

7041.1300 OPERATIONAL STANDARDS; PATHOGEN REDUCTION.

Subpart 1. **General.** Bulk sewage sludge must meet the requirements of Class A pathogen reduction or Class B pathogen reduction and the site restrictions in subpart 3, item D, when it is applied to agricultural land, forest, a public contact site, or a reclamation site. Bulk sewage sludge applied to a lawn or home garden and sewage sludge sold or given away in a bag or other container must meet Class A pathogen reduction requirements.

Subp. 2. **Pathogens in sewage sludge; Class A.** To be classified Class A with respect to pathogen reduction, the requirements in items A and B must be met.

A. One of the Class A pathogen requirements in items C to H must be met either prior to or at the same time the vector attraction reduction requirements in part 7041.1400, subpart 2, are met except when the vector attraction reduction requirements in part 7041.1400, subpart 2, item F, G, or H, are met.

B. Either the density of fecal coliform in the sewage sludge must be less than 1,000 most probable number per gram of total solids (dry weight basis), or the density of *Salmonella* sp. bacteria in the sewage sludge must be less than three most probable number per four grams of total solids (dry weight basis) at the time the sewage sludge is applied to the land, at the time the sewage sludge is prepared for sale or giveaway in a bag or other container for application to the land, or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements of exceptional quality sewage sludge.

C. Class A, Alternative 1. (Not applicable for composting.) The temperature of the sewage sludge shall be maintained at a specific value for a period of time.

(1) When the percent solids of the sewage sludge is seven percent or higher, the temperature of the sewage sludge shall be 50 degrees Celsius or higher, the time period shall be 20 minutes or longer, and the temperature and time period shall be determined using the equation in this unit, except when small particles of sewage sludge are heated by either warmed gases or an immiscible liquid.

$$D = \frac{131,700,000}{10^{0.1400t}}$$

Where,

D=time in days.

t=temperature in degrees Celsius.

(2) When the percent solids of the sewage sludge is seven percent or higher and small particles of sewage sludge are heated by either warmed gases or an immiscible

liquid, the temperature of the sewage sludge shall be 50 degrees Celsius or higher, the time period shall be 15 seconds or longer, and the temperature and time period shall be determined using the equation in subitem (1).

(3) When the percent solids of the sewage sludge is less than seven percent and the time period is at least 15 seconds, but less than 30 minutes, the temperature and time period shall be determined using the equation in subitem (1).

(4) When the percent solids of the sewage sludge is less than seven percent, the temperature of the sewage sludge is 50 degrees Celsius or higher, and the time period is 30 minutes or longer, the temperature and time period shall be determined using the equation in this unit.

$$D = \frac{50,070,000}{10^{0.1400t}}$$

Where,

D=time in days.

t=temperature in degrees Celsius.

D. Class A, Alternative 2. The pH of the sewage sludge shall be raised to above 12 and shall remain above 12 for 72 hours.

(1) The temperature of the sewage sludge shall be above 52 degrees Celsius for 12 hours or longer during the period that the pH of the sewage sludge is above 12.

(2) At the end of the 72-hour period during which the pH of the sewage sludge is above 12, the sewage sludge shall be air dried to achieve a percent solids in the sewage sludge greater than 50 percent.

E. Class A, Alternative 3. The sewage sludge shall be analyzed prior to pathogen treatment to determine whether the sewage sludge contains enteric viruses and helminth ova.

(1) When the density of enteric viruses in the sewage sludge prior to pathogen treatment is less than one plaque-forming unit per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to enteric viruses until the next monitoring episode for the sewage sludge.

(2) When the density of enteric viruses in the sewage sludge prior to pathogen treatment is equal to or greater than one plaque-forming unit per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to enteric viruses when the density of enteric viruses in the sewage sludge after pathogen treatment is less than one plaque-forming unit per four grams of total solids (dry weight basis) and when

the values or ranges of values for the operating parameters for the pathogen treatment process that produces the sewage sludge that meets the enteric virus density requirement are documented.

(3) After the enteric virus reduction in subitem (2) is demonstrated for the pathogen treatment process, the sewage sludge continues to be Class A with respect to enteric viruses when the values for the pathogen treatment process operating parameters are consistent with the values or ranges of values documented in subitem (2).

(4) When the density of viable helminth ova in the sewage sludge prior to pathogen treatment is less than one per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to viable helminth ova until the next monitoring episode for the sewage sludge.

(5) When the density of viable helminth ova in the sewage sludge prior to pathogen treatment is equal to or greater than one per four grams of total solids (dry weight basis), the sewage sludge is Class A with respect to viable helminth ova when the density of viable helminth ova in the sewage sludge after pathogen treatment is less than one per four grams of total solids (dry weight basis) and when the values or ranges of values for the operating parameters for the pathogen treatment process that produces the sewage sludge that meets the viable helminth ova density requirement are documented.

(6) After the viable helminth ova reduction in subitem (5) is demonstrated for the pathogen treatment process, the sewage sludge continues to be Class A with respect to viable helminth ova when the values for the pathogen treatment process operating parameters are consistent with the values or ranges of values documented in subitem (5).

F. Class A, Alternative 4.

(1) The density of enteric viruses in the sewage sludge shall be less than one plaque-forming unit per four grams of total solids (dry weight basis) at the time the sewage sludge is applied to the land, at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land, or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements of exceptional quality sewage sludge, unless otherwise specified by the permitting authority.

(2) The density of viable helminth ova in the sewage sludge shall be less than one per four grams of total solids (dry weight basis) at the time the sewage sludge is applied to the land; at the time the sewage sludge is prepared for sale or give away in a bag or other container for application to the land, or at the time the sewage sludge or material derived from sewage sludge is prepared to meet the requirements of exceptional quality sewage sludge, unless otherwise specified by the permitting authority.

G. Class A, Alternative 5. Sewage sludge shall be treated in one of the processes to further reduce pathogens in subitems (1) to (7).

(1) Composting. Using either the within-vessel composting method or the static aerated pile composting method, the temperature of the sewage sludge is maintained at 55 degrees Celsius or higher for three days. Using the windrow composting method, the temperature of the sewage sludge is maintained at 55 degrees or higher for 15 days or longer. During the period when the compost is maintained at 55 degrees or higher, there shall be a minimum of five turnings of the windrow.

(2) Heat drying. Sewage sludge is dried by direct or indirect contact with hot gases to reduce the moisture content of the sewage sludge to 10 percent or lower. Either the temperature of the sewage sludge particles exceeds 80 degrees Celsius or the wet bulb temperature of the gas in contact with the sewage sludge as the sewage sludge leaves the dryer exceeds 80 degrees Celsius.

(3) Heat treatment. Liquid sewage sludge is heated to a temperature of 180 degrees Celsius or higher for 30 minutes.

(4) Thermophilic aerobic digestion. Liquid sewage sludge is agitated with air or oxygen to maintain aerobic conditions and the mean cell residence time of the sewage sludge is ten days at 55 to 60 degrees Celsius.

(5) Beta ray irradiation. Sewage sludge is irradiated with beta rays from an accelerator at dosages of at least 1.0 megarad at room temperature (ca. 20 degrees Celsius).

(6) Gamma ray irradiation. Sewage sludge is irradiated with gamma rays from certain isotopes, such as Cobalt 60 and Cesium 137, at room temperature (ca. 20 degrees Celsius).

(7) Pasteurization. The temperature of the sewage sludge is maintained at 70 degrees Celsius or higher for 30 minutes or longer.

H. Class A, Alternative 6. Sewage sludge that is applied to the land shall be treated in a process that is equivalent to a process to further reduce pathogens in item G, as determined by the permitting authority.

Subp. 3. **Sewage sludge; Class B.** The requirements in item A, B, or C must be met for sewage sludge to be classified as Class B with respect to pathogen reduction and when Class B sewage sludge is applied to agricultural land, forest, a public contact site, or a reclamation site, the site restrictions in item D must also be met.

A. Class B, Alternative 1.

(1) Seven representative samples of the sewage sludge that is applied to the land shall be collected.

(2) The geometric mean of the density of fecal coliform in the samples collected in subitem (1) shall be less than either 2,000,000 most probable number per gram of total solids (dry weight basis) or 2,000,000 colony forming units per gram of total solids (dry weight basis).

B. Class B, Alternative 2. Sewage sludge shall be treated in one of the Processes to Significantly Reduce Pathogens in subitems (1) to (5).

(1) Aerobic digestion. Sewage sludge is agitated with air or oxygen to maintain aerobic conditions for a specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature shall be between 40 days at 20 degrees Celsius and 60 days at 15 degrees Celsius.

(2) Air drying. Sewage sludge is dried on sand beds or on paved or unpaved basins. The sewage sludge dries for a minimum of three months. During two of the three months, the ambient average daily temperature is above zero degrees Celsius.

(3) Anaerobic digestion. Sewage sludge is treated in the absence of air for a specific mean cell residence time at a specific temperature. Values for the mean cell residence time and temperature shall be between 15 days at 35 to 55 degrees Celsius and 60 days at 20 degrees Celsius.

(4) Composting. Using either the within-vessel, static aerated pile, or windrow composting methods, the temperature of the sewage sludge is raised to 40 degrees Celsius or higher and remains at 40 degrees Celsius or higher for five days. For four hours during the five days, the temperature in the compost pile exceeds 55 degrees Celsius.

(5) Lime stabilization. Sufficient lime is added to the sewage sludge to raise the pH of the sewage sludge to 12 after two hours of contact.

C. Class B, Alternative 3. Sewage sludge shall be treated in a process that is equivalent to a process to significantly reduce pathogens, as determined by the permitting authority.

D. Site Restrictions.

MINIMUM DURATION BETWEEN APPLICATION AND
HARVEST/GRAZING/PUBLIC ACCESS FOR
CLASS B SEWAGE SLUDGE APPLIED TO THE LAND

Criteria	Surface Applied or Incorporated	Injected
Food crops whose harvested part may touch the soil/sludge mixture (melons, squash, tomatoes, etc.)	14 mos.	14 mos.

Food crops whose harvested parts grow in the soil (potatoes, carrots, etc.)	20/38 mos. ¹	38 mos.
Feed, other food crops (field corn, sweet corn, etc.) hay, or fiber crop	30 days	30 days
Grazing of animals	30 days	30 days
Public access to the land		
- High potential ²	1 year	1 year
- Low potential ³	30 days	30 days

¹The 20-month duration between application and harvesting applies when the sewage sludge that is surface applied stays on the soil surface for four months or longer prior to incorporation into the soil. The 38-month duration is in effect when the sewage sludge remains on the soil surface for less than four months prior to incorporation.

²This includes, but is not limited to, a public contact site and reclamation site located in populated areas, for example, a construction site located in a city, turf farms, and plant nurseries.

³Land the public uses infrequently which includes, but is not limited to, agricultural land, forest, and a reclamation site located in an unpopulated area.

Statutory Authority: *MS s 116.07*

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