Chapter 11 – Odor Control and Aesthetics in Land Application Programs

Odors and aesthetics are the most common causes for opposition to land application programs. Once people are sensitized to either of these issues, real or perceived, it is difficult to regain their support for a program. Odor control, containment, collection and treatment, at a wastewater treatment facility or biosolids management facility are discussed in Odor Control, Chapter 6 of this Manual. This chapter discusses odor control as part of a land application program, which differs from dealing with facility odor issues in a number of ways. It is important to recognize those differences and address odor control at both the facilities generating or treating biosolids and at land application sites.

This chapter also discusses the impact aesthetics can have on a program. People will "smell with their eyes". Plastic material in the product or dirty vehicles with rags hanging from them are certain to generate concern.

Critical Control Points / Operational Controls
There are a number of controls that should be addressed to minimize potential for unwanted materials and odors associated with land application of biosolids. These locations and their accompanying operational controls are discussed in this chapter. Additional operational control details are provided in other chapters of this Manual. Operational controls may consist of treatment and/ or field management measures. Critical controls include:

- Liquid Stream Treatment
- Biosolids Treatment
- Transportation
- Storage
- Buffers
- Operating Practices
- Community Relations

11.1 Liquid Stream Treatment

In simple terms, wastewater treatment is designed to remove suspended and dissolved solids. Suspended solids are removed using clarification. In the majority of wastewater treatment facilities, microorganisms are used to consume dissolved solids and are removed using clarification.

These systems, commonly referred to as primary and secondary treatment, will also collect and remove foreign objects such as plastic and rags. These materials will remain through the stabilization process and become part of the biosolids product.

To eliminate these materials from the final product, they must be removed prior to primary treatment. This removal takes place in the preliminary treatment processes contained in the headworks.

11.1.1 Influent Screening

Influent screening has been used to remove objects that can damage downstream equipment. While protecting equipment they can allow a great deal of debris to pass. Advances in technology have resulted in screens with significantly smaller openings. These “fine screens” are much more efficient and will remove the majority of the plastics and rags that enter the collection system. The removal of these materials can significantly improve the appearance of your biosolids product.

11.1.2 Grinding

To reduce or eliminate the need for screening disposal, a number of facilities pass their influent wastewater through a grinder or comminutor. This equipment reduces the size of the material, but does not remove it. The material that passes through the grinder will be collected along with the biosolids or removed with the scum. While grinders may not improve the aesthetics of the biosolids product as much as fine screening, it will provide protection for equipment located downstream. A number of facilities have incorporated grinders within their solids handling train to protect equipment

11.1.3 Grit Removal

Grit removal also improves aesthetics while enhancing biosolids product quality. Grit can result in equipment wear and the addition of fixed solids to the process. Grit removal is a significant issue in combined systems.

11.2 Biosolids Treatment

The vector attraction reduction (VAR) requirements of the Part 503 Rule were developed to reduce odors and other factors that attract disease vectors to biosolids, and thus are primarily related to public health implications of biosolids management as well as to the odor issue. The term "stability" which is often used to describe biosolids treatment methods is closely tied to vector attraction reduction and therefore to biosolids' odor potential. Stability is not regulated as such by the Part 503 Rule; meeting VAR requirements does not, therefore, guarantee that stability is achieved, although stable biosolids will generally meet VAR requirements. More detailed information on biosolids stability is contained in Ref. (Water Environment Research Foundation 1997). Since treatment processes generally are conducted at the wastewater treatment plant, the plant becomes the fundamental control point location for addressing potential land application odors. Treatment options may be classified as biological or chemical, and biosolids managers are urged to consult Ref. (USEPA 1999) of this Chapter for more detailed discussion of regulatory requirements and process controls.

11.2.1 Biological Treatment

Biological processes are those which use microbes to decompose volatile solids, thereby reducing the food available to active microorganisms in the biosolids and reducing the odor potential of the material. These processes may be aerobic (with oxygen) or anaerobic (without oxygen), and each type depends on sustaining the life cycles of the organisms that thrive under each of these two different conditions, as described in Solids Stabilization, Chapter 4 of this Manual. The effectiveness of these processes is expressed in terms of volatile solids reduction as measured before and after treatment. The "after

treatment" measurement can be immediately after leaving the processing unit or at the point of use or disposal if this occurs without any significant downstream dilution with inert (non-volatile) solids. Volatile solids reduction that occurs in such facility processes as drying beds or lagoons is included in this measurement (USEPA 1999). Biosolids that meet the federal regulatory requirement of 38% reduction in volatile solids may not achieve the desired level of "stability" to reduce odors to a level that is acceptable to the public. Additional treatment may be required to decrease odor potential (and vector attraction) of the biosolids to the point where remaining biodegradable material does not attract vectors or produce odors that people may find objectionable.

11.2.2 Chemical Treatment

In contrast to the digestion processes described above, chemical treatment relies on chemical additions to retard or stop the biological processes that produce offensive odors. The most widely used chemical processes for treating biosolids are those employing alkaline materials such as lime to raise the pH of the mixture to 12 to prevent biological activity. It is important to understand that such processes are not permanent, and that if the pH drops to 10 or below over time (e. g., during biosolids storage), surviving bacteria can become active and odors may result. Adding more liming agent than is needed to achieve regulatory requirements can address this issue, just as additional digestion does for the biological treatment processes.

11.3 Transportation

The transportation of biosolids should be managed to minimize odor potential and other nuisance conditions (e. g., excessive traffic, and unsightly vehicles) that can cause negative reaction to land application in the local community. Attention to these conditions cannot overcome the impact of inherently odorous biosolids, but careful attention to treatment of the material, coupled with insistence on clean vehicles throughout transport and community-sensitive transport methods will go a long way toward preventing complaints (odor and otherwise) in a biosolids land application program.

Be sure that trucks will have adequate maneuverability at application and storage sites. Trucks should not queue up on public roads and create a nuisance for other traffic and neighbors. Being considerate in all aspects of the biosolids operation helps establish community acceptance.

11.4 Storage

The seasonal use of biosolids in agriculture (discussed in Agricultural Land Application, Chapter 8 of this Manual) creates the need for storage in virtually all land application programs. Well-operated stabilization processes at the treatment plant usually will result in biosolids that can be stored off-site and not create odor or other nuisance conditions. Odors can result from inadequately stabilized biosolids, whether this occurs at the time of processing or later on, as may occur with the alkaline treatment processes (see Chemical Treatment, above).

During storage, intensified management is needed, especially when stored material is being spread. Managers should monitor storage sites to determine whether unacceptable odors are occurring, and be prepared to implement mitigation measures whenever possible.

The combination of stabilization and storage should be considered prior to implementing a biosolids management program. For example, storing lime-treated biosolids can result in significant odors if the pH drops during storage, allowing microbial growth when the material is removed from storage and used. The biosolids/alkaline mixture should be carefully established to provide conditions that minimize the potential for microbial growth and associated odor.

Since alkaline materials are effective microbial inhibitors, they may also be useful as a topical treatment to suppress odors for both stored and land-applied (especially surface-applied) biosolids. It is also advisable to minimize the length of time biosolids are kept in storage (especially in hot weather) in order to prevent odor-causing conditions from developing.

In most cases, storage (especially small scale field stockpiling) does not call for sampling and analysis of odor compounds. For larger constructed facilities that operate longer-term, a specific plan for odor prevention and minimization may be needed. Odor control plans must be sensitive to community concerns, and should include methods of prompt response to complaints, along with procedures for investigation and follow-up. Plans may also include some type of monitoring for odors and methods to determine the effectiveness of mitigation measures.

The Guide to Field Storage of Biosolids contains comprehensive discussions of both constructed facility storage and field stockpiling in land application programs, along with checklists and other management tools for addressing issues that relate to storing biosolids. Biosolids managers are urged to consult this publication when developing their programs.

11.5 Buffers

Physical barriers between vectors and volatile solids in the biosolids may be useful in reducing nuisance and odor potential. These barriers may be natural (e. g., distance, trees) or man-made (e. g., covering stored biosolids). Biosolids should only be stored in areas with adequate buffers(this may mean buffers that are significantly greater than those specified in regulations). All such measures should be designed to fit local situations and programs, and are discussed in the references to this Chapter.

Biosolids programs that surface-apply biosolids without incorporation will have some degree of odor associated with the program. This odor can be minimized through adequate stabilization. Proper siting and maintaining adequate buffers to neighbors can also minimize the impact of any odors. Surface application, without incorporation, of lime-treated Class B biosolids has a significant potential for malodor. If this practice cannot be avoided (for example, on permanent pastures), it is recommended that remote sites be selected whenever possible and that spreading operations be conducted with careful attention to good housekeeping practices.

11.6 Operating Practices

The impact of exceptional housekeeping associated with a land application program is vital to success. The public's perception regarding the overall biosolids program management is often determined by the appearance of the vehicles and equipment used in a program. This concept also applies to odors - they may be perceived as more offensive if housekeeping measures are neglected. One of the most important housekeeping aspects of land application is preventing the plastics that often accumulate in anaerobic digesters from showing up at a land application field. Farmers and neighbors alike are understandably upset if this occurs and biosolids managers should be alert to that possibility and include such measures as screening (at the treatment plant or in the field), and even diverting biosolids to a sanitary landfill if necessary, in their management program options.

Use common sense and do not schedule spreading operations when neighbors are most likely to be outdoors, such as before and after work hours and on weekends. If possible, avoid surface application of potentially odorous biosolids during meteorological conditions (hot, humid, little air movement) that can result in odor problems.

As also discussed in Agricultural Land Application, Chapter 8 of this Manual, field operations at the farm can employ several strategies to reduce the risk of odors. Methods will differ depending on the physical properties of biosolids and the agricultural practices being implemented at each site. Injection or same-day incorporation into the soil provides both a physical barrier and an active soil microbial population to greatly reduce odor potential when biosolids are land applied. For surface application, it is prudent to apply biosolids in a thin layer in order to prevent odors and vector attraction.

When biosolids are stockpiled in the field, select stockpile areas with the objective of minimizing both visibility to neighbors and potential for odors (e. g., avoid low areas where ponding of water may result in odors). Be sure designated stockpile areas are clearly marked or otherwise conveyed to truck drivers.

When applied at agronomic rates, the amount of biosolids added typically is about 1/100th or less of the mass of soil in the plow layer (approximately the top six inches of soil). With good mixing, the dilution of biosolids the surface soil is similar to that resulting from soil injection. Odor may be present and vectors attracted temporarily, as the biosolids dry on the soil surface, but diminish and are virtually eliminated when the biosolids are mixed with the soil. This mixing option applies to liquid biosolids, dewatered cake, and to dried biosolids that have not already achieved one of the vector attraction reduction requirements of the Part 503 Rule. If the biosolids are incorporated (a step that is particularly recommended when the biosolids are not well stabilized), plan to pace spreading operations to match the rate at which the biosolids can be incorporated. If biosolids must be held overnight or over a weekend, be prepared to cover them with an impermeable tarp or with a layer of pulverized lime to form an odor barrier crust.

11.7 Community Relations

The importance of community relations cannot be overstated, and is discussed throughout this Manual (see especially Chapter 1, Public Acceptance). As stated elsewhere, odor problems are the most likely to adversely affect biosolids programs, and this is certainly the greatest area of concern for land application programs.

Biosolids managers should be familiar with community sensitivities with respect to timing of operations, location of offloading areas, housekeeping and other management practices.
If the biosolids land application program is located in a remote area with a great deal of buffer to neighbors, an occasional odor associated with the program may well go unnoticed. The location of land application sites and the proximity of neighbors will often dictate the choice of specific management practices and biosolids treatment options.

Odors during delivery and land application of biosolids are a major source of complaints in biosolids programs. Several strategies can be used to reduce the potential for creating an odor nuisance. Generally, when the quality of the product is good, odors are less likely to occur. To address odors effectively, start at the treatment facility to determine steps that may help, such as:

- Reducing the holding time of biosolids at the plant prior to land application, because biosolids can become septic when stored
- Optimizing processes for volatile solids reduction or high pH, depending on stabilization methods
- Increasing detention times for stabilization processes.
- Evaluating chemical additions (e. g., iron salts, polymers) or operational changes that may affect odor in the biosolids and modifying these as appropriate

It may be useful to develop descriptors (terms to characterize specific odors) to address odor issues with neighboring communities. Both field operators and citizens will then be better able to determine whether biosolids are, in fact, the source of an odor event, and initiate corrective measures as appropriate (USEPA 2000).

In addition to any processing or operational factors that will minimize odor concerns in a community, biosolids managers should acquire the communication skills needed to interact with community neighbors. Listening skills and acknowledgement of valid concerns and complaints must be coupled with a genuine commitment to address such concerns. This approach will help significantly to reassure communities located near land application projects that biosolids are an agricultural resource, not a threat or a nuisance. By raising the level of public trust, biosolids managers may find that community odor issues are less likely to be based on fear and hostility and thus more readily resolved.

References

United States Environmental Protection Agency, (1999), *"Control of Pathogens and Vector Attraction in Sewage Sludge"*, (USEPA/625/R-92/013)

United States Environmental Protection Agency, Office of Wastewater Management, (July, 2000), *"Guide to Field Storage of Biosolids"*, (4204) (USEPA/832-B-00-007)

Water Environment Research Foundation, (1997), "Defining Biosolids Stability: A Basis for Public and Regulatory Acceptance"