Chapter 1 – Public Acceptance

Various barometers may be used to measure whether or not a biosolids program is following good management practices. One is technical, focusing on equipment performance (i.e. the mechanical infrastructure) needed to run a good program. Others revolve around personnel, regulatory compliance, and overall program logistics (i.e. coordinating all program elements). But one of the most critical, and most often overlooked, barometers is public acceptance of the biosolids management program. 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 the solids. Too often, however, public acceptance doesn't enter the picture until there is a problem with the biosolids management program.

The goal of this chapter is to foster the "mindset" that public acceptance is an integral component of good biosolids management practices. It is perhaps one of the most important considerations of any biosolids management program, especially if land application is selected as a management method.

At the core of this mindset is putting public acceptance issues and strategies at the same level of importance as other elements of a biosolids management program. This means that throughout the decision-making and design processes, impacts on public acceptance must be addressed.

Typically, the need for public acceptance is most directly associated with beneficial use (land application) programs. Beneficial use programs often put biosolids into the public arena more broadly than incineration or disposal, since the biosolids are used in more diverse geographic areas. However, any biosolids management method must consider issues such as truck traffic and air quality/odors, both of which affect public acceptance. More importantly, addressing public acceptance from day one goes a long way toward building flexibility into a biosolids program because managers have laid the groundwork -- the infrastructure -- for gaining public support.

This chapter is structured around the issues that need to be considered in developing an effective public acceptance strategy. These issues are:

- Shaping public perception
- Analyzing operations
- Dealing with odors
- Developing effective communication
- Environmental management system connection
- Message development
- Maintaining support

1.1 Shaping Public Perception

The public's perception of biosolids can make or break any management program, no matter how well it is run. Biosolids managers should take advantage of every avenue and opportunity to have a positive impact on that perception.

The foundation for that effort is a well-run operation, one that has a basic commitment to avoid negative impacts on the community and the environment. A well-run program provides the foundation upon which public support can be built. It gives you the confidence to go out to your community and emphasize the benefits of your program to win public support.

To succeed in community outreach, everyone involved in the biosolids program must understand and believe steadfastly in its benefits, and convey them to the public. Two important categories are environmental and community benefits.

1.1.1 Environmental Benefits

Connecting wastewater treatment (and therefore biosolids) to the goal of clean water is a fundamental message to take to communities (Powell Tate Communications 1993; USEPA 1994). Wastewater treatment is specifically designed to prevent negative environmental and public health impacts, and managing biosolids from that treatment should be understood in the same context. The link with clean water is a significant community benefit that people can relate to. Issues surrounding biosolids management (including potential odor and nuisances) are more readily resolved if communities appreciate why we produce biosolids in the first place.

As part of the clean water message, the public needs to understand the role of industrial pretreatment in the wastewater treatment process. The pretreatment program directly determines biosolids quality and is not well understood by the general public – or sometimes by biosolids managers. Public outreach should include specific information about the requirements and implementation/enforcement of the local pretreatment program. The basic principle of pollution prevention is at the heart of industrial pretreatment. Industry has learned, especially over the past 15 to 20 years, that it makes good business sense to minimize the amount of pollutants that go out of their pipe by recapturing and recycling them within the industrial process. Capital investments in industrial recycling processes provide an excellent return on investment to companies, and have gone a long way to improving biosolids quality. Industrial pretreatment practices and household hazardous waste programs should be showcased as part of the biosolids quality assurance program.

Land application programs should highlight the beneficial impacts that result from biosolids use. For example, biosolids provide nutrients and valuable organic matter to improve soils. They can play a critical role in remediating contaminated or disturbed sites that are eyesores in the community.

1.1.2. Community Benefits

Wastewater treatment and thus biosolids management are a critical component of any economic development effort. Wastewater treatment enables residential and industrial growth. It is important that the public understand that connection, especially if industries are providing jobs to a community.

Biosolids managers also need to have the mindset that a well-run biosolids program can benefit the community just as a solid waste recycling program does. The public has been

educated about the importance of recycling, and most citizens willingly take on the responsibility to participate in programs. Unfortunately, wastewater treatment is usually an out-of-sight, out-of-mind infrastructure, an “assumed” service. Often, the public’s only connection to that service is flushing the toilet and sending the dish or bath water down the drain. Building a positive perception for biosolids requires that a connection be made to this assumed service, that biosolids result from this process and must be managed, just as the trash a household generates must be managed.

Communities located at a distance from the treatment plant also need to be part of a facility's outreach program. Agricultural application, in particular, often operates in different communities at varying distances from the treatment facility and in different political jurisdictions. Outreach efforts should be designed to be flexible enough to work in various settings -- from rural agricultural to rapidly developing suburban areas. Biosolids managers will need to become familiar with these diverse communities, and remain flexible enough to establish rapport with all of them to maintain a successful land application program.

1.2 Analyzing Operations

Operators should first analyze the impact of their design and operational decisions on the public

With public acceptance as a core component of wastewater treatment and biosolids management, operators should first analyze the impact of their design and operational decisions on the public. Each decision, in other words, should be evaluated for its nuisance potential and the degree of flexibility that decision provides in terms of ultimate management options. Engineering considerations based only on efficiency and conformity to regulations will seldom meet all the needs of neighbors and the public.

Some questions that should be answered in selecting biosolids handling alternatives may include:

- Is there a connection between processing and odor generation at the biosolids management facility?
- What impact will dewatering have on management options?
- In transporting and storing biosolids, what are the possible public impacts resulting from vehicle traffic, spills, odors and vectors?

Another important consideration is developing a recordkeeping and biosolids tracking systems -- not just for regulatory compliance, but for achieving public acceptance as well. Accessible and understandable tracking systems give operators the ability to demonstrate that they know exactly what is going on in their programs. The information contained in project records is a valuable source of data to provide to various segments of the public, both on a regular basis and to address specific concerns as they arise. This linkage in turn builds public confidence, as well as the confidence of local officials and regulators.

Each biosolids management alternative -- landfilling, land application, incineration and surface disposal -- has its own set of process-specific issues that affect public acceptance. Biosolids managers should be prepared to make the appropriate connections described in this chapter to

help create the public acceptance mindset.

1.3 Dealing with Odors

Probably no issue in biosolids management is more important than addressing odors. Every biosolids processing and management technique has some odor associated with it. Because current treatment and handling methods cannot eliminate odors, managing operations to minimize odors must be a fundamental consideration for all biosolids programs.

Odors are, in short, one of the biggest red flags when it comes to public acceptance. Since no biosolids management practice is immune from public issues relating to odors (unlike, for example, pathogens, which are primarily connected to land application of biosolids), they are a universal management reality.

For a long time, many wastewater treatment plants and biosolids facilities had the “luxury” of being in relative isolation, away from housing developments and industrial parks. That is no longer true in many places, with neighbors often a stone’s throw away from the operation. Even when the operations are in areas with “compatible” neighbors, e.g., farms or industrial facilities, odors may be linked in the public mind with the biosolids, even if operation isn’t the source.

These realities translate into the need for an effective outreach effort that addresses odor issues and includes budgeting resources for both preventive and corrective actions that may be required. Such corrective actions may be needed within the wastewater treatment plant, the biosolids management program, or both.

While odors primarily fall into the nuisance category in the public’s mind (and nose), they also may raise public health concerns (i.e., if it smells this bad, it must be bad for my health). Discussing the odors related to biosolids management early on, explaining the absence of health effects, showing how an operation deals with odor incidents, and creating avenues of communication (e.g., hotlines, response teams, advisory committees that include neighbors) is key to gaining public understanding and support.

In the case of agricultural application, the transitory nature of biosolids operations and the context of other farming practices can sometimes serve to mitigate public concerns about odor and other potential nuisances. This usually will not be true if the biosolids processing and treatment are inadequate and result in highly odorous material. Another major factor with land application odors is the fact that most such programs operate in communities located at some distance from the treatment plant. Additional discussion of the odor issue in land application is contained in Odor Control in Land Application Programs, Chapter 11 of this manual.

The pathogen and vector attraction reduction (disinfection) processes required by biosolids regulations are designed to reduce (but not eliminate) odor potential. Further odor reduction may be accomplished by decreasing the amount of organic material in the biosolids or by otherwise preventing its decomposition by soil microbes (e. g., adding alkaline material). In most cases, biosolids managers must provide a greater degree of treatment (disinfection) than is required to meet pathogen and vector attraction reduction regulatory standards if they plan to meet the

aesthetic standards needed for acceptance by neighbors and the public.

In the case of land application, odors from decomposition of adequately treated biosolids are generally much less noticeable and persistent than odors from the decomposition of raw organic materials, such as animal manure. Applying biosolids at crop nutrient rates using the management practices required by regulations also reduces odor potential. It should be noted, however, that biosolids odor is qualitatively different from that of other commonly used nutrient materials, and this unfamiliarity must be addressed for people to accept biosolids application.

Unfortunately, meeting regulatory requirements for protecting human health and the environment does not guarantee adequate odor control. This concept is difficult for many biosolids managers to accept, and often even more difficult to address with decision-makers who control funding and want to minimize costs. Persuading those decision-makers to commit the additional resources to address a non-regulatory issue can be challenging.

Having an odor management plan that the regulatory community supports -- with public input -- can enhance public acceptance. The plan identifies odor sources, odor management systems for each source, corrective actions if problems arise, and public communications linkages. This plan can be incorporated in a facility's Environmental Management System, and is a tool that helps facility employees and biosolids managers identify "checkpoints" and practices that will enable them to better address community needs as well as demonstrate their commitment to good practice.

1.4 Developing Effective Communication

Every facility/project needs to have a public acceptance strategy and the resources to carry it out. Staff at the wastewater treatment plant, the biosolids management facility, and use/disposal sites should be involved in the effort outreach (helping to create the public acceptance mindset), which can be divided into Communications Approaches and Communication Tools.

1.4.1 Communication Approaches: Proactive Reactive

Communication generally falls into one of two categories: proactive and reactive. Proactive strategies focus on building a positive public perception for biosolids, which in turn leads to public acceptance for the program. Reactive methods are often used during difficult or crisis situations.

Practice Strategies

One of the basic principles of proactive communication is the need to recognize and be sensitive to community questions and concerns. Regardless of the management option being used, the "good neighbor" approach is essential. If some impact is felt from the facility or practice, local citizens will be much more accepting of that impact if they already have a positive relationship with the biosolids practitioner. To establish such rapport, biosolids staff and managers should know and understand their local communities' views and issues. All staff members should be imbued with the concept that they have a real obligation to be aware of and sensitive to the communities they may affect.

To respond to community questions and concerns, biosolids managers should be prepared to address:

- Understanding of wastewater and biosolids treatment processes
- Measures taken to establish and maintain quality control
- Properties of biosolids
- Regulatory requirements
- Nuisance potential
- Protection of public health and the environment
- Local history and experience with biosolids or related issues (e. g., solid waste)

Each facility/project should assess the issues that are likely to be important to their community when developing public outreach. In all cases, this outreach effort needs to be made as early as possible and appropriate communication methods initiated with the various segments of the community's members. Every project should aim to become accepted and credible within every community affected by the project. Such acceptance depends on:

- Establishing local alliances
- Responding to specific concerns
- Providing empathetic staff as contact point(s)
- Providing credible information to community members
- Willingness to listen, not just talk
- Offering open and honest dialogue
- Providing ways for the community to continue to participate in the project

A successful communications approach must reflect an understanding of human nature and motivational factors, especially with regard to actual and perceived risks. Biosolids managers should do more than just present scientific data to address the public's concerns related to risk. Openness and personal credibility play a big part in determining whether the public believes the messages about low risk from biosolids. A respected independent source can be invaluable in establishing credibility. Invest the time to identify and understand these issues before a "crisis" occurs so that facility/operational staff can respond appropriately. Use that understanding to improve program management and public acceptance efforts.

Reactive Strategies

Reactive strategies are necessary because no matter how much groundwork is laid and outreach is done, there will be situations that happen in a crisis mode, as well as ones that cannot be anticipated or predicted. Reactive strategies are much more effective, however, when strong proactive approaches have been developed and carried out, and a trusting relationship established.

Predictable "crises" may include a biosolids transport vehicle turning over on the highway or an odor incident. Biosolids managers can plan approaches to react to these situations. Less predictable crises will need a more general response plan, with the details to be developed according to the specific situation at hand. For example, for any situation

that involves questions about public health, the response team may include a local physician who knows about biosolids and understands possible public health risks and exposure. The key is to have a crisis response plan that can be carried out immediately, and staff people trained to respond to community concerns and the media.

1.4.2 Communication Tools

An effective community outreach program must be active, not passive. Opportunities abound to present information to the community, and successful biosolids programs take advantage of these. Presentations to local groups, participation in community events, facility/operations tours, distributing educational information, and media outreach are some ways to develop community awareness and acceptance. In many cases, some type of state or local regulatory requirement also provides an opportunity (through a public meeting or notification process) to interact with the public. Biosolids managers should make every effort to use these opportunities to provide factual information and assure communities that communication links will be maintained.

Table 1.1 lists suggested components (tools) of a public information program.

Media contact	news releases and informational materials describing biosolids management practices in general as well as project specifics
Written and Audiovisual Materials	detailed manuals, specific project information, brochures, question-and-answer pamphlets, news reprints and slide presentations (3, 4, 5, 6)
Public Meetings	public information, regulatory, and special interest groups
Tours	at sites and in conjunction with the treatment of wastewater to discharge clean effluent
Regulatory Liaison	to provide regulators with technical and operational information beyond the minimum required for the permitting process; regulators should also be included in non-regulatory meetings, field days, tours and other community outreach programs

All of the components require resources, and biosolids managers must include and be prepared to defend their need for funding such efforts as part of their organization's budget allocations.

Some audience-specific communication tools include:

- Biosolids users: Provide information regarding their type of biosolids management (as written material, videotapes, orally or otherwise as appropriate), and keep them up-to-date as you become aware of issues and questions that may arise and be asked of them by their neighbors, community members, the media or the general public.
- General public: Offer tours, demonstrations and field days. Develop outreach

programs for schools and public events such as community festivals.

- Public officials: Be sure to educate public officials about your biosolids management operation. In times of crisis, you do not want people to whom the public looks for answers to have no knowledge of your program. When not informed, these individuals can be primary sources of misinformation.

Sponsor special tours, demonstrations and field days for public officials. Make sure you give them a brief -- and understandable -- summary of your program's system costs and benefits. Educate officials about biosolids management practices so they are aware of potential impacts that their decisions may have on your program changes in (e.g. zoning status from agricultural to residential).

Develop checklist(s) of officials you need to reach and update it regularly; schedule meetings or other contacts with officials on a predetermined frequency; evaluate effectiveness of there efforts (this can be a component of an Environmental Management System (EMS) -- see discussion below).

Educational materials should be updated as necessary, and reflect specific issues and concerns in the community. Treatment plants that manage biosolids by incineration or disposal will likely need materials focused on a more specific audience (plant neighbors), and may feel less need to work directly with the general public. However, these facilities should maintain some avenues of communication both for general educational purposes (on wastewater treatment) and for specific problems that may arise (e.g. odors or spills). Laying the groundwork for public support also makes it easier should the need arise to manage biosolids -- even if only for the short term -- in a different way. If that alternative involves any kind of approval and/or permitting process that includes the public, it is wise to have established communication channels prior to any operational mishap or public relations crisis.

1.5 Environmental Management System Connections

Public outreach can be improved in several ways by adopting the Environmental Management Systems (EMS) approach, which if selected, should be integrated into the overall effort to improve public understanding and support for a biosolids management program. An EMS, because it is voluntary on the part of biosolids generators, offers a unique opportunity to set forth the commitments made to implement practices that go beyond just meeting regulatory requirements. The "transparency" of the EMS approach is vital to public understanding and support for biosolids programs.

An EMS benefits the public for a number of reasons. First, this approach can "institutionalize" the mindset in program managers and staff, no matter what aspect of the operation they are involved in. These individuals also can work within their organization to include public acceptance efforts as line items in the wastewater treatment plant's budget.

Second, an EMS can help build the public's confidence in the biosolids management program by providing documented systems that demonstrate how performance goals are achieved.

Third, an EMS can be a vehicle for members of the public to have input into the program with regard to their concerns. It can serve as a tool for bringing facility managers, plant neighbors, community organizations and others together to establish realistic and acceptable operational parameters.

Fourth, an EMS sets a level of operational performance for staff and contractors. Creating a mechanism for the public and local officials to have input into performance standards will boost confidence in third party oversight and verification mechanisms as well as understanding and support for regulatory requirements.

Fifth, the formal review component of an EMS provides an excellent opportunity to share information with decision-makers within and outside an organization. It also can be used as the basis for providing information to the media, legislators, local officials, and organizations that are allies of a biosolids program. Information about environmental and other benefits can be incorporated in this information-sharing process.

Lastly, and perhaps most importantly, the independent third party verification included in an EMS offers a tremendous opportunity to insure that someone outside the wastewater treatment/biosolids agency organization itself is carefully "minding the store". If your community and public understand this and are given the opportunity to participate in the EMS process, you will have an exciting and invaluable way to demonstrate to them that their issues and concerns are being addressed in your biosolids program.

Educational resources for community outreach and communication are contained in the references to this chapter and in various state and regional biosolids publications. Additional sources may be found in the references contained in other chapters of this Manual. Information from these references can be used directly or adapted as needed in response to specific community needs.

1.6 Message Development

Biosolids management projects often encounter apprehension and sometimes opposition from the public for a variety of reasons (Forster, D. Lynn 1986; Forste, J.B. and Machno, P.S. 1994). The attitudes that fuel such opposition are now recognized as a significant factor in developing biosolids use programs. Appropriate and effective communication is essential to adequately address concerns relating to biosolids. The benefits of good biosolids management as well as specific environmental, health and agricultural considerations must all be addressed for a biosolids management program to succeed.

The community attitudes that constrain biosolids programs are important considerations to be addressed along with federal, state or local regulations that govern biosolids. Concerns about health risk, nuisances and environmental quality are often coupled with political and attitudinal considerations that are not based on either science or regulation. Much of the information addressing the issues associated with biosolids management has been developed for land application (beneficial use) options. However, the data and methods used to assess risk were applied to disposal and incineration methods as well. Biosolids managers employing these

methods readily can use the communication principles and, with some modification as needed, the messages used to address land application issues discussed in this chapter as part of their public acceptance efforts.

The ways in which biosolids managers can affect the beliefs and opinions of community neighbors depend, to a large degree, on the attitudes that both parties bring to the table. Advocates and opponents alike have preconceived ideas and priorities that must be reconciled. The following discussion on risk communication and the examples provided focus on the attitudes of the parties involved, the methods by which they communicate with one another, and the messages they convey to one another. The communication process is a two-way street, and biosolids managers are negotiating for acceptance as well as providing information.

1.6.1 Risk Communications

To transfer information and be responsive to questions and concerns, biosolids managers must adopt methods (both operational and communications-related) that address the critical components essential to developing positive links to their communities. Biosolids managers often find themselves in a defensive posture due to their reliance on technical and scientific data in their attempts to address public concerns and fears. They are usually more familiar with risk assessment and risk management than with the skills that enable them to communicate effectively about these subjects. Risk communication has become more significant in recent decades as the public became more interested in business and government activities that affected them, and more demanding of their right to know about and participate in those activities. In many instances, the concerned public has influenced risk management decisions that may not have been scientifically sound or in society's best interest. Nevertheless, the reality of public participation in decision-making means that biosolids managers must become more active in risk communication if they want to avoid wasteful decisions that affect their bottom line.

To achieve a positive outcome, biosolids managers must engage in an interactive process with their public and examine some of their management decisions based on input from the public during the communication process.

It is also critically important that facility operations and management practices be sensitive to the issues that are important to local communities. To address these issues, present your management practices and demonstrate their safety when conducted under existing regulations. Frequently, this demonstration involves discussion of the science of risk assessment, particularly the risk assessment process used in developing the 40CFR Part 503 Rule (Part 503 Rule). Refer to Appendix A for additional information on the Part 503 Rule. Critics often focus on what they perceive to be deficiencies in rulemaking -- a criticism that can be leveled at virtually any environmental regulatory program. Policy choices inevitably play a role in establishing environmental regulations, and because of the unprecedented complexity of the Part 503 Rule standards, some individuals may question the conclusions. However, the vast majority of qualified scientific opinion supports the conclusions that are the basis of the Part 503 Rule. Biosolids managers must understand and effectively communicate their confidence in the scientific integrity of biosolids regulations and practices.

Public outreach efforts must also recognize that scientific data and information about risk assessment do not necessarily result in public acceptance, since perceived risk is just as important (or more so) to the concerned individual than actual risk. The perception of risk has repeatedly been shown to be very different from actual or scientifically determined risk. Issues of control, fear of industrial contaminants, lack of familiarity, and inflammatory press can and do shape public perception of risk. While the process and findings of scientific risk assessment should be understood and communicated, do not expect science alone to win over people who have emotional reactions and concerns about biosolids management. However, perceptions about many subjects can and do change in time -- remember when wetlands were just swamps to be drained? Accurate, credible communication efforts that give people an opportunity to be heard and understood can help change their opinions and perceptions.

Public acceptance efforts must include an ongoing method for maintaining the flow of information and keeping communication lines open among all interested parties. Concerns about health, odor, groundwater contamination, decline in property values and other legitimate issues can be anticipated and defused in a well-managed public acceptance program. Biosolids managers must continually set forth the beneficial aspects of their biosolids program.

The messages conveyed by outreach programs must be credible, understandable to each audience, and responsive to their concerns. In the case of biosolids, credibly addressing risks relies on the extensive data compiled by scientists during the last several decades and used to develop the Part 503 Rule. Efforts to communicate with concerned individuals, groups and institutions should include discussion of the quality standards for safe biosolids management, which are based on protective assumptions about the impact of biosolids on the environment, animals, crops, and humans. However, as noted earlier in this chapter, these messages must be presented with an empathetic approach that acknowledges and speaks to the underlying emotional issues, even if these issues appear to have no valid scientific basis. Careful and genuine listening will enable you to discern what people are really saying and thinking, and respond credibly to their concerns. Biosolids managers should understand thoroughly the information they provide in response to citizens' concerns and be prepared to explain this information in as much detail as their audience needs.

1.6.2 Information Examples with Land Application

The most common concerns related to land application of biosolids are water quality; synthetic organic compounds; pathogens, and trace metals. The examples given below provide suggested perspectives that can help to address concerns expressed by communities. The challenge is to present such information in easily understood terms tailored for the specific audience you are addressing while retaining scientific integrity and credibility. Try to avoid oversimplifying, while accurately conveying the basic principles relating to each issue. These examples should be modified to suit specific audiences and must be accompanied by a basic understanding of the scientific issues.

Water Quality

Water quality protection in a land application program addresses the most likely potential source of water pollution from applying biosolids as a nutrient source: the nitrogen contained in the biosolids. Nitrate, the mobile form of nitrogen, is released slowly from organic material such as biosolids and therefore moves with soil water more slowly than does soluble nitrate from chemical fertilizers. For agricultural use, application rates are based on the calculated amount of nitrogen the crop will use, coupled with estimates of the decomposition rate of organic nitrogen contained in biosolids to forms available to crops (mineralization). Nitrogen taken up by crops is not available for leaching to groundwater or surface runoff and the basic agronomic principle of matching as closely as possible biosolids applications to the nitrogen need of the crop assures protection of groundwater.

Biosolids also are managed to prevent undesirable levels of phosphorus buildup in soils. Unlike nitrogen, such levels are not identical with the amounts taken up by crops, since phosphorus becomes less mobile over time through soil reactions. Biosolids are also managed to prevent undesirable levels of phosphorus buildup in soils. Unlike nitrogen, the soil levels at which phosphorus becomes mobile are generally much higher than the amounts needed to feed crops and those environmentally significant levels represent the appropriate limits. In addition, the phosphorus contained in biosolids is generally less soluble (bioavailable) than that contained in animal manures and chemical fertilizers, and thus less likely to cause surface water enrichment.

With respect to most trace metals potentially present in biosolids, water quality is protected by the low mobility of these pollutants in soils. The concern in this case is based on possible transfer to plants, animals and humans, since these components of biosolids remain in the upper layer (plow layer) of the soil.

Applying biosolids can actually help improve water quality. The natural organic matter in biosolids helps bind soil particles to improve soil structure, making it more resistant to erosion. Adding biosolids to soil also increases the soil’s ability to retain water. The same characteristics that can improve soil structure also prevent the movement of biosolids applied to the surface (for example, on pastures where biosolids are not incorporated). Analysis of runoff water from pastures has shown that surface-applied biosolids are less likely to pollute than are animal manure or chemical fertilizers.

Organic Compounds

The possible presence of organic compounds is sometimes a public concern when biosolids are applied to land. Based on nationwide United States Environmental Protection Agency (USEPA) surveys of treatment plants, the maximum concentrations of organic pollutants potentially of concern in biosolids are below amounts found to produce a toxic effect when applied to the land. By way of comparison, when contained in biosolids applied at agronomic rates, these compounds will typically be applied in amounts 10 to 100 times lower than the amounts applied at recommended rates for agricultural pesticides. They also would have to be directly ingested to have any potential effect on consumers, since plants do not absorb them to any significant degree.

While not each and every individual organic compound potentially present in biosolids has been extensively tested on agricultural land, information on the behavior of various classes of compounds (i.e., those that are chemically similar and behave in similar ways in the environment) can be used to assess their impacts. This information can be coupled with data on the concentrations of the compounds that are of potential concern through various environmental exposure routes to establish risk. For the compounds potentially of concern in biosolids, independent scientists conducted detailed risk assessment as part of the development of the Part 503 Rule. When evaluated in light of actual concentrations found in biosolids, a negligible level of risk was found.

Pathogens

Risk of disease (like the concern for ingesting organic priority pollutants) is negligible when treated biosolids are applied to land. Processes to reduce pathogens (typically digestion or lime stabilization) are required before any biosolids can be applied to land. These disinfecting processes do not sterilize biosolids. However, disease-causing organisms are reduced to such low levels that they do not present risk of infection or disease, especially when combined with the required crop management practices for land-applied biosolids.

If some pathogens remain in biosolids following the required stabilization processes, they die off in the soil environment, and their movement through soils is very limited. Good management practices in applying biosolids (e. g., setback distances) also serve to prevent runoff of surface water that might contain pathogens.

Not only has there never been a demonstrated instance of human or animal disease resulting from biosolids that are recycled in accordance with regulations, but epidemiological evidence with real people living where biosolids are applied verifies that this practice does not represent a health risk (USEPA 1985).

***Example**: The 14-pathway risk assessment approach contained in the Part 503 Rule includes specific consideration of the plant uptake of metals that could result in either phytotoxicity (damage to the plants themselves) or result in concentrations that would be undesirable in the human food chain. The risk assessment assumes that metal uptake is directly proportional to cumulative application rates of biosolids. This results in a very conservative assessment because field data establish that the relationship is, in fact, nonlinear (that is, uptake plateaus over time as shown in Figure 1.1. Assumed vs. Actual Metal Uptake from Biosolids Amended Soils). Since the actual uptake is lower than the assumed rate used as the basis for regulation, the Part 503 Rule overestimates metal uptake and thus provides a greater degree of protection.*

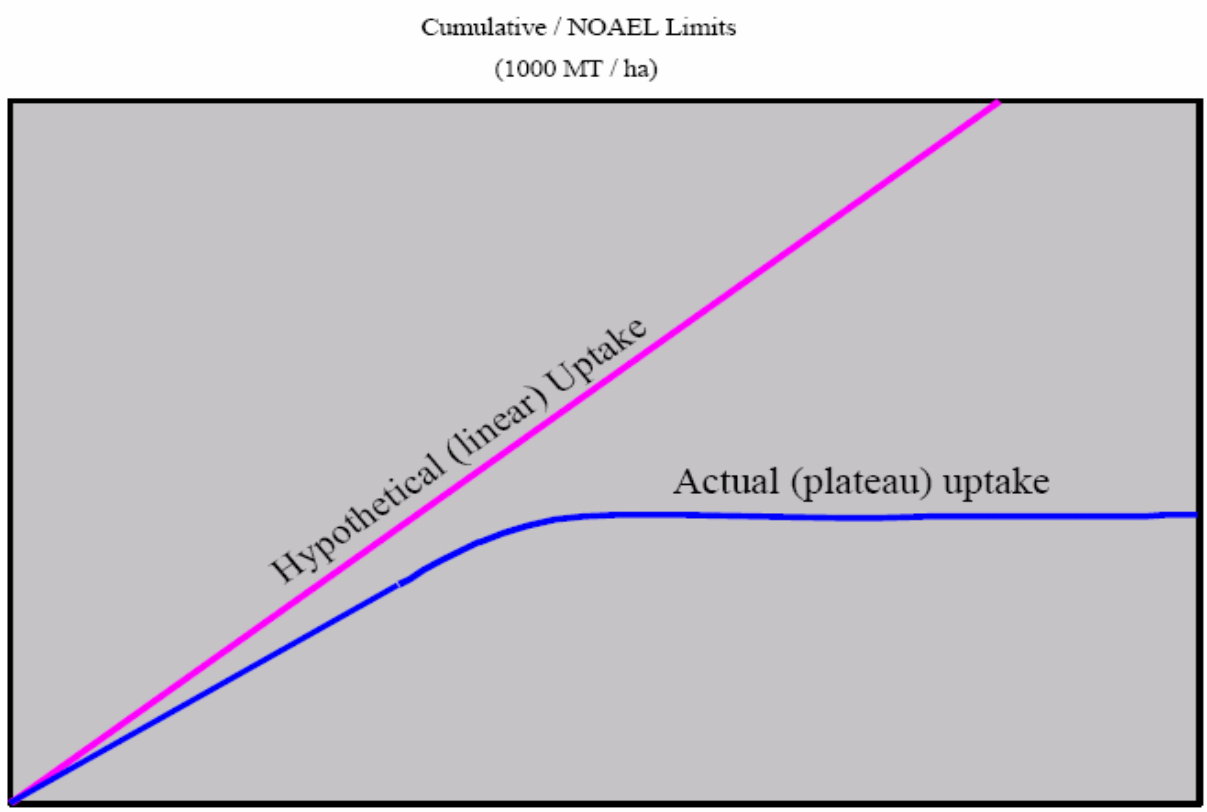
Using a linear model for plant uptake is one of the many conservative factors built into the risk assessment used to develop metal limits for the Part 503 Rule. Discussion of other risk assessment pathways may be found in Chapter 3 of this manual and in the technical support documents developed for the Part 503 Rule.

Trace Metals

Perhaps the best known consideration in applying biosolids to land is the management of trace metals contained in biosolids. As mentioned in the discussion on water quality above, these metals are regulated based on well-known behaviors in soils, and to prevent uptake by crops to protect the food chain. Regulatory standards establish the amounts of trace metals that may be applied to soil to allow unrestricted future use of each site. In addition, the amounts of metals in biosolids-treated soils have been established by regulation to protect individuals that might actually consume biosolids from land application sites (by soil adherence to crops or directly).

For the Part 503 Rule, USEPA established management practices and numerical limits (standards) to safeguard public health and the environment by examining the probability of individuals' exposure to pollutants from biosolids. These standards were based on data provided by researchers throughout the United States. The standards also include special populations at greater risks (e.g., small children playing in gardens where biosolids have been applied). Exposure assessment (mathematical) models projected the effect on an individual receiving maximum dose throughout an average life span of 70 years. All the models contain assumptions that are highly conservative (protective).

Figure 1.1 Plateau Effect



1.6.3 Presenting Messages Effectively

Factual and technical messages should be presented creatively and compellingly if they are to resonate with communities and the general public. Fundamental to this approach is the need to listen carefully and empathetically to questions, concerns and doubts. There are a number of ways to accomplish such listening, but all require an approach that is more people-oriented than the methods typically used in the past. Establishing an atmosphere of mutual respect from the beginning is the most effective way to win people's trust, and requires honesty and sensitivity.

> *Biosolids managers should insure that they and their staff members who are responsible for community outreach have the necessary understanding and skills to deal with people who are uninformed and may have been exposed to negative points of view about biosolids.*

1.6.4 Developing Outreach

As biosolids programs are becoming more publicly visible, interest in such programs is intensifying. Public meetings, field days, and media coverage all can help to provide the informational outreach needed to operate a program. These efforts are even more important given the greater likelihood that inaccurate, negative information will reach more people than in the past.

Outreach materials and ongoing efforts to achieve public acceptance should include such messages as environmental benefit, agricultural benefit and the protection of the environment, health and safety embodied in existing practices and regulation. Achieving public acceptance includes outreach efforts to the general public, and specifically developing local community support from the outset. In many cases, such support will only be forthcoming if biosolids programs are managed to go beyond the minimum (i.e., regulatory) requirements. One example of such an approach is to include voluntary water well monitoring as part of a land application program. Not only does this effort serve to reassure farmers and neighbors, the information acquired can be very useful in addressing any future questions and concerns about water quality.

> *"Going beyond the minimum" will only succeed if it is based on the need of the community as seen by the community, not just from the biosolids managers' perspective.*

The Environmental Management System (EMS) approach of voluntarily implementing practices that are community-sensitive is especially important for effective outreach. Such practices may include communication as well as operational commitments, and should be developed individually in response to each community's needs and desires. Two-way communication and effective listening are means by which mutually acceptable goals for biosolids management can be determined. Meeting with citizens' groups and other regular points of contact can be very effective in such communication efforts.

To ensure ongoing and up-to-date scientific information is available for outreach efforts, methods for compiling data and exchanging information on beneficial use issues are

critical. Research in related areas should be evaluated for its relevance to the issues surrounding biosolids management. Efforts to gain new insights and data should be accompanied by a commitment to provide this information to the community and to interested members of the general public.

Some specific areas to address in an outreach program are local concerns; aesthetics – including odors; traffic; storage; and quality assurance.

Addressing Local Concerns
It is critical that everyone involved in biosolids projects be responsive to the underlying concerns many people have, regardless of their scientific validity. They must be particularly sensitive to the impacts of local nuisance factors that may be associated with biosolids (e. g., truck traffic and odors). Even if people's fears and concerns are not based on scientific evidence, they are nonetheless real and must be respected to get at the root of issues that can impede success and address them effectively. The listening and communication skills discussed in this chapter are most important in addressing local concerns.

Regional biosolids organizations that have been formed in several parts of the country can facilitate exchange of information and experiences in various geographic areas, and provide mutual support. By sharing the same concerns, issues, and solutions among biosolids managers, regulators and citizens, a common understanding can replace skepticism and misinformation. The efforts of regional groups offer an opportunity to neutralize and prevent opposition with community-sensitive outreach, credible science, and good operational practices.

Addressing Aesthetic, Considerations
One of the most important factors in a biosolids management program is the prevention of aesthetically unacceptable or nuisance conditions. While these factors may have no environmental or health effects, they are critical to achieving public approval. Truck traffic, dust, and especially odors must be managed and minimized, as discussed in Chapters 8 and 11 of this Manual, and in section 1.3, above, in this Chapter.

It is particularly important that biosolids managers be aware of the complexity of human responses to odorous chemicals. As our control over environmental aspects of biosolids management increases, we are faced more and more with questions about more subtle aspects of environmental exposure to odors. Human responses to various chemical concentrations consist of both physiologic responses (direct, measurable physical or chemical changes) and indirect, cognitive responses (influenced by the brain) that are difficult to quantify. In order to address complaints from workers and/or neighbors, biosolids managers will need to have better understanding of the interaction of direct as well as indirect, induced responses in individuals. Research to address such issues is ongoing (10), and the results should be helpful in responding to public concerns and developing communication methods that can describe odor responses in ways that enable people to modify their perception, and therefore their physiologic reaction to odors associated with biosolids. This approach must of necessity be integrated with the efforts

made to develop technological solutions to controlling odor emissions. This combined approach offers the greatest chance for successfully addressing odor issues in biosolids management.

> Biosolids managers must become aware of this variability in human odor responses and develop their odor control programs accordingly.

Since individuals vary greatly in their response -- and even in their ability to detect -- odors it is impossible to establish a one-size-fits-all odor standard. Scientific understanding and better methods for quantifying odors objectively will help in this effort, but ultimately standards relating to odor will be determined by acceptability to the public.

Increased public sensitivity means that the processing and management techniques for biosolids must be accompanied by the communications skills described in this chapter in order to achieve public understanding of the meaning and significance of odors. Since odor duration is often a significant factor in determining public acceptability, measures such as immediate incorporation or subsurface injection of biosolids can be employed in some cases. Attention to atmospheric conditions such as temperature, humidity, and air inversion patterns may provide a way to schedule operations to minimize odors. Selecting sites for application that are more remote from neighboring homes and businesses also can help to reduce odor impacts. All of these measures, however, must be accompanied by the commitment to processing the biosolids to the degree necessary to address community sensitivity. Although we may not be able to reduce odors to zero, we can improve performance to a point that satisfies our particular public.

Traffic Considerations

Traffic considerations should be addressed during the planning phase of any biosolids operation. The larger the project, the more sensitive this issue can become. Biosolids managers should provide as much flexibility as possible in scheduling truck traffic to avoid prolonged or excessive impact on neighborhoods. Scheduling hours of operations to minimize impacts on the community is important for most projects. Having alternate traffic routes is especially important when using secondary or less -- traveled roads. For many agricultural programs, using traffic control measures (e. g., signs and flags) minimizes the impact of the temporary increase in traffic entering and leaving farm roads. In addition, a brush or water truck can be used to remove soil tracked onto roads at farm entrances.

The bottom line, as with most aesthetic concerns, is the need to be aware of the sensitivities of other people, and to make every effort to accommodate those sensitivities in your operations.

Storage Considerations

More intensive methods may be needed to address the concerns of neighbors and the public around areas where large amount of biosolids remain before being used or disposed. Treatment processes may need to be modified to meet the aesthetic standards

appropriate for biosolids management.

A good example of a processing modification is the need to increase alkaline addition for lime-treated biosolids in order to keep pH elevated to a level (10.5 or higher) that prevents decomposition (and therefore odor) during and after storage periods. Simple laboratory tests can be conducted to determine percentages of liming potential in the biosolids that are linked to minimizing odors and other nuisance potential over time.

Biosolids managers should be prepared to make the operation and budgetary commitment to adopt process modifications necessary to prevent nuisance potential from storage of biosolids.

Additional discussion of storage considerations is contained in chapter 6 (Transportation) of this manual and in reference 3 of that chapter.

Quality Assurance
A compliance system is a core component of a successful biosolids management program. This includes:

- Collecting, recording and reporting all required information to demonstrate conformance with permit conditions, regulations and biosolids quality requirements
- Developing procedures and mechanisms (e. g., checklists) to ensure that operations will conform to permit conditions and the additional internal requirements that address community concerns
- Providing information about the quality assurance program to the public in a readily understandable format.

The specific requirements and procedures that maintain quality assurance are described in greater detail in the various operational chapters of this Manual, and are contained in an Environmental Management System. The level of detail and manner of presentation should be developed to meet your specific situation. The important point to remember is that making quality assurance information (including the operation of your pretreatment program) available to the public will go a long way toward demonstrating that their concerns are being met in an organized, documented and credible manner.

1.7 Maintaining Support

Every biosolids management program should develop a support system that is based on the surrounding community and its needs as communicated to the biosolids program manager and staff.

For agricultural programs, the farming community is an obvious first source of public support. Agricultural organizations, individual farmers, and cooperative extension agents can provide strong local support if their concerns and issues are being addressed. Their support is also valuable in developing the understanding and approval of neighbors and local officials. The value of biosolids as a significant resource must be recognized and articulated by farmers or

others who use them for the practice to remain viable.

Appropriate field management that involves coordination with individual farming practices is essential to maintain support for the agricultural use of biosolids. Land appliers should pay careful attention to the timing, methods of application and housekeeping details during operations to insure that they meet agricultural producers' needs as well as the needs of generators. To accomplish this, a highly motivated staff with experience in such disciplines as agriculture, natural resources and environmental science can interact with individual farmers and their organizations/associates. The staff's role in the permitting and monitoring requirements for land application as well as their responsiveness to farmer’s needs provide the necessary link between the biosolids generator, field operations and local communities.

The following activities can provide support for agricultural programs:

- Arranging field operational demonstrations
- Sponsoring local programs (e.g., agricultural appreciation days)
- Providing biosolids nutrient information to cooperative extension agents
- Funding research and extension publications
- Presenting information at meetings for the farming community
- Providing participating farmers with the results of soil testing, field application reports,
- and actual cost savings from biosolids as compared to current fertilizer prices

The activities described above should be modified (as dictated by the local situation) for other methods for using and disposing biosolids. Facilities that process biosolids and projects where the material is applied (such as agricultural operations) require different approaches to achieving local acceptance. In both cases, however, open communication and responsiveness are essential to develop alliances and support.
Detailed discussion of research finding on attitudes, effective messages and elements required for an effective communications plan may be found in Reference (1) of this Chapter.

To expand the base of local support for biosolids projects, it is important to maintain contact with key individuals in the local communities including:

- Administrators and managers
- Elected officials
- State legislative representatives
- Environmental organizations
- Community associations
- Civic groups
- Media representatives

The effort to gain and maintain public acceptance is an integral part of any biosolids management project throughout its lifetime. Needs and concerns differ from project to project, but community acceptance can never be taken for granted. In the face of increased public involvement and demands, more detailed and specific management and operational practices for biosolids are likely to be needed in the future. Biosolids managers will be faced with continuing and significant challenges. Developing the skills to interact successfully with the public is perhaps the greatest of those challenges.

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