MISSOURI
DEPARTMENT OF
NATURAL RESOURCES

Title 10—DEPARTMENT OF NATURAL RESOURCES
Division 20—Clean Water Commission
Chapter 8—Minimum Design Standards

WORKING DOCUMENT
Strawman

The Department presents these draft materials for stakeholder review and discussion only.
Subject to the Red Tape Reduction review.

The Missouri Department of Natural Resources has identified 10 CSR 20-8, Minimum Design Standards, as a potential rulemaking amendment. This workgroup has been convened for the purpose of informal and voluntary public participation and discussions regarding the development of this rule prior to initiating formal rulemaking.

Under Governor Greitens' leadership, all state agencies are working to reduce regulations and other government processes that unnecessarily burden individuals and businesses while doing little to protect or improve public health, safety, and our natural resources. The Missouri Department of Natural Resources is committed to limiting regulation to what is necessary to protect Missouri's environment, implementing statutory mandates, and maintaining state control of programs. Any further proposed changes to rules discussed on this page are being developed with these goals in mind. We welcome your comments to help ensure that our regulations provide required protections but do not add unnecessary costs.

10—DEPARTMENT OF NATURAL RESOURCES
Division 20—Clean Water Commission
Chapter 8—*[Design Guides]* Minimum Design Standards

10 CSR 20-8.170 *[Sludge]* Solids Handling and Disposal

[PURPOSE: The following criteria have been prepared as a guide for the design of sludge handling and disposal facilities. This rule is to be used with rules 10 CSR 20-8.110–10 CSR 20-8.220 for the planning and design of the complete treatment facility. This rule reflects the minimum requirements of the Missouri Clean Water Commission as regards adequacy of design, submission of plans, approval of plans and approval of completed sewage works. Deviation from these minimum requirements will be allowed where sufficient documentation is presented to justify the deviation. These criteria are taken largely from Great Lakes-Upper Mississippi River Board of State Sanitary Engineers, Recommended Standards for Sewage Works and are based on the best information presently available. These criteria were originally filed as 10 CSR 20-8.030. It is anticipated that they will be subject to review and revision periodically as additional information and methods appear. Addenda or supplements to this publication will be furnished to consulting engineers and city engineers. If others desire to receive addenda or supplements, please advise the Clean Water Commission so that names can be added to the mailing list.]

PURPOSE: The following minimum criteria have been prepared as a standard for the design of wastewater systems. This rule is to be used with rules 10 CSR 20-8.110 through 10 CSR 20-8.500 for the planning and design of a treatment facility. It is not reasonable or practical to include all aspects of design in these standards. The design engineer may use other appropriate reference materials for these design aspects not addressed in this rule, which include but are not limited to: copies of all ASTM International and American Water Works Association (AWWA) standards pertaining to wastewater systems and appurtenances, design manuals such as Water Environment Federation's Manuals of Practice, the University of Missouri Extension Water Quality Guides 420-449, Department prepared guides, and other wastewater design manuals containing principles of accepted engineering practice. This rule specifies minimum standards for the design and construction of wastewater systems, in addition to engineering experience and judgement in accordance with standards of practice.

[(1) Definitions. Definitions as set forth in the Clean Water Law and 10 CSR 20-2.010 shall apply to those terms when used in this rule, unless the context clearly requires otherwise. Where the terms shall and must are used, they are to mean a mandatory requirement insofar as approval by the agency is concerned, unless justification is presented for deviation from the requirements. Other terms, such as should, recommend, preferred and the like, indicate discretionary requirements on the part of the agency and deviations are subject to individual consideration.

(2) Exceptions. This rule shall not apply to facilities designed for twenty-two thousand five hundred gallons per day (22,500 gpd) (85.4m^3) or less (see 10 CSR 20-8.020) for the requirements for those facilities.]

(1) Applicability. Wastewater systems shall be designed on criteria contained in this rule, published standards, applicable federal and state requirements, standard textbooks, current technical literature and applicable safety standards. To the extent of any conflict between the above criteria, the requirement in this rule shall prevail.

(A) This rule does not apply to animal waste management systems. Regulations for these facilities are found in 10 CSR 20-8.300.

(B) This rule does not apply to agrichemical facilities. Regulations for these facilities are found in 10 CSR 20-8.500.

*[3]***(2) General** Design Considerations. *[The selection of sludge handling and disposal methods should include the following considerations: energy requirements; efficacy of sludge thickening; complexity of equipment; staffing requirements; toxic effects of heavy metals and other substances on sludge stabilization and disposal; treatment of side-stream flow such as digester and thickener supernatant; a back-up method of sludge handling and disposal; and methods of ultimate sludge disposal.]*

(A) Industrial Wastes. Industrial wastes and industrial residuals shall not be discharged to land application system without a beneficial use assessment of the effects the substances may have upon the vegetation and soils in accordance with state and federal laws.

(B) Safety. Refer to 10 CSR 20-8.140(8).

(C) Chemical Handling, Safety, and Identification. See 10 CSR 20-8.140(9)

[(4) Sludge Thickeners. As the first step of sludge handling, the need for sludge thickeners to reduce the volume of sludge should be considered. The design of thickeners (gravity, dissolved air flotation, centrifuge and others) should, consider the type and concentration of sludge, the sludge stabilization processes, the method of ultimate sludge disposal, chemical needs, and the cost of operation. Particular attention should be given to the pumping and piping of the concentrated sludge and possible onset of anaerobic conditions. Sludge should be thickened to at least five percent (5%) solids prior to transmission to digesters.]

(3) Gravity Sludge Thickeners. The minimum side water depth shall be ten feet (10').

*[(5)]***(4)** Anaerobic *[Sludge]* **Solids** Digestion.

(A) General.

[1. Multiple units. Multiple tanks are recommended. Where a single digestion tank is used, an alternate method of sludge processing or emergency storage to maintain continuity of service shall be provided.

2. Depth. For those units proposed to serve as supernatant separation tanks, the depth should be sufficient to allow for the formation of a reasonable depth of supernatant liquor. A minimum sidewater depth of twenty feet (20') (6.10 m) is recommended.

3. Maintenance provisions. To facilitate draining, cleaning and maintenance, the following features are desirable:

A. Slope. The tank bottom should slope to drain toward the withdrawal pipe. For tanks equipped with a suction mechanism for withdrawal of sludge, a bottom slope of one to twelve (1:12) or greater is recommended. Where the sludge is to be removed by gravity alone, one to four (1:4) slope is recommended.

B. Access manholes. At least two (2) thirty-six inch (36") (91 cm) diameter access

manholes should be provided in the top of the tank in addition to the gas dome. There should be stairways to reach the access manholes. A separate sidewall manhole shall be provided. The opening should be large enough to permit the use of mechanical equipment to remove grit and sand.

C.] **1.** Safety. Nonsparking tools, safety lights, rubber-soled shoes, safety harness, gas detectors for inflammable and toxic gases, and at least two (2) self-contained breathing units shall be provided for emergency use.

2. Alarms shall be installed to warn of:

A. Any drop of the liquid level below minimum operating elevation; and

B. Low pressure in the space above the liquid level.

(B) *[Sludge Inlets and Outlets]* **High Level Emergency Overflow**. **An unvalved vented overflow shall be provided to prevent damage to the digestion tank and cover in case of accidental overfilling. Pipe this emergency overflow back to the treatment process or side stream treatment facility.** *[Multiple recirculation withdrawal and return points should be provided to enhance flexible operation and effective mixing, unless mixing facilities are incorporated within the digester. The returns, in order to assist in scum breakup, should discharge above the liquid level and be located near the center of the tank. Raw sludge discharge to the digester should be through the sludge heater and recirculation return piping or directly to the tank if internal mixing facilities are provided. Sludge withdrawal to disposal should be from the bottom of the tank. This pipe should be interconnected with the recirculation piping to increase versatility in mixing the tank contents, if the piping is provided. Sludge withdrawal should be at the bottom of the tank.*

(C) Tank Capacity. The total digestion tank capacity should be determined by rational calculations based upon such factors as volume of sludge added, its percent solids and character, the temperature to be maintained in the digesters, the degree or extent of mixing to be obtained and the degree of volatile solids reduction required. Calculations should be submitted to justify the basis of design. When the calculations are not based on these factors, the minimum combined digestion tank capacity outlined in paragraphs (5)(C)1. and 2. will be required. The requirements assume that a raw sludge is derived from ordinary domestic wastewater, that a digestion temperature is to be maintained in the range of ninety degrees to one hundred degrees Fahrenheit (90°–100 °F) (32.2 °C–37.8 °C), that forty to fifty percent (40–50%) volatile matter will be maintained in the digested sludge, and that the digested sludge will be removed frequently from the system (see also paragraph (5)(A)1. of this rule).

1. Completely-mixed systems. Completely-mixed systems shall provide for intimate and effective mixing to prevent stratification and to assure homogeneity of digester content. The system may be loaded at a rate up to eighty pounds (80 lbs.) of volatile solids per one thousand (1000) cubic feet of volume per day (1.28 kg/m^3/day) in the active digestion units. When grit removal facilities are not provided, the reduction of digester volume due to grit accumulation should be considered. Complete mixing can be accomplished only with substantial energy input.

2. Moderately-mixed systems. For digestion systems where mixing is accomplished only by circulating sludge through an external heat exchanger, the system may be loaded at a rate up to forty pounds (40 lbs.)of volatile solids per one thousand (1000) cubic feet of volume per day (0.64 kg/m^3/day) in the active digestion units. This loading may be modified upward or downward depending upon the degree of mixing provided. Provisions for mixing scum shall be included.

(D)] **(C)** Gas Collection, Piping and Appurtenances.

[1. General. All portions of the gas system, including the space above the tank liquor, storage facilities and piping, shall be so designed that under all normal operating conditions, including sludge withdrawal, the gas will be maintained under positive pressure. All enclosed areas where any gas leakage might occur shall be adequately ventilated.

2.] **1.** Safety equipment. *[All necessary safety facilities shall be included where]* **Where** gas is produced*[.]* **, all necessary safety facilities shall:**

A. *[Pressure]* **Provide pressure** and vacuum relief valves and flame traps, together with automatic safety shutoff valves *[, shall be provided.]* **and protect from freezing;**

B. *[Water]* N**ot install water** seal equipment *[shall not be installed.]***; and**

C. *[Gas]* **House gas** safety equipment and gas compressors *[should be housed]* in a separate room with an exterior entrance.

2. Piping galleries shall be ventilated in accordance with paragraph (4)(C)4. below.

[3. Gas piping and condensate. Gas piping shall be of adequate diameter and shall slope to condensate traps at low points. The use of float-controlled condensate traps is not permitted.

4. Gas utilization equipment. Gas-fired boilers for heating digesters shall be located in a separate room not connected to the digester gallery. The separated room would not ordinarily be classified as hazardous location. Gas lines to these units shall be provided with suitable flame traps.

5.] **3.** Electrical fixtures**, equipment, and controls**. Electrical fixtures**, equipment,** and controls *[in places enclosing anaerobic digestive appurtenances where hazardous gases are normally contained in the tanks and/or piping]* shall comply with the National Electrical *[Code, Class I, Group D, Division 2 locations]* **Manufacturers Association (NEMA) 4X enclosure rating where necessary. Electrical equipment, fixtures, and controls, in places enclosing and adjacent to anaerobic digestive appurtenances where hazardous gases are normally contained in the tanks and/or piping shall comply with the National Electrical Manufacturers Association (NEMA) 4X enclosure rating where necessary.** *[Digester galleries should be isolated from normal operating areas to avoid an extension of the hazardous location in accordance with paragraph (5)(D)7. of this rule.*

6. Waste gas. Waste gas burners shall be readily accessible and should be located at least twenty-five feet (25') (7.6 m) away from any plant structure if placed at ground level or may be located on the roof of the control building if sufficiently removed from the tank. All waste gas burners shall be equipped with automatic ignition, such as pilot light or a device using a photoelectric cell sensor. Consideration should be given to the use of natural or propane gas to insure reliability of the pilot light. In remote locations it may be permissible to discharge the gas to the atmosphere through a return-bend screened vent terminating at least ten feet (10') (3 m) above the ground surface, provided that the assembly incorporates a flame trap.

7.] **4.** Ventilation. Any underground enclosures connecting with digestion tanks or containing *[sludge]* **solids** or gas piping or equipment shall be provided with forced ventilation **for dry wells** in accordance with *[10 CSR 20-8.130(4)(G) and 10 CSR 20-8.130(4)(G)2]* **10 CSR 20-8.130(4)(H) and 10 CSR 20-8.140(7)(J)**. *[The piping gallery for digesters should not be connected to other passages. Where used, tightly fitting, self-closing doors should be provided at connecting passageways and tunnels to minimize the spread of gas.]*

[8. Meter. A gas meter with bypass shall be provided to meter total gas production.

(E) Digester Heating.

1. Insulation. Wherever possible digestion tanks should be constructed above groundwater level and should be suitably insulated to minimize heat loss.

2. Heating facilities. Sludge may be heated by circulating the sludge through external heaters or by heating units located inside the digestion tank.

A. External heating. Piping shall be designed to provide for the preheating of feed sludge before introduction to the digesters. Provisions shall be made in the layout of the piping and valving to facilitate cleaning of these lines. Heat exchanger sludge piping should be sized for heat transfer requirements.

B. Other heating methods. Other types of heating facilities will also be considered on their own merits.

3. Heating capacity. Heating capacity sufficient to consistently maintain the design sludge temperature shall be provided. Where digester tank gas is used for sludge heating, an auxiliary fuel supply is required.

4. Hot water internal heating controls.

A. Mixing valves. A suitable automatic mixing valve shall be provided to temper the boiler water with return water so that the inlet water to the heat jacket can be held below a temperature at which caking will be accentuated. Manual control should also be provided by suitable bypass valves.

B. Boiler controls. The boiler should be provided with suitable automatic controls to maintain the boiler temperature at approxi-mately one hundred eighty degrees Fahrenheit (180 °F) (82 °C) to minimize corrosion and to shut off the main gas supply in the event of pilot burner or electrical failure, low boiler water level or excessive temperature.

C. Thermometers shall be provided to show temperatures of the sludge, hot water feed, hot water return and boiler water.]

(D) Water Supply. Refer to 10 CSR 20-8.140(7)(D) regarding indirect water supply connections.

[(F) Supernatant Withdrawal.

1. Piping size. Supernatant piping should not be less than six inches (6") (15 cm) in diameter.

2. Withdrawal arrangements.

A. Withdrawal levels. Piping should be arranged so that withdrawal can be made from three (3) or more levels in the digester. A positive unvalved vented overflow shall be provided.

B. Supernatant selector. If a supernatant selector is provided, provisions shall be made for at least one (1) other draw-off level located in the supernatant zone of the tank in addition to the unvalved emergency supernatant draw-off pipe. High pressure backwash facilities shall be provided.

3. Sampling. Provisions should be made for sampling at each supernatant draw-off level. Sampling pipes should be at least one and one-half inches (1 1/2") (3.8 cm) in diameter and should terminate at a suitably-sized sampling sink or basin.

4. Alternate supernatant disposal. Consideration should be given to supernatant conditioning where appropriate in relation to its effect on plant performance and effluent quality.

(6)] **(5)** Aerobic *[Sludge]* **Solids** Digestion *[.]* **High Level Emergency Overflow. An unvalved emergency overflow shall be provided that will convey digester overflow to the treatment plant headworks, the aeration process, or to another liquid sludge storage facility and that has an alarm for high level conditions.**

[(A) General. Aerobic digestion can be used to stabilize primary sludge, secondary sludge or a combination of the two. Digestion is accomplished in single or multiple tanks designed to provide effective air mixing, reduction of the organic matter, supernatant separation and sludge concentration under controlled conditions.

1. *Digestion tanks. Multiple tanks are recommended. A single sludge digestion tank may be used in the case of small treatment plants or where adequate provision is made for sludge handling where a single unit will not adversely affect normal plant operations.*

(B) Mixing and Air Requirements. Aerobic sludge digestion tanks shall be designed for effective mixing by satisfactory aeration equipment. Sufficient air shall be provided to keep the solids in suspension and maintain dissolved oxygen between one and two (1–2) mg/l. A minimum mixing and oxygen requirement of thirty (30) cfm per one thousand (1000) cubic feet of tank volume (30 l/min/m^3) shall be provided with the largest blower out-of-service. If diffusers are used, the nonclog type is recommended, and they should be designed to permit continuity of service. If mechanical aerators are utilized, a minimum of 1.0 horsepower per one thousand (1000) cubic feet (28.3m^3) should be provided. Use of mechanical equipment is discouraged where freezing temperatures are normally expected.

(C) Tank Capacity. The determination of tank capacities shall be based on rational calculations, including such factors as quantity of sludge produced, sludge characteristics, time of aeration and sludge temperature.

1. *Volatile solids loading. It is recommended that the volatile suspended solids loading not exceed one hundred pounds per one thousand cubic feet (100 lb/1000 ft^3) of volume per day (1.60 kg/m^3/day) in the digestion units. Lower loading rates may be necessary depending on temperature, type of sludge and other factors.*
2. *Solids retention time. Required minimum solids retention time for stabilization of biological sludges vary depending on type of sludge. Normally, a minimum of fifteen (15) days' retention should be provided for waste activated sludge and twenty (20) days for combination of primary and waste activated sludge, or primary sludge alone. Where sludge temperature is lower than fifty degrees Fahrenheit (50 °F) (10 °C), additional detention time should be considered.*

(D) Supernatant Separation. Facilities shall be provided for effective separation and withdrawal of supernatant and for effective collection and removal of scum and grease.

(7) Sludge Pumps and Piping.

(A) Sludge Pumps.

1. *Capacity. Pump capacities should be adequate but not excessive. Provision for varying pump capacity is desirable.*
2. *Duplicate units. Duplicate units shall be provided where failure of one (1) unit would seriously hamper plant operation.*

3. *Type. Plunger pumps, screw feed pumps, recessed impeller type centrifugal pumps, progressive cavity pumps or other types of pumps with demonstrated solids handling capability shall be provided for handling raw sludge. Where centrifugal pumps are used, a parallel plunger type pump should be provided as an alternate to increase reliability of the centrifugal pump.*
4. *Minimum head. A minimum positive head of twenty-four inches (24") (61 cm) shall be provided at the suction side of centrifugal type pumps and is desirable for all types of sludge pumps. Maximum suction lifts should not exceed ten feet (10') (3m) for plunger pumps.*
5. *Sampling facilities. Unless sludge sampling facilities are otherwise provided, quick closing sampling valves shall be installed at the sludge pumps. The size of valve and piping should be at least one and one-half inches (1 1/2") (3.8 cm).]*

(6) For solids pumping systems, at a minimum audio-visual alarms shall be provided for:

(A) Pump failure;

(B) Loss of pressure; and

(C) High pressure.

[(B) Sludge Piping.

1. *Size and head. Sludge withdrawal piping should have a minimum diameter of eight inches (8") (20.3 cm) for gravity withdrawal and six inches (6") (15.2 cm) for pump suction and discharge lines. Where withdrawal is by gravity the available head on the discharge pipe should be adequate to provide [at least three feet (3') per second (0.9m/sec) velocity.*
2. *Slope. Gravity piping should be laid on uniform grade and alignment. The slope of gravity discharge piping should not be less than three percent (3%). Provisions should be made for cleaning, draining and flushing discharge lines.*
3. *Supports. Special consideration should be given to the corrosion resistance and continuing stability of supporting systems located inside the digestion tank.*

(8) Sludge] **(7) Solids** De*[-]*watering.

[(A) Sludge Drying Beds.

1. *Area. In determining the area of sludge drying beds, consideration shall be given to climatic conditions, the character and volume of the sludge to be de-watered, the method and schedule of sludge removal and other methods of sludge disposal. (It should be recognized that, in northern areas of the country, the drying season is only six (6) months a year.) In general, the sizing of the drying bed may be estimated on the basis of 2.0 ft^2/capita (0.2 m^2/capita) when the drying bed is the primary method of de-watering, and 1.0 ft^2/capita (0.1 m^2/capita) if it is to be used as a back-up de-watering unit. An increase of bed area by twenty-five percent (25%) is recommended for paved-type bed.*
2. *Percolation type. The lower course of gravel around the underdrains should be properly graded and should be twelve inches (12") (30 cm) in depth, extending at least six inches (6") (15.2 cm) above the top of the underdrains. It is desirable to place this in two (2) or more layers. The top layer of at least three inches (3") (7.6 cm) should consist of gravel one-eighth inch (1/8") to one-fourth inch (1/4") (3.2–6.4 mm) in size.*
   A. *Sand. The top course should consist of at least six to nine inches (6"–9") (15–23 cm) of clean coarse sand. The finished sand surface should be level.*
   B. *Underdrains. Underdrains should be clay pipe or concrete drain tile at least four*

inches (4") (10 cm) in diameter laid with open joints. Underdrains should be spaced not more than twenty feet (20') (6 m) apart. As to the discharge of the underdrain filtrate, refer to subsection (8)(C) of this rule.

3. Partially paved type. The partially paved type drying bed should be designed with consideration for space requirement to operate mechanical equipment for removing the dried sludge.

4. Walls. Walls should be watertight and extend fifteen to eighteen inches (15"–18") (38 cm–46 cm) above and at least six inches (6") (15 cm) below the surface. Outer walls should be curbed to prevent soil from washing into the beds.

5. Sludge removal. Not less than two (2) beds should be provided and they should be arranged to facilitate sludge removal. Concrete truck tracks should be provided for all percolation type sludge beds. Pairs of tracks for percolation type should be on twenty-foot (20') (6 m) centers.

6. Sludge influent. The sludge pipe to the drying beds should terminate at least twelve inches (12") (30 cm) above the surface and be so arranged that it will drain. Concrete splash plates for percolation type should be provided at sludge discharge points.

7. Protective enclosure. A protective enclosure shall be provided if winter operation is required.

(B) Mechanical De-watering Facilities. Provision shall be made to maintain sufficient continuity of service so that sludge may be de-watered without accumulation beyond storage capacity. The number of vacuum filters, centrifuges, filter presses, belt filters or other mechanical de-watering facilities should be sufficient to de-water the sludge produced with one (1) largest unit out-of-service. Unless other standby facilities are available, adequate storage facilities shall be provided. The storage capacity should be sufficient to handle at least a three (3)-month sludge production.

1. Auxiliary facilities per vacuum filters. There shall be a back-up vacuum pump and filtrate pump installed for each vacuum filter. It is permissible to have an uninstalled back-up vacuum pump or filtrate pump for every three (3) or less vacuum filters, provided that the installed unit can easily be removed and replaced.

2. Ventilation. Adequate facilities shall be provided for ventilation of de-watering area. The exhaust air should be properly conditioned to avoid odor nuisance.

3. Chemical handling enclosures. Lime-mixing facilities should be completely enclosed to prevent the escape of lime dust. Chemical handling equipment should be automated to eliminate the manual lifting requirement.

(C) Drainage and Filtrate Disposal. Drainage from beds or filtrate from de-watering units shall be returned to the sewage wastewater treatment process at appropriate points.

(D) Other De-watering Facilities. If it is proposed to de-water or dispose of sludge by other methods, a detailed description of the process and design data shall accompany the plans.]

(A) Belt presses and conveyors shall be provided with emergency pull cords along the entire length of the belt presses and conveyors that will:

1. Stop the press in an emergency; and

2. Trigger an audible alarm.

(B) Alarm systems shall be provided to notify the operator(s) of conditions that could result in process equipment failure or damage, threaten operator safety, or a solids spill or overflow condition.

(8) Sludge and Biosolids Storage Lagoons. Seal the sludge lagoon bottoms and embankments in accordance with 10 CSR 20-8.200(4)(C) to prevent leaching into adjacent soils or groundwater.

*[(9) Municipal Sludge Disposal on Land. The program of land spreading of sludge must be evaluated as an integral system which include**s** stabilization, storage, transportation, application, soil, crop and groundwater. The following guidelines were formulated to provide the criteria of municipal sludge disposal on land. Sewage sludge is useful to crop and soil by providing nutrients and organic matter. Sewage sludge contains heavy metals and other substances which could affect soil productivity and the quality of food. Sufficient information is not available to completely evaluate the deleterious effects. The purpose of the guidelines is to indicate the acceptable method of sludge disposal on land surface based on current knowledge. It is recognized that these guidelines should be revised as more information becomes available.*

(A) General Limitations to be Observed.

1. *Stabilized sludge. Only stabilized sludge shall be surface applied to farmland or pasture. Stabilized sludge is defined as processed sludge in which the organic and bacterial contents of raw sludge are reduced to levels deemed necessary by the agency to prevent nuisance odors and public health hazards. Any process which produces sludge equivalent in quality to the above in terms of public health factors and odor potential may be accepted. Additional treatment would be required to further reduce pathogens when the sludge is to be spread on dairy pastures and other crops which are in the human food chain.*
2. *Raw vegetables. Sludge should not be applied to land which is used for growing food crops to be eaten raw, such as leafed vegetables and root crops.*
3. *Minimum pH. No sludge shall be applied on land if the soil pH is less than 6.5 when sludge is applied and pH shall be maintained above 6.5 for at least two (2) years following end of sludge application.*
4. *Persistent organic chemicals. At present time, sufficient information is not available to establish criteria of sludge spreading in regard to persistent organic chemicals, such as pesticides and polychlorinated biphenyls (PCB). However, if there is a known source in the sewer service area which discharges or discharged in the past such chemicals, the sludge should be analyzed for chemicals and the agency shall be consulted for recommendations concerning sludge spreading.*

(B) Site Selection. By proper selection of the sludge application site, the nuisance potential and public health hazard should be minimized. The following items should be considered and the agency should be consulted for specific limits: land ownership information; groundwater table and bedrock location; location of dwellings, road and public access; location of wells, springs, creeks, streams and flood plains; slope of land surface; soil characteristics; climatological information and periods of ground freezing; land use plan; and road weight restrictions.

(C) Sludge Application on Farmland. Heavy metal loading to land should be limited in order to avoid reduction of soil productivity. A detailed chemical analysis of the sludge shall be made and the application rate shall be based on characteristics of the application site and crop uptake. The agency shall be contacted for specific limits.

(D) Sludge Application on Forested Land. Disposal of sludge on forested land is considerably less hazardous than on cropland in terms of heavy metal toxicity unless the land is to be converted to cropland. For the allowable sludge loading the agency should be consulted.

(E) Management of Spreading Operation.

1. Hauling equipment. The sludge hauling equipment should be designed to prevent spillage, odor and other public nuisance.

2. Valve control. The spreading tank truck should be provided with a control so that the discharge valve can be opened and closed by the driver while the vehicle is in motion. The spreading valve should be of the fail-safe type (that is, self-closing) or an additional manual standby valve should be employed to prevent uncontrolled spreading or spillage.

3. Sludge storage. Sufficient sludge storage capacity shall be provided for periods of inclement weather and equipment failure. The storage facilities shall be designed, located and operated so as to avoid nuisance conditions.

4. Spreading methods. The selection of spreading methods depends on the sludge characteristics, environmental factor and others. When control of odor nuisance and runoff is required, immediate incorporation of sludge after spreading or subsurface injection should be considered. When such method is utilized, an adjustment in the reduced rate of ammonia loss into the atmosphere should be considered in the computation for nitrogen balance. The sewage sludge should be spread uniformly over the surface when tank truck spreading, ridge and furrow irrigation or other methods are used. Proposals for subsurface application of sludge shall include for review a description of the equipment and program for application. Spray systems except for downward directed types will not ordinarily be approved.

5. Boundary demarcation. The boundaries of the site shall be marked (for example, with stakes at corners) so as to avoid confusion regarding the location of the site during the sludge application. The markers should be maintained until the end of the current growing season.

6. Public access. Public access of the disposal site must be controlled by either positive barriers or remoteness of the site.

(F) Monitoring and Reporting. The requirement of the agency on the monitoring and reporting of sludge spreading operation should be followed. As a minimum, the producer of sludge should regularly collect and record information on the sludge and soil characteristics and volume of sludge spread to a particular site.

(10) Other Sludge Disposal Methods. When other sludge disposal methods, such as incineration and landfill, are considered, pertinent requirements from the agency shall be followed.]

AUTHORITY: section 644.026, RSMo Supp. 1988. Original rule filed Aug. 10, 1978, effective March 11, 1979.*
**Original authority 1972, amended 1973, 1987, 1993.*