Chapter 12 – Storage

Storage is an extremely important element in almost every biosolids management unit process. Storage provides flexibility within and between processes. As an example, storage downstream of a gravity belt thickener allows the operators of an aerobic digester to feed the system on a schedule to optimize digestion not to meet the requirements of thickening. Storage downstream of stabilization prior to transport or dewatering has similar advantages.

Storage is also important following management at the treatment facility prior to use or disposal.

This chapter has been developed to highlight the operational controls associated with long term, greater than three days, storage of biosolids and biosolids products.

This chapter has been developed to highlight the operational controls associated with long term, greater than three days, storage of biosolids and biosolids products. Storage recommendations associated with other unit processes are discussed as part of those critical control point categories or locations.

12.1 Critical Control Points / Operational Controls

There are a number of controls that should be considered in the design and management of storage facilities for biosolids and biosolids products. They include:

- Odor potential during and as a result of storage
- Volume of biosolids to store
- Solids content of biosolids to be stored
- Stability of biosolids

The USEPA Guide to Field Storage of Biosolids. (USEPA, Office of Wastewater Management (4204) EPA/832-B-00-007, July 2000), describes these operational controls as variables related to intensity of management.

12.2 Odor Potential During and as a Result of Storage

The Guide to Field Storage (USEPA 2000) states that the public's greatest concern associated with biosolids storage is odor. This statement can be expanded to state that odor is the issue that ignites public concern regarding biosolids management programs. With this in mind, it is easy to understand how odor associated with the storage of biosolids can jeopardize and entire biosolids management program. What seems straightforward during the planning process, a dry level area to store biosolids when product demand is low, can turn into the issue that results in the closure of an otherwise successful program.

What seems straight-forward during the planning process, a dry level area to store biosolids when product demand is low, can turn into the issue that results in the closure of an otherwise successful program.

There are a number of factors which contribute to odor generation. Factors highlighted in the Field Storage Guide include:

- pH changes in lime stabilized biosolids
- Deficient oxygen concentrations within the biosolids
- Rewetting of dried product
- Length of storage period
- Inadequate drainage associated with the storage facility
- Storage of not fully stabilized biosolids
- Less then adequate housekeeping

Factors that influence the impact of odor include:

- Distance to receptors
- Meteorological conditions
- Volume of material stored
- Physical features of site, vallets, water courses.

Of these factors, three should be very carefully considered; degree of stability, volume stored and distance to receptors.

Very stable product will generate little if any offensive odor. The benefit of proper stabilization can not be overemphasized. The volume stored will impact the odor potential while straight forward, the volume to be stored at a given site should be carefully considered.

Proximity to receptors is extremely important criteria relative to storage.

Proximity to receptors is extremely important criteria relative to storage. If you can clearly see a home or commercial facility, you are more than likely too close for biosolids storage. Very remote locations for storage is not always practicable. If storage will be close to neighboring receptors, additional stabilization and precisely controlled management of the storage site are warranted.

12.3 Volume of Biosolids to Store

"A small volume of biosolids stored in a large field creates less management issues than a large volume stored in a small area"

The volume of biosolids that require storage will be dependent upon the biosolids characteristics and the program selected. Agricultural land application programs may require storage for relatively long periods based on crop patterns and climate. Other management options may have storage requirements based on market conditions.

The characteristics of the biosolids will also impact the volume to be stored. Liquid biosolids will require a much greater volume than dewatered biosolids. Dried biosolids will have yet a higher solids concentration and require a smaller volume per unit dry weight.

A wise person once said, “A small volume of biosolids stored in a large field creates less management issues than a large volume stored in a small area”. With this in mind, it is advantageous to locate enough remote sites to provide flexibility in storage.

12.4 Solids Content of Biosolids to be Stored

As discussed, the solids content of the biosolids will impact the volume to be stored. The volume difference between liquid biosolids at 2 percent solids and 4 percent solids is not 2 percent, but 100 percent.

One dry ton of biosolids at 2 percent solids will weigh 100,000 pounds with a volume of 1,600 cubic feet or 12,000 gallons. Increasing the solids content to 4 percent reduces the weight to 50,000 pounds and the volume to approximately 800 cubic feet or 6,000 gallons. If the biosolids are dewatered to produce a cake with a solids concentration of 20 percent, the weight will be further reduced to 10,000 pounds and the volume to approximately 160 cubic feet, 6 cubic yards. This is a volume one-tenth of that entering the process.

If biosolids need to be stored for long periods and then transported over relatively short time periods, the costs associated with dewatering can be easily justified. However, before implementing dewatering based on transportation or storage, consider the impact on the rest of the system. Consider the impact dewatering will have at the WWTF. Will the sidestream associated with belt filter press dewatering impact the organic or hydraulic loading to the facility? If the agency historically injected biosolids, can surface application be immediately followed by incorporation?

As the total solids concentration within the biosolids continue to increase, the concerns change from volume to dust and combustion or explosion hazard. The storage of composted and dried products presents a number of challenges. The potential for fire and explosion are very real and must be carefully considered. Heat dried products are erosive. Some compost products, depending on the amendment used, also display erosive tendencies. These must be carefully considered during the planning and design process.

12.5 Biosolids Stability

The stability of the biosolids is an extremely important critical control category. As discussed in the Guide to Field Storage of Biosolids, the public’s greatest concern associated with biosolids storage is odor. Odors also generate concerns with land application programs and remote processing facilities. Proper stabilization is the best means to reduce the generation of product odor. The method by which the biosolids are stabilized is not as important as the degree of stabilization achieved. Well stabilized biosolids will generate far fewer odors than those that have not been fully stabilized. Stabilization systems and recommended operating controls are described in Chapter 4.

12.6 Recommended Management Practices

The recommended management practiced contained in this chapter are meant to compliment those contained in the other chapters of this manual and those contained in the references cited. They are not inclusive and may not apply to all storage systems.

Buffers. For field storage associated with land application, if you can see the neighbors to a storage site or a frequently traveled roadway, your buffer is not large enough. Storing biosolids in remote locations, may seem like extra effort, but it may be the effort that allows a successful program.

Special precautions must be made for storing dried products.

Water Protection. Groundwater and surface should be protected from the concentrated nutrients associated with a stockpile. The site should be graded so that water does not pond on or around the stockpile. Water that has runoff the stockpile should be collected for evaporation or application with the biosolids. The storage pad should include an impervious base to protect groundwater quality. In certain areas, limestone should be considered for the construction of the pad. Lime can provide a good surface for vehicle traffic and storage. When solids are collected from storage, any lime that is inadvertently collected, is land applied.

Liquid Biosolids Storage. Liquid biosolids must be very well stabilized prior to storage. Mixing prior to application should be performed by mechanical mixer rather than by aeration.

Dried Material Storage. Special precautions must be made for storing dried products. The products range from compost product with a solids concentration of approximately 60 percent to heat dried product with solids concentration in excess of 90 percent. Care must be taken to minimize the potential for fire or explosion. Care must also be taken to insure that the products are stable, reducing the potential for odor.

References

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