Biosolids Standards for Pathogens and Vectors

Ken Arnold, Chief of Land Application, Missouri Department of Natural Resources
John Dunn, Environmental Engineer, Environmental Protection Agency, Region VII
Dennis Sievers, Agricultural Engineering, University of Missouri-Columbia

Biosolids is a term for domestic wastewater sludge that meets standards for use as a fertilizer or soil conditioner. Biosolids standards include limitations for metal and other compounds, pathogen reduction, vector requirements and best management practices.

EPA regulations, under Title 40 Code of Federal Regulations Part 503 (40 CFR 503), establish the minimum national standards for the use and disposal of domestic sludge. These standards include limitations for the land application of biosolids. This publication outlines biosolids standards for pathogens and vectors.

Pathogen limitations for Class A biosolids

Class A biosolids are required for application onto public-use sites. This includes residential areas, road banks, parks, golf courses, schools and other similar areas.

Class A is also required for applying biosolids to turf, vegetable crops, root crops or home gardens.

Alternatives for Class A pathogen treatment

Class A biosolids must meet one of the following bacterial limitations and one of the process treatment alternatives:

Bacterial limitations

Biosolids must comply with one of the following:
1. Fecal coliform is less than 1,000 Most Probable Number (MPN) per gram of total solids (dry weight).
2. Salmonella sp. bacteria density is less than 3 MPN per 4 grams total solids (dry weight).

Class A Process treatment alternatives

Biosolids must also meet one of the following:

1. Maintain the sludge at the time, temperature and percent solids determined by using the formula in EPA Class A alternative 1, per 503.32(a)(3).

2. The sludge must be above pH 12 for 72 hours, during which the temperature must be above 52 degrees C for 12 hours. Thereafter, air-dry the sludge to 50 percent solids or higher, [EPA Class A alternative 2, per 503.32(a)(4)].

3. Use other treatment process to achieve the following:
   • Enteric virus density must be less than 1 Plaque Forming Unit (PFU) per 4 grams of total dry weight solids.
   • Viable helminth ova density must be less than 1 per 4 grams of total dry weight solids, [EPA Class A alternatives 3 or 4, per 503.32(a)(5) and (6)].

4. Use a Process to Further Reduce Pathogens (PFRP) or equivalent treatment process approved by the permitting authority, [EPA Class A Alternative 5 or 6, per 503.32(a)(7) and (8)]. (See Table 1.)
Processes to Further Reduce Pathogens

- Compost, using the within-vessel method or the static aerated pile method. This maintains the temperature at 55 degrees C or higher for three days. Maintain the temperature of windrow compost at 55 degrees C or higher for 15 days or longer. Turn the windrow at least five times when the compost temperature is above 55 degrees C.
- Heat drying with hot gases reduces the moisture content to 10 percent or lower. The temperature of the sludge exceeds 80 degrees C.
- Heat treat liquid sludge to a temperature of 180 degrees C or higher for 30 minutes.
- Thermophilic aerobic digest sludge for at least 10 days at a temperature between 55 to 60 degrees C.
- Beta ray irradiate sludge with an electron accelerator at dosages of at least 1.0 megarad at 20 degrees C.
- Gamma ray irradiate waste with certain isotopes, such as Cobalt 60 and Cesium 137 at dosages of at least 1.0 megarad at 20 degrees C.
- Pasteurize sludge. Maintain the temperature at 70 degrees C or higher for 30 minutes or longer.
- Use an equivalent treatment process approved by the permitting authority.

Pathogen limitations for Class B biosolids

Apply Class B biosolids on grain and forage crops, pastures, grassland, fallow land and timberland.

The alternatives for Class B biosolids consist of either a treatment process, such as a Process To Significantly Reduce Pathogens (PSRP) or a bacterial limitation, based on fecal coliform.

Fecal coliform testing is recommended for all treatment processes for at least two years of operation in order to verify PSRP performance. Conduct tests during seasons of the year when biosolids will be applied. Equivalent PSRP processes must be approved by the permitting authority.

Alternatives for Class B pathogen treatment

1. Fecal coliform test the biosolids. The geometric mean of the density of fecal coliform must be less than 2,000,000 Colony Forming Units (CFU) or 2,000,000 Most Probable Number (MPN), per gram of total dry weight solids. Collect seven grab samples of sludge within one day.

2. Use PSRP or an equivalent treatment method approved by the permitting authority. (See Table 2.) Daily operating records must be maintained to document that PSRP method was achieved.

Table 1. Processes to Further Reduce Pathogens (PFRP).

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| • Aerobic digestion between 40 days at 20 degrees C and 60 days at 15 degrees C.
| • Anaerobic digestion between 15 days at 35 to 55 degrees C and 60 days at 20 degrees C.
| • Air dry for at least three months. Two of the months must have average daily temperature above freezing.
| • Compost with temperatures greater than 40 degrees C for five days. The temperature must be greater than 55 degrees C for four hours during the five days.
| • Lime stabilization to a pH greater than 12 for two hours. If the sludge is domestic, lime (alkali) stabilize to a pH greater than 12 for 30 minutes.
| • Use an equivalent process approved by the permitting authority. (See Table 3.)

Table 2. Processes to Significantly Reduce Pathogens (PSRP).

Table 3. Processes to Further Reduce Pathogens (PFRP).
Alternatives for vector attraction treatment

All biosolids (Class A and Class B) must meet one of the following alternatives for vector attraction reduction:

1. Reduce volatile sludge solids by 38 percent.

2. Alternate sludge testing for volatile solids:
   Digest sludge samples in laboratory (30 days for aerobic sludge and 40 days for anaerobic sludge). The resulting additional volatile solids reduction during the testing must be less than 15 percent for aerobic sludge and less than 17 percent for anaerobic sludge.

3. SOUR (Specific Oxygen Uptake Rate) is equal to or less than 1.5 mg oxygen per hour per gram of total dry weight solids at 20 degrees C. For anaerobic sludge, the sample must be aerated in the lab until dissolved oxygen saturation is reached before testing.

4. Aerobic sludge digester at an average temperature of greater than 45 degrees C for more than 14 days and at least 40 degrees C.

5. The pH must be greater than 12 for two hours and followed by a pH greater than 11.5 for an additional 22 hours.

6. Dry sludge to less than 25 percent moisture for stabilized sludge or less than 10 percent for primary sludge.

7. Subsurface inject the sludge.

8. Incorporate the sludge into the soil within six hours after surface spreading.

9. If the sludge is domestic septage only, the pH must be greater than 12 for 30 minutes.

10. Use an equivalent method approved by the permitting authority.

Processes approved by EPA as equivalent to PSRP

• Use a combination oxidation ditch, aerated storage and drying process. Treat sewage sludge in oxidation ditch for at least 26 days and then store it in an aerated holding tank for up to a week. Following de-watering to 18 percent solids, dry the sewage sludge on a paved surface to a depth of two feet. Turn the sewage sludge over during drying. After drying to 30 percent solids, stockpile the sludge before land application. To ensure that PSRP requirements are met, the stockpiling period must include one full summer season. Together, the drying and stockpiling steps take about a year.

• Use cement or lime kiln dust (instead of lime) to treat sewage sludge by raising sewage sludge to at least 12 pH for 2 hours.

• Use anaerobic digestion for sewage sludge in a lagoon. In one example of this method, the solids were detained up to 15 years in a wastewater treatment lagoon, resulting in a level of treatment exceeding that provided by conventional anaerobic digestion.

• Use oxidation ditch treatment and storage combination. Process sewage sludge in aeration basins, then store it in aerated sludge holding tanks. The total sewage sludge aeration time is greater than the aerobic digestion operating conditions (specified in the Part 503 regulation) of 40 days at 20 degrees C to 60 days at 15 degrees C. Next, store the oxidation ditch sludge in batches for at least 45 days in an unaerated condition or 30 days in an aerated condition.

• Use aerobic digestion for 20 days at 30 degrees C or 15 days at 35 degrees C.
