EPA/530/R94/003. 12-13, 108, 111-114. **#4, composting, odors, traffic, need for public information.**

U.S. Environmental Protection Agency. 1995. *A Guide to the Biosolids Risk Assessments for the EPA Part 503 Rule*, Washington, DC: USEPA Office of Wastewater Management.

U.S. Environmental Protection Agency. 1997. Compost – New Applications for an Age-Old Technology. Folder & Fact Sheets. No. EPA/530-F-97-047. October.

U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. 1999. *Biosolids Generation, Use and Disposal in the United States*. EPA 530-R-99-009. **#2.** This current assessment of biosolids use and disposal practices includes a discussion of public acceptance as an obstacle to further biosolids recycling efforts.

U.S. Environmental Protection Agency Office of Water. 1999. Biosolids Data Management System. http://www.biosolidsinfo.com **#3. Lack of information, oversight/enforcement.** A biosolids data system that could assist in providing information on where, when, how much, and the quality of biosolids recycled.

U.S. Environmental Protection Agency Office of Inspector General. 2000. *Audit Report, Water, Biosolids Management and Enforcement (2000-P-10),* March 20. **#3. Lack of oversight/enforcement, lack of public information/data.**

U.S. Environmental Protection Agency Office of Inspector General. 2002. Memorandum: EPA's Key Management Challenges. Washington, DC: USEPA. September 6. **#1. Public concerns.** The Office of Inspector General (OIG) at the U. S. Environmental Protection Agency (USEPA) sent Administrator Christine Todd Whitman an updated list of the "key management challenges confronting the… Agency. The list includes two new challenges, *Challenges in Addressing Air Toxics Program Phase 1 and Phase 2 Goals* and *Management of Biosolid."* Here is the description of the rationale for adding biosolids management to the list: **"**Approximately six million tons of sewage sludge ("biosolids") are produced annually by sewage treatment plants in the United States. With inadequate treatment these biosolids may contain a wide variety of chemicals and pathogens, the remains of the sewage treatment process. (1) EPA does not know whether current regulations, when adhered to, are protective of public health; (2) EPA does not have an overall understanding of the magnitude and quality of Biosolids production and disposal practices; (3) EPA does not know if the enforcement and compliance resources committed to managing biosolids are adequate to ensure that the regulations are adhered to. EPA has not conducted the basic research needed to determine the risk associated with certain biosolids disposal practices. The Agency has taken the position that biosolids management is a low-risk activity. As a result, EPA has failed to adhere to its commitment to comprehensively assess the extent of the risk. EPA issued Part 503 of Title 40 of the Code of Federal Regulations ("The Sludge Rule") to govern the use and disposal of biosolids in February 1993 under court order. When it issued the rule, EPA committed to conducting a comprehensive research program to assess the risks associated with land application of biosolids, yet it has not yet done so. In June 2002 the National Academy of Sciences (NAS) recommended additional research. EPA is currently studying those recommendations, and has committed to producing a research work plan by the end of 2003, nearly 11 years after committing to do so. EPA uses the Permit Compliance System (PCS) to manage water quality activities of point source dischargers such as sewage treatment plants, but PCS is acknowledged by the Office of Water (OW) as inadequate for managing biosolids. EPA is unable to answer basic questions such as how much biosolids are land-applied. As a result of this data gap, OW developed an independent system, the Biosolids Data Management System (BDMS), to track compliance with biosolids regulations. EPA is revising PCS, but has not yet decided whether to incorporate BDMS into this new version. According to OW, "the ultimate usefulness of the BDMS on a national basis is likely dependent upon its adoption into PCS." EPA has diverted compliance and enforcement resources away from this program. The safety of biosolids land application depends on the adherence to highly technical treatment standards by land applicators across the country. In a 2000 report we found inadequacies in EPA's management and enforcement of the biosolids program. In a status report on the biosolids program published two years later, we reported a further 44% reduction in full-time equivalent (FTE) positions (from 18 to 10). This is a particular concern because EPA runs the biosolids program in 45 states. Adequate oversight of this program is critical for ensuring regulatory compliance. To date, EPA has not committed the resources needed to fulfill its oversight responsibilities. In convening a committee to study the NAS recommendations EPA is beginning to address these issues. However, several issues remain unsettled and we are not convinced that the agency is directing adequate resources to resolving these concerns once and for all. We will continue to monitor EPA's progress in this area until these issues are settled. In May 2002, we recommended this issue from as an Agency-level weakness candidate under the Federal Managers' Financial Integrity Act."

U.S. Environmental Protection Agency Office of Water. 2000. *Progress in Water Quality: An Evaluation of the National Investment in Municipal Wastewater Treatment.* Washington, DC: U.S. EPA. **#3. Water quality**. This report evaluates whether or not the huge public investment in wastewater treatment during the last third of the 20th century provided benefits to surface waters, as intended. "At both broad and local scales, the water pollution control policy decisions of the 1972 CWA have achieved significant successes nationwide in terms of reduction of effluent BOD from POTWs, worst-case (summertime, low-flow) DO improvement in waterways, and overall water quality improvements in urban case study areas."

U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management. 2000(a). *Guide to Field Storage of Biosolids.* EPA/832-B-00-007. July. **#2. Odors, aerosols, trucking & traffic, appearance, best management practices, Class B, stockpiling, land application, communication.** Includes a chapter on "Community Relations." "The ultimate goal of the community relations program is to develop public acceptance of biosolids storage within the community…The public desires a voice in activities that may impact their community, and they need to know that biosolids managers share their concerns and are responsive to their comments. Seeking early input from local officials and the citizens during the planning phase is the best way to gain public support. Active listening and responsiveness to public concerns builds trust and ensures that the project fits successfully into the community." Recommends adapting program to local needs; establishing system to address complaints and take corrective actions; noting the variety of "publics:" government officials, citizens groups, agricultural organizations, etc.; and educational tools and outreach options.

U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management. 2000(b). *Biosolids*. http://www.epa.gov/owm/bio.htm, retrieved November 27.

U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management. 2000(c). *Summary of State Biosolids Programs: Draft Report*. December.

U.S. Environmental Protection Agency, Office of Water, Office of Wastewater Management. 2000(d). *Biosolids and Residuals Management Fact Sheet: Odor Control in Biosolids Management*. September.

U.S. Environmental Protection Agency, Office of Policy, Economics, and Innovation. 2001. *Stakeholder Involvement & Public Participation at the U.S. EPA: Lessons Learned, Barriers, & Innovative Approaches.* Washington, DC. January.

U. S. Environmental Protection Agency. 2002. Enhancing Facility-Community Relations. Brochure. "This is the third document in a series of U.S. EPA Office of Solid Waste (OSW) publications on hazardous waste management facility locations as they relate to social and environmental issues. For more information, read *Social Aspects of Siting RCRA Hazardous Waste Facilities*, EPA530-K-00-005, April 2000. *Sensitive Environments and the Siting of Hazardous Waste Management Facilities*, EPA530-K-97-003, May 1997. Both are available at http://www.epa.gov/epaoswer/hazwaste/tsds/site/sites.htm…. With more than 2,260 hazardous waste facilities in the U.S., developing and maintaining good community relations is vital. It is important for facilities to maintain continuous, strong relationships with neighboring communities throughout their operation and after closure. Although not all communities are affected by federal hazardous waste regulations, for those that are, their concerns need to be addressed early, collaboratively, and compassionately."

U.S. Environmental Protection Agency. 2003a. Public Involvement Policy of the U.S. Environmental Protection Agency. http://www.epa.gov/publicinvolvement/policy2003.htm

U.S. Environmental Protection Agency, 2003b. Response to the Center for Food Safety et al. petition seeking an emergency moratorium… Washington, U.S. EPA Office of Water, December 24.

U. S. Environmental Protection Agency, 2003c. Standards For The Use Or Disposal Of Sewage Sludge; Final Agency Response to the National Research Council Report on Biosolids Applied to Land and the Results of EPA's Review of Existing Sewage Sludge Regulations, in the *Federal Register*, December.

U.S. Geological Survey. Expanded Monitoring Program Near Deer Tail, Colorado. *USGS Quarterly Report*, 2(2):1-12, April-June 2000. Research monitoring Denver's land application program.

U.S. House of Representatives. 2000. Hearing Charter: EPA's Sludge Rule: Closed Minds or Open Debate? March 22, 2000. **#2. Concerned citizens, politics**. This hearing addressed whether EPA, in its development and enforcement of the Part 503 Sludge Rule, is failing to foster sound science with an open exchange of ideas and information between scientists, EPA officials, and private citizens.

UC Berkeley Wellness Letter. 2000. Organic Questions: The Answers May Surprise You. Berkeley, CA. October, p. 6.

U.S. 9th Circuit Court of Appeals. 2000. Decision filed on the Appeal From the United States District Court for the District of Montana regarding "Gunk" from Septic Tanks, Classified as "Sewage Sludge" from a "...treatment works treating domestic sewage" making illegal disposal of septic tank septage subject to enforcement under the Clean Water Act. *http://laws.findlaw.com/9TH/9930112.html*. March 22. #**4, 503.**

U.S. District Court for the Western District of Virginia, Charlottesville. 1995. *W. Dale Welch, et al., Plaintiffs, v. The Board of Supervisors of Rappahannock County, Virginia, Defendant*. Civil Action No 94-002-C. May 24. #**2, health, land application, local ban.** The County did not want sewage sludge land applied at all, no matter the source. Farmers fought for the right to apply sewage sludge on their lands and lost. The court cited that the County had a real view of protecting human health and the environment. "Safety concerns are not illusory." See also Hassell (above).

University of Nebraska. 2000. Biosolids Land Application Program: A Partnership Between the City of Lincoln, UNL Cooperative Extension in Lancaster County, and County Crop Producers. http://www.ianr.unl.edu/ianr/lanco/enviro/biosolids/overvew.htm.

University of Nebraska. 2000. http://www.ianr.unl.edu/ianr/lanco/enviro/biosolids/research.htm. Research description.

USA Today, 1999. Faced With Evidence of Health Threat, EPA Looks the Other Way. *USA Today* editorial, October 7. **#3. Lack of trust.** Criticism of USEPA; mention of Shayne Conner, NH case. "And when not attacking critics, the agency has been busy promoting sludge use. Over the past threee years, for example, it has spent almost $70,000 on grant to the Water Environment Federation for a sludge 'public acceptance campaign,'…."

USA Today. 2000. Faced With Faulty Science, EPA Muzzles Critics. *USA Today* editorial, Oct. 5. http://www.usatoday.com/news/comment/nceditf.htm

Vanderford, Ken. 2001. Having Trouble Farming Out Your Biosolids?: Follow Tried-and-True Tips to Sell Your Biosolids for Land Application. *WE&T*. February.

Vaughan, F., L. Koontz, and B. Barnes. 1994. Planning and Implementation of Wichita's Successful Biosolids Reuse Program. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 347-353. #**2, land application, city with extensive public education outreach plan, biosolids management plan.** When new federal regulations for monitoring and disposal of sewage sludge were published in 1993, the City of Wichita Water and Sewer Department knew that significant changes were required to comply with the new regulations. The City determined through the development of a Biosolids Management Plan that a beneficial reuse program was the most practical and effective means of achieving compliance. Implementation of the Biosolids Management Plan has resulted in higher quality biosolids and a reliable method of disposal. The biosolids reuse program has been unusually successful due to a combination of thoughtful planning, honest dialogue with the public, facilities improvements, and responsible operation. A certain measure of the noted success is due to the City's accommodation of the farmers' crop and site requirements. In this way, the City provides the farmer with a valued service in addition to the product.

Vermont Agency of Natural Resources. An Assessment of the Quality of Vermont's Environment. *Environment 1999*. http://www.anr.state.vt.us/env99/index.html "While great strides have been made in recycling and reuse of other waste streams, there has been a substantial decline in beneficial use of biosolids, from about 98 percent in 1987 to the 40 percent of 1997. While the amount of biosolids being composted has increased, there has been a significant decline in direct land application. Vermont's beneficial use of biosolids is below the national average of 54 percent and lower than some northeastern states, such as Maine, which reuses 90 percent."

Vermont Public Interest Research Group (VPIRG). 1999. *On the Ground: The Spreading of Toxic Sludge in Vermont*. Montpelier, VT: Vermont Public Interest Research Group. June. **#1, public acceptance, concerned citizens, personal control.** Thousands of tons of sewage sludge and septage have been distributed through Vermont's environment by being spread directly on land or composted and given away for use on home gardens, farms, and landscape projects. In 1997 alone, 1,535 tons of sewage sludge were applied to Vermont land, while 767 tons were distributed as compost. Reusing clean human waste would be a positive practice. But sludge contains far more than just human waste. The practice of applying municipal sludge to the land entails many serious risks to environmental sustainability and public health. It is economically short-sighted, given its potential to contaminate the land, undermine Vermont foods' reputation for purity, and undercut the pristine environmental image that brings so many tourists into our state. Many citizens oppose it on grounds ranging from issues of local control to public health fears to aesthetic concerns. Yet regulators with the state's Department of Environmental Conservation steadfastly maintain that the only problem with sludge "recycling" is the public's attitude toward it and insist that there is no need to reexamine the current system of regulation or make it more stringent.

Virginia Cooperative Extension. 1999. *Agricultural Land Application of Biosolids in Virginia: Risks and Concerns.* Crop and Environmental Sciences Publication 452-304. Petersburg, VA: Virginia Cooperative Extension. **#3. Land application, education.**

Virginia, State of. 2000. Biosolids Lifecycle: Concerns & Risks. http://www.biosolids.state.va.us/concerns.htm. **#3. Metals, chemicals, pathogens, odors, surface water, groundwater, trucking.**

Vos, Sarah. 2001. Farmer Wants to Spread Sludge by Marriott Hotel. *Concord Monitor*. August 20. New Hampshire.

Wagner, E.O. 1990. Sludge Management Concerns in the United States. In *Water Pollution Control Federation Specialty Conference, The Status of Municipal Sludge Management for the 1990s*, New Orleans, LA: Water Pollution Control Federation. OGS-1–OGS-5. **#2, using sludge (biosolids) in a beneficial way, public participation, public education.**

Wagner, Holly. Biosolids: A Financial Look. #**2.** A worksheet that teaches kids the financial side to biosolids recycling by comparing yields and costs to conventional and no fertilizer treatments.

Wakefield, S. and S.J. Elliott. Environmental risk perception and well-being: effects of the landfill siting process in two southern Ontario communities. Hamilton, Ont: School of

Geography and Geology. **#2. Risk perception, public participation, personal control.** “In the context of siting (environmentally) noxious land uses, recent research suggests that the well-being of individuals and communities is impacted as much by the decision-making process as the outcome itself. The study results presented in this paper stem from an ongoing, two-stage quantitative/qualitative investigation of impacts on individual and community well-being associated with the environmental assessment process in Ontario, Canada. This research uses a parallel case-study design to investigate two proposed landfill sites in southern Ontario. Qualitative in-depth interviews (n = 36), conducted across a variety of stakeholder groups, were used to address the following objectives: to explore the nature of concerns experienced by individuals faced with a local landfill site proposal; to explore the effects of the siting process on individuals and communities; and to examine the coping strategies employed by individuals in response to impacts experienced. The work attempts to apply theories of risk society (as conceptualized by Beck and Giddens) at a community scale. In so doing, we build on the work of health geographers attempting to link the social and contextual with the medical. Overall, substantial impacts on individual and community well-being were reported across all stakeholder groups interviewed: these included stress, disempowerment, hostility and divisions within the community. The experience of psychosocial impacts and effectiveness of coping strategies is shaped by certain factors associated with the site and the siting process (including uncertainty and the perceived lack of meaningful participation). The links between risk, process and impacts are theorized using a conceptual framework which incorporates site and process factors, effects on daily life (e.g. feelings of losing control, mistrust), and Gidden's conception of 'ontological security'. These findings have implications for environmental decision-making, as they suggest a need to locate the delicate balance point between community involvement and an expedient decision-making process within variable community contexts.”

Walker, J. 1997. *Rutland, VT*. Draft Report to Katie Gehr, VT DEC for comment. United States Environmental Protection Agency. August 18.

Walker, J.M. 1993. Production, Use & Creative Design of Sewage Sludge Biosolids. *Sewage Sludge: Land Utilization and the Environment*, Bloomington, MN: Soil Science Department and USDA-ARS, University of Minnesota. August 11-13. #**4, end product concerns, beneficial use, education.**

Walker, J.M. 2000. A Regulatory Perspective on Biosolids Management. In *Biosolids Management in the 21st Century Conference*, College Park, MD. 5-11. #**2, biosolids management, negative cases.**

Walker, John M., Robert W. Southworth, and Alan B. Rubin. 1997. EPA Regulations and Other Stakeholder Activities Affecting the Agricultural Use of By-Products and Wastes. Washington, DC: U.S. Environmental Protection Agency, Office of Water.

Walsh, Kate. 2002. Compost Using Sewage Sludge as Seed Material - Is It Harmful? *Townsend Times*. May 3.

Walter, F. 1997. Washington Zoners Approve Composting. *The Morning Call*, Easton Section, p. B3. Allentown, PA. April 2.

Wantland, Sheri (ed.). 2002. *Survival Guide: Public Communications for Water Professionals.* Alexandria, VA: Water Environment Federation. **#1. Communications, public participation, media.** An excellent resource for communicating with the public and the media. Includes resources on public participation.

Wardell, M.R.1994. Building Acceptance for Biosolids Use. *BioCycle*. 35(7):56-59. **#1, land application, facility siting, lack of public information/data, liability.** Identifying what the obstacles are to the beneficial use of biosolids in the Northeast depends on who is asked. Lack of effective regulation, questions concerning health or environmental impact, lack of farmer or landowner interest in using biosolids, overregulation and the cost of permitting and compliance, and fears over potential liability are all among the answers given by the various parties involved in managing or using these materials. Another frequently cited obstacle is public opposition to the siting of beneficial use facilities. This problem is especially acute in the Northeast, where population density makes it difficult to site facilities away from residential development.

Warrick, Joby and Pat Smith. 1995. New Studies Show That Lagoons Are Leaking: Groundwater, Rivers Affected by Waste. *The News & Observer*. February 19. http://www.pulitzer.org/year/1996/public-service/works/1water.html.

Warrick, Joby and Pat Stith. 1995. New Studies Show the Lagoons Are Leaking. *The News & Observer*. February 19.

Washington (DC) Suburban Sanitary Commission website http://www.wssc.dst.md.us/about/history.html:

Washington (DC) Suburban Sanitary Commission. Late 1990's. Beneficial Use: The Successful Management of Wastewater Products. Hyattsville, MD: Washington Suburban Sanitary Commission. **#3.** Booklet describing biosolids recycling program.

Washington State Department of Ecology. 1998. Fact Sheet: Washington State fertilizer and soils studies

Washington State Department of Ecology. 2000. State biosolids recycling program. http://www.ecy.wa.gov/programs/swfa/biosolids/index.html. **#2.** A respected and well-developed state biosolids management regulatory program that supports recycling.

Washington State Department of Natural Resources. 1995. *Sustained Forest Growth: Biosolids Recycling.* University of Washington, College of Forest Resources; King County; and Weyerhauser. #4

Washington State University Cooperative Extension. 1998. Biosolids, A Recycled Organic Fertilizer. http://gardening.wsu.edu/stewardship/biosolid/biosolid.htm. **#3. University involvement.**

Washington, University of, Pack Experimental Forest. 1995. *Recycling a Resource: Biosolids Self-Guided Trail*. #**3.**

Waste News. 2002. Land Application of Biosolids Draws Flak: EPA Neutralizes Stance. March 4.

Water Environment Federation and United States Environmental Protection Agency. 1997. *Biosolids Fact Sheets*. March. **#3. Bad management, metals, chemicals, groundwater, urban/rural conflict, someone else's biosolids…** Informative fact sheets that detail investigations of cases where harm from biosolids was alleged, as well as an introduction to biosolids recycling. Includes peer-reviewed fact sheets on "Biosolids Recycling in West Texas" (Sierra Blanca), "Biosolids in Southern California" ("Mount San Diego"), "Biosolids in Northern Washington State" (Zander Farm), "Biosolids and Miniature Horses in Oklahoma," "Can AIDS Be Transmitted by Biosolids?," "Biosolids and Bahamian Papaya Crops," and "Biosolids Application to Forestland in the Pacific Northwest." In the introduction regarding biosolids recycling: "Why Should I Care About Biosolids?

Wastewater treatment and management of wastewater residuals should concern all municipal sewer users, agricultural interests, and environmentalists. More than $2 billion is spent annually treating and managing approximately 5.3 million dry metric tons of biosolids from public owned wastewater treatment plants in the United States….National biosolids generation rates are estimated to reach 47 dry pounds per American yearly. Regarding Sierra Blanca: "In 1991, MERCO applied for a land application permit with the State of Oklahoma. The application was withdrawn, company officials explain, when logistical difficulties threatened to delay the project past July 1, 1992, the deadline for New York City to stop ocean dumping of wastewater residuals. Public criticism of the proposal was linked mostly to disapproval of a rural state acting as a 'dumping ground' for large eastern cities." Regarding the Zander claims and resulting articles by Ed Haag in *Farm Journal*: One quoted expert, "Darrell O. Turner, a retired soil scientist from Washington State University and witness for the plaintiffs in the Zander case, stated in Haag's article that farmers should not land apply biosolids to their crops. In a later, private correspondence, Turner stated that contemporary wastewater treatment technology can produce safe, clean biosolids if properly implemented by responsible operators. 'This is not a problem resulting from lack of technology; it is a people problem….When and if we succeed in bringing our agencies into line…I will support land application,' Turner wrote." Regarding the

Water Environment Federation. 1985. *Nature's Way- How Wastewater Treatment Works for You*. Brochure.

Water Environment Federation. 1990. *Biosolids - Too Valuable to Waste*. Brochure.

Water Environment Federation. 1990. *Biosolids, Too Valuable to Waste*. Alexandria, VA. #**2.** "What happens to the materials that disappear down our drains and storm sewers? In our modern society, it's easy to think that "out of sight is out of mind," that waste miraculously evaporates once it has vanished into the pipeline. Early humans knew better. Agrarian societies have been using both human and animal wastes to fertilize the land for as long as humans have planted seeds, and those seeds have been thriving. The materials that wash down our drains are not wastes: they are a valuable, age-old resource for enriching the soil. Our modern wastewater treatment facilities are not only water cleaning systems, but they are also reclamation factories that produce safe, reusable solids – biosolids. Recycling wastewater solids for beneficial use is gaining acceptance worldwide and is encouraged by the U.S. Environmental Protection Agency, the U.S. Department of Agriculture, the U.S. Food and Drug Administration, and the National Association of Conservation Districts. Most important, these recycling efforts put valuable resources back where they belong – in the natural cycle."

Water Environment Federation. 1992(a). Executive Committee Supports Biosolids. *Federation Highlights* 29(3). March.

Water Environment Federation. 1992(b). Federation Opposes New Sludge Legislation. *Federation Highlights* 29(6). June.

Water Environment Federation. 1992(c). Biosolids Conference a Success Despite Regulatory Delay. *Federation Highlights* 29(9). September.

Water Environment Federation. 1992(d). The National Beneficial Biosolids Use Awards. *The 1992 EPA Awards*, Operating Projects >5 MGD. October.

Water Environment Federation. 1993. National Sewage Sludge Standards Rule Signed: Federation Applauds Culmination of Effort, Calls for Public Support. *Federation Highlights* 30(1). January.

Water Environment Federation. 1994(a). Educate Your Public About Biosolids Recycling. *Federation Highlights* 31(6). June.

Water Environment Federation. 1994(b). Beneficial Use of Biosolids. *Operations Forum* 11(11). November.

Water Environment Federation. 1994(c). *Biosolids Recycling – Beneficial Technology for a Better Environment.* #**2. Video promotes recycling and reuse, especially for the Northeast and Mid-Atlantic.**

Water Environment Federation. 1994(d). Biosolids Recycling: Beneficial Technology for a Better Environment. Brochure. **#3. Education.** Stresses environmentally sound practice, strict standards and scientific controls, makes economic sense.

Water Environment Federation. 1995(a). Earth Day Calendar Features Biosolids. *Federation Highlights* 32(1). January.

Water Environment Federation. 1995(b). EPA and WEF Collaborate on Radioactivity in Wastewater Solids Issue. *Federation Highlights* 32(1). January.

Water Environment Federation. 1999(a). Biosolids: NBP Focuses on Environmental Management System, communication. *Water Environment & Technology*. November, pp. 15-17.

Water Environment Federation. 1999(b). *Response To Biosolids Questions and Current Public Acceptance Issues*. WEF Residuals and Biosolids Committee, Public Acceptance Subcommittee. **#2. Dioxin, food safety, metals, concerned citizens.** Includes responses to Cornell "Case for Caution" and National Sludge Alliance.

Water Environment Federation. 2000(a). *Biosolids Success Stories.* Alexandria, VA: Water Environment Federation. #**1.** A collection of narrative case studies of successful biosolids recycling programs from around the United States; includes a thorough summary of background/history of US biosolids recycling and occasional discussions of public acceptance efforts. "Through this publication, readers may recognize a recycling technology that is used or proposed for use in their own community. Raising the level of awareness, locally and nationally, that biosolids recycling is a viable alternative to disposal is a necessary first step in gaining public acceptance. The success stories presented are ways to measure and document progress. The present publication emerged from a proposal to share with the public and with other interested parties the variety of ways in which biosolids are beneficially used in the United States. An initial set of drafts was solicited from the members of WEF's Residuals and Biosolids Committee, state officials, federal regulators, and others who were asked to provide stories and suggestions of biosolids projects that have been successfully implemented and are environmentally sound. The intent was to provide relatively detailed information on the range of options available to municipal owners, managers, and consultants." From chapter "Fort Worth Texas: Biosolids Recycling Expanding Far and Wide in Texas." "Public Acceptance Activities: The Fort Worth program has met the five basic strategies of the Biosolids 2000 goals articulated by the Water Environment Federation by: Promoting Recycling 100% Biosolids Recycling, Providing Information Video & Publications, Developing Partnerships County Officials & Farmers, Be Pro-Active Open and Aggressive, Insure Compliance/No Enforcement Violations. In addition, the Fort Worth beneficial recycling program has met the five measurements for public acceptance outlined in the Biosolids 2000 Program: % Biosolids Recycled =100%, No Major Controversies, Public Demand for Biosolids Recycling: 60 Day Waiting Period, Users Willing to Pay for Biosolids: Yes, Agencies "advertise" their Biosolids Products: Being

Developed. The success of the City and the contractors public acceptance efforts have achieved positive results: Majority of local & vocal public opposition, now generally supportive of program, Opposition now wanting to participate in the program, More land owners wanting to participate, Larger land owners wanting to participate, More "prominent" land owners interested in participating in the program, Land owners closer in towards the city limits wanting to participate in the program, Greater support & acceptance from other local and county governments, Pamphlets, brochures, literature and handouts have been developed and are made available to the public, providing educational and informational facts about biosolids and the City of Fort Worth's "beneficial recycling" of biosolids program. Over-Coming Obstacles: Misinformation: Science based management combined with dedicated employees using common sense and good management practices have overcome public misinformation and emotion based opposition. Organization Opposition: Operating biosolids dewatering, sampling and testing, transport and field application activities in compliance to state and federal rules has allowed the City of Fort Worth's land application program to grow in agricultural communities even with organized public opposition. Political Campaigns: False accusations of environmental contamination, political campaigns "sludge judge that won't budge" have all been overcome by patience, community dialogue, science based site management, public relations and local farm and rancher support in these areas." From the chapter "King County, Washington: The Mountains to Sound Greenway Biosolids Forestry Program." "The public acceptance campaign demonstrated the benefits of having an independent third party deliver information about biosolids. The Greenway Trust had a reputation for obtaining collaborative, reasonable solutions among divergent interests. They were well known as conservation and environmental advocates. They were able to research biosolids and tell people, in a direct, believable manner, what they had found. The campaign employed a series of consistent message points summarizing the Greenway's independent conclusions about biosolids: Recycling biosolids in our home county is the responsible thing to do, Recycling biosolids in our forests builds a sustainable habitat for plants and animals, Using forests productively encourages landowners to keep lands on the edge of the city in forest use, Biosolids have been researched thoroughly by scientists and found to be safe and beneficial for the environment, Recycling biosolids produces many environmental and economic benefits such as soil enhancement, maintenance of water quality, improved wildlife habitat, and increased sustainable timber production. During the development of the program, more than 20 local groups endorsed the program. A pair of prominent environmentalists, including a representative from the Sierra Club, volunteered to serve as program spokespersons. Presentations were made to local mayors, councils, agencies, the media, and environmental groups. The effort yielded broad political and environmental support for the program and more than 40 positive media articles about recycling biosolids in local forests….For the past three years, consultants for King County Wastewater Treatment Division have conducted public opinion surveys by telephone of ratepayers in the greater Seattle area. In 1994, 50 percent of respondents approved of the use of biosolids in forests. In 1995, the approval rate was 75 percent. The unprecedented amount of media coverage about biosolids in the first half of 1995 may have contributed to this increase. The surveyed public also gave higher approval rates to other uses of biosolids: agricultural use increased from 49 percent to 67 percent, and composting rose from 55 percent to 70 percent approval." From the chapter "Lincoln, Nebraska: A Biosolids Program With Strong Links to University:" "The City of Lincoln's biosolids program is an innovative effort to bring new technology, scientific research, and a variety of agencies together for the betterment of biosolids application in Lancaster County. All the entities involved - the

University of Nebraska, Cooperative Extension, and the City of Lincoln - have specific strengths and roles that are well suited to various aspects of the program. This unique relationship and progressive approach to the management of the program sets it apart from many other land application programs, and has led to a successful program." From the chapter "Montgomery Area, Pennsylvania: Nourishing Farmland on a Regional Basis:" "Public Acceptance: Through conscientious project management, UAJA has maintained a publicly supported program. When the permit application was initially submitted, however, some neighbors of the Crossley Farm expressed concern about the biosolids project. The public's trust was won by personal communication with UAJA staff and board members, responsiveness to inquiries, presentations at local meetings, distribution of literature explaining biosolids recycling, and tours of the wastewater treatment plant. In addition, the local press is invited to the wastewater treatment plant on an ongoing basis. When UAJA applied for a PADEP Agricultural Use Permit, a certified letter was sent to 149 contiguous land owners, township supervisors and the County Planning Commission. The letter emphasized that biosolids recycling was a normal agricultural practice, explained that modern equipment would inject the liquid, and provided the name and number of the executive superintendent. A colorful WEF brochure was enclosed with the letter. All calls to the superintendent were promptly returned with an offer to tour the facility. UAJA board members and staff volunteered to attend a town meeting in Seisoltzville to answer questions. UAJA representatives were trained to answer questions effectively by: Expressing empathy with the resident's concerns, Gaining trust by emphasizing a local, good neighbor presence, Repeating key message points, such as: Agricultural use is recycling, Biosolids recycling is beneficial, UAJA's facilities use the latest technology to produce a safe product, UAJA's water quality professionals have the expertise needed to correctly, carry out the program. As a result, a majority of residents accepted the program. At a second meeting with the Berks County Planning Commission, a similar approach was used to respond to questions from the commissioners. Since UAJA's PADEP permit was issued, UAJA has received no odor complaints. Questions about the project from residents are answered by the Executive Superintendent with an offer to tour the wastewater treatment plant and to meet the caller at the farm site. UAJA board and staff have met with local newspaper reporters several times to educate them about biosolids recycling. Public acceptance tools developed by EPA and professional organizations are used whenever possible. UAJA distributes brochures prepared by EPA and WEF to explain 150 the science and policy behind land application of biosolids. UAJA loans its copy of WEF's "Biosolids Recycling" video to all interested parties." From the chapter "Wichita, Kansas: Working to Help Farmers Throughout the State:" Bringing agricultural landowners on board was the key to launching a successful land application program. This was achieved through a gradual demonstration process. Landowner demand for the biosolids product now is self-sustaining as a result of the high level of service provided by biosolids management staff." "Social Impact: The transformation of local attitudes toward biosolids and, more specifically, biosolids-derived compost in Centre County was profound. When the program began in 1992, UAJA had difficulty in finding adequate distribution for free material. Initial contacts with the local green industries and general public revealed considerable hesitance to try UAJA compost. The concept that biosolids could be composted and made suitable for home use was completely new to most area residents. After several years of hard work, product demand now exceeds supply. In fact, the enormous success of UAJA's marketing program has led to some ruffled feathers. At this time, supply to local customers is limited, despite efforts to give preference to

sewerage customers. The Authority's efforts have succeeded in changing public perception of biosolids compost from that of a waste to that of a beneficially reusable product."

Water Environment Federation. 2000(b). The Nature's Blend Story. *14th Annual Residuals and Biosolids Management Conference*. (1-12) Specialty Conference Paper. Water Environment Federation. February/March.

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Water Environment Research Foundation. 2002. *The Development and Implementation of Successful Outreach and Community Partnering Programs*, a seminar workbook developed for WEFTEC 2002 conference, Chicago, IL, September 29. **#1 Media, public perceptions, public participation, communications.** MeIncludes summaries and copies of workshop presentations by Ned Beecher ("Public Perception of Biosolids Recycling"), Linda Kelly ("Marketing for Success and Understanding"), Linda MacPherson ("Changing Mindsets: Are New Vocabulary and New Images Needed for Success?"), Mary McDaniel ("How to Talk About Water Reuse"), Juliana Birkhoff ("Development and Implementation of Successful Outreach and Public Partnering Programs"), Dale Manty ("Public Outreach and Co-Learning"), and Steve Frank ("Media Relations for Water Quality Professionals").

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Water Pollution Control Federation. 1989. The Sludge Pie. *Operations Forum* 6(11):20-21. November.

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Welch, Craig. 2000. Some Say Poplars Are Eco-Marvels. *The Seattle Times*. October 9. **#2.** Poplar farm in Everett is seen from highway where everyone can see what the benefits of biosolids applications.

Werner, Kathleen and Jacques Martineau. 2001. O.K. in my Backyard. *Water Environment & Technology*. September, pp. 118-125.

West, R. 1994. Western Carolina Regional Sewer Authority's Long-term Plan for Biosolids Management. In *12th Annual Residuals and Biosolids Management Conference*, Bellevue, WA: Water Environment Federation. 371-376. **#2, land application, excellent public acceptance, education program.** Western Carolina Regional Sewer Authority (WCRSA) operates 12 wastewater facilities in the upstate of South Carolina. During the past 10 years, the Upstate has realized tremendous growth, and the quantity of solids generated has increased with regional growth and more stringent NPDES permit requirements. As a result, Western Carolina implemented a long-range plan for biosolids management in 1994. This plan provides for 100% reuse of the biosolids generated by all WCRSA facilities, cooperative efforts between other municipalities in the Upstate to recycle their biosolids, and the development of a sustainable program that will provide for efficient management of all solids produced.

West, R. 2000. Biosolids Carolina Style--Over Easy Without the Grits! *Beneficial Use of By-Products: Regional Issues,* a conference at The Ohio State University, December 1.

Westell, Dan. 1994. Town turning sludge into germ-free fertilizer. *The Globe and Mail.* March 2. **#2. Pathogens. Landfilling. Heat drying. Education.** Expresses gain of diverting waste from landfill.

Wheelabrator Water Technologies, Inc. 1996? What New England Should Know About Biosolids Recycling and Land Application. Pamphlet.

Wheelabrator Water Technologies. 2000. Wheelabrator Defendants' Memorandum of Law in Support of Motion to Exclude Plaintiffs' Expert Evidence on Causation. Filing at Rockingham Superior Court, NH. **#3. Land application, concerned citizens, pathogens, chemicals.** Rebuts claims by David L. Lewis and others that biosolids were linked to death of Shayne Conner, Greenland, NH.

Whitcomb, J.L., J.M. Halstead, L.C. Hamilton, and G.O. Estes. 1994. Community Issues in Facility Siting: The Case of Municipal Solid Waste Composting. New Hampshire Agriculture Extension Station, University of New Hampshire. 18p. #**1, toxins, groundwater, compost, lack of oversight/trust, personal control.** In the fall of 1993, a public attitude survey was administered to 2,000 randomly selected households in Greenfield, Massachusetts and Keene and Rochester, New Hampshire. The goal of the survey was to determine the attitudes towards siting a hypothetical MSW composting facility. More than 36 percent of the 725 survey respondents said they would accept the facility, 33 percent said they might accept the facility, while 31 percent rejected the facility. A model was developed based on the economic utility theory. The results show that as distance to the facility, perceived economic opportunity, and waste involvement increases, the probability of facility acceptance increases. Perceived environmental impact, levels of no trust, age, and income negatively affected the public’s attitude. Women seemed less willing to accept a facility than men did. These relationships are critical pieces of the siting puzzle for waste managers, planners, and developers. Six general siting principles emerged from the research: to clearly establish need, to involve trusted officials, to address perceived risk, to generate support for waste management, to ensure public safety and local control before compensation, and to provide a predictable siting and permitting process. While none of these principles guarantee siting success, they could reduce the chance of failure.

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Windsor-Smith, Barry. 1993. *Sludge*, *Ultraverse*. The first edition of the comic book *Sludge.*

Wolz, Dan. 2000. The Bio-Chef and Living Creatively on the Other Side of the Nitrogen Cycle. *Beneficial Use of By-Products: Regional Issues,* a conference at The Ohio State University.

Wood, Paul. 1997. EKO Compost: A Maui story. *The Haleakala Times*. June 17. **#2. EKO Compost responds and cites support of Maui's mayor.** "The story was irresponsible because it alarmed residents without demonstrating that there is anything to be alarmed about."

Wrenn, Deanna. 2002. City's Compost is Piling Up. *Charleston Daily Mail*. March 2.

Wright, Robert J., W.D. Kemper, P.D. Millner, J.F. Power, and R.F. Korcak, eds. 1998. Agricultural Uses of Municipal, Animal, and Industrial Byproducts. U.S. Department of Agriculture, Agricultural Research Service, Conservation Research Report No. 44, 135 pp. **#3. Regulations, manure, air quality, composting, land application, nutrients.** This report emphasizes potential agricultural uses for major byproduct sources, including municipal byproducts (biosolids and solid residues), industrial byproducts (coal combustion residues and other selected byproducts), and animal manures. Individual chapters address each major byproduct source by providing information about amount produced, composition of the waste, current uses, problems and opportunities associated with agricultural and horticultural uses of the byproduct, and research needs. The audience for this publication includes scientists and administrators in research, education, and industry, and policymakers. "Environmental regulations developed and interpreted by individual states currently constitute one of the main barriers to increased land application of these materials."

Yeo, Eun-Ho; Clifford Scherer; and Alicia Marshal. 1997. Social Influence and Socially Desirable Risks: An Exploratory Study. Ithaca, NY: Cornell University Department of Communication. One of the common assumptions in risk perception studies is that awareness and knowledge about a high-risk situation will tend to cause individuals to avoid those high-risk behaviors. This model, based on a rational cognitive decision-making approach, assumes that high-risk behaviors are undesirable. However, some high-risk activities such as recreational skydiving and skiing are considered desirable by a special segment of the population. In this instance, the assumption has been that individual personalities largely determine participation in these high-risk behaviors. The study reported in this paper examined the possibility that under certain circumstances high-risk behaviors may not only be desirable, but that the social system may override individual perceptions of risk and rational decision-making. The study utilized survey data from a sample of young adults prone to engaging in a variety of high-risk behaviors. Results of a path analysis suggest that the social characteristics of the event play an important role in predicting the relationship between risk perception and risk behavior.

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WASTEWATER UTILITY

Alabama
Montgomery Water Works & Sanitary Sewer Board

Alaska
Anchorage Water & Wastewater Utility

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Gila Resources
Glendale, City of, Utilities Department
Mesa, City of
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Arkansas
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Nov 04