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**TITLE 252. DEPARTMENT OF ENVIRONMENTAL QUALITY
CHAPTER 616. INDUSTRIAL WASTEWATER SYSTEMS**

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SUBCHAPTER 1. INTRODUCTION

Section

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252:616-1-1. Purpose

This Chapter establishes requirements for industrial surface impoundments, industrial tank systems and land-application of industrial sludge and wastewater. This Chapter does not apply to regulated hazardous waste. This Chapter applies to any person who constructs or operates an industrial surface impoundment system, industrial tank system, and industrial land-application sites. These rules are authorized by Title 27A O.S., §§ 2-6-101 through 2-6-106 and 2-6-501 through 2-6-501.5.

252:616-1-2. Definitions

The following words and terms, when used in this Chapter, shall have the following meaning, unless the context clearly indicates otherwise:

"Beneficial use" means in the context of land application the use of sludge or wastewater through land application for the purpose of soil conditioning, crop vegetative fertilization, or erosion control, or the use of wastewater for dust suppression where fugitive dust control would otherwise be an air quality problem, in a manner which does not pollute or tend to pollute waters of the state of Oklahoma, the environment or pose a risk to human health.

"Berm" means a man-made barrier designed to control waste and/or stormwater within a surface impoundment or to retard or contain runoff in a given area.

"Bypass" means the intentional or unintentional diversion of waste streams from any portion of a facility.

"Cathodic protection" means protecting a metal from electrochemical corrosion or rusting by using it as the cathode of a cell with a sacrificial anode.

"Cell" means a part of a surface impoundment system that shares a vertical concrete wall with another part of the surface impoundment area.

"DEQ" means the Oklahoma Department of Environmental Quality.

"Engineer" means a professional engineer registered in the state of Oklahoma.

"Flow-through surface impoundment" means a surface impoundment designed and constructed with an outfall structure which allows the controlled discharge of wastewater out of the impoundment.

"Freeboard" means the vertical distance from the surface water or sludge/solids level to the overflow elevation (outfall structure or the lowest part of the surrounding berm) in a surface impoundment.

"Hydraulic conductivity" means the coefficient of proportionality that describes the rate at which a fluid can move through a permeable medium. It is a function of both the medium and of the fluid flowing through it; also defined as the quantity of water that will flow through a unit cross-sectional area of porous material per unit of time under a hydraulic gradient of 1.00 (measured at right angles to the direction of flow) at a specified temperature.

"Industrial wastewater treatment permit" shall include any permit for construction, operation, treatment, storage or disposal required under this Chapter.

"Land application" means the controlled application of treated industrial wastewater or sludge onto the land surface for beneficial use.

"Liner" means a barrier which is designed, constructed and installed in a surface impoundment and which has appropriate chemical and physical properties to ensure that such structures control the seepage or release of waste and wastewater from the impoundment.

"Monitoring well" means all borings, wells, piezometers, or other means of retrieving a soil, waste, wastewater or vapor sample from the subsurface.

"Oklahoma Water Quality Standards" means the rules promulgated by the Oklahoma

Water Resources Board and contained in OAC 785:45 which classify waters of the state, designate beneficial uses for which the various waters of the State shall be maintained and protected, and prescribe the water quality standards required to sustain designated uses.

"OPDES" means the Oklahoma Pollution Discharge Elimination System Act at 27A O.S. § 2-6-201 *et seq.*

"Operator" means the person responsible for the maintenance and operation of a surface impoundment, or disposal or wastewater treatment system and responsible for keeping records and providing reports to the DEQ.

"Outfall" means the point where monitoring shall occur for the purpose of evaluating compliance with rules, permits or orders of the DEQ.

"Person" means any individual, company, corporation, government agency, municipality, or any other entity.

"Permeability" means the rate at which liquids pass through soil or other materials in a specified direction.

"Receiving water" means that portion of any waters of the State into which wastewater is or may be released, leached, or discharged.

"Sanitary wastewater" means and includes but is not limited to wastewater from drinking fountains, showers, toilets, lavatories, and kitchens.

"Surface impoundment" means a native soil or lined basin either below or above ground level which is designed, maintained and/or operated to store, recycle, treat and/or dispose of industrial wastewater or stormwater, and shall include but is not limited to lagoons, excavations, basins, diked areas, and pits.

"Synthetic liner" means a manufactured liner material composed of plastics, resins or other flexible materials, which is designed and manufactured to be used to control the seepage or release of waste through the liner material.

"Tank system" means any subsurface disposal system which involves the storage and treatment of wastewater.

"Total retention surface impoundment" means a surface impoundment designed and constructed without an outfall structure.

"U.S.C." means United States Code.

"Waste class" means the following classification of wastewater, including stormwater:

(A) Class I: containing or suspected to contain pollutants for which the toxicity, concentration and volume pose a significant risk of harm to humans, aquatic life, wildlife or the environment, either through high potential to migrate in groundwater or the likelihood, if discharged, to significantly degrade the beneficial uses of the receiving water as designated in the Oklahoma Water Quality Standards. These wastewaters require the most restrictive environmental protection measures.

(B) Class II: containing or suspected to contain pollutants for which the toxicity, concentration and volume pose a moderate risk of harm to humans, aquatic life, wildlife, or the environment, either through the potential to migrate in groundwater or a reasonable possibility, if discharged, to degrade the beneficial uses of the receiving water as designated in the Oklahoma Water Quality Standards.

(C) Class III: containing or suspected to contain pollutants which do not pose a substantial risk of harm to humans, aquatic life, wildlife, or the environment because of a relative immobility in groundwater or a general lack of direct toxicity, and which are not likely, if discharged, to degrade the beneficial uses of the receiving water as designated in the Oklahoma Water Quality Standards.

(D) Class IV: containing only sanitary wastewater from industrial facilities. Class IV wastewaters are not subject to this Chapter, but are governed by OAC 252:641 (under 5,000 gpd) or by OAC 252:656 (5,000 gpd or more).

(E) Class V: industrial wastewater not otherwise classified.

"Waste containment system" means storage tanks, containers and other storage reservoirs, transfer lines, pumps, fittings, overflow prevention devices, and any associated anticorrosion measures and leak prevention or detection systems.

252:616-1-3. Engineer Required

Pursuant to 59 O.S., § 475.2 and a ruling by the Oklahoma State Board of Registration for Professional Engineers and Land Surveyors, the design and closure activities required by this chapter constitute the practice of engineering and thus, require the seal and signature of an engineer registered to practice in the State of Oklahoma.

SUBCHAPTER 3. PERMIT PROCEDURES

Section

- 252:616-3-1. Requirement to obtain a permit
- 252:616-3-2. Duration of permit and renewal
- 252:616-3-3. Fees
- 252:616-3-4. Applications

252:616-3-1. Requirement to obtain a permit

(a) Permits are required for the construction, installation, modification, operation and closure of any industrial wastewater system and are processed according to the Uniform Permitting Act, Title 27A § 2-14-101, and the Tier classifications listed in OAC 252:4-7. This Chapter contains the standards to be met. Industrial wastewater system requirements under this Chapter may be issued as components of discharge permits issued under OAC 252:606.

(b) Instream sand and gravel facilities using hydraulic dredging that have applied for a Section 404 permit pursuant to the Clean Water Act and other sand and gravel facilities that completely operate outside the wetted perimeter of a water body may seek coverage under only the DEQ's Multi-Sector General Permit for Industrial Activities, unless the sand and gravel operation:

- (1) has a point source discharge of process water to waters of the state, in which case a discharge permit, pursuant to OAC 252:606, is also required, or
- (2) utilizes surface impoundment(s) that store wastewater from processes other than the washing of sand and/or gravel, in which case a surface impoundment permit, pursuant to the requirements of this Chapter, is also required.

252:616-3-2. Duration of permit and renewal

Industrial wastewater treatment permits issued pursuant to this Chapter shall be for a term of no more than five years and may be renewed upon receipt of proper and timely application according to criteria and provisions of this Chapter and applicable law. An application for renewal of an existing permit shall be filed at least 180 days prior to the expiration date of the existing permit. If a proper and complete application for renewal is filed, the existing permit shall continue in effect unless otherwise terminated, modified, suspended or revoked and reissued.

252:616-3-3. Fees

(a) **Application fees.** Application fees for new industrial wastewater system permits or to renew existing industrial wastewater system permits are non-refundable and are set forth below:

- (1) Class I - \$300.00
- (2) Class II - \$200.00
- (3) Class III and authorizations under a general permit - \$100.00
- (4) Class V - \$300.00

(b) **Annual fees.** Permit holders shall submit payment to DEQ for annual fees upon receipt of an invoice from DEQ. Payments for annual fees received by DEQ shall be applied to the twelve-month period following the due date of the initial invoice issued by DEQ, but not past the expiration of the permit. Failure to pay an annual fee may result in suspension or termination of the permit. The annual fees are set forth below.

- (1) **Industrial tank systems.** The annual fees for industrial tank systems are as follows:
 - (A) Class I or II - \$970.00
 - (B) Class III - \$330.00

(C) Class V - \$440.00

(2) **Industrial surface impoundments.** The annual fees for industrial surface impoundment systems are as follows:

(A) Class I - \$1,670.00 per impoundment

(B) Class II - \$1,120.00 per impoundment

(C) Class III and authorizations under a general permit - \$330.00 per impoundment

(D) Class V - \$440.00 per impoundment

(3) **Land application of industrial wastewater or industrial sludge.** The holder of a permit for an industrial tank or impoundment system that allows for the land application of industrial wastewater and/or industrial sludge shall pay an annual fee of \$690.00 in addition to the annual fees set forth in (1) and (2) of this subsection.

(c) **Consumer Price Index adjustment.** To assist in meeting rising costs for the industrial wastewater program, the fees set out in (a), and (b) of this Section shall be automatically adjusted on July 1st every year to correspond to the percentage, if any, by which the Consumer Price Index (CPI) for the most recent calendar year exceeds the CPI for the previous calendar year. The Department may round the adjusted fees up to the nearest dollar. The Department may waive collection of an automatic increase in a given year if it determines other revenues, including appropriated state general revenue funds, have increased sufficiently to make the funds generated by the automatic adjustment unnecessary in that year. A waiver does not affect future automatic adjustments.

(1) Any automatic fee adjustment under this subsection may be averted or eliminated, or the adjustment percentage may be modified, by rule promulgated pursuant to the Oklahoma Administrative Procedures Act. The rulemaking process may be initiated in any manner provided by law, including a petition for rulemaking pursuant to 75 O.S. § 305 and OAC 252:4-5-3 by any person affected by the automatic fee adjustment.

(2) If the United States Department of Labor ceases to publish the CPI or revises the methodology or base years, no further automatic fee adjustments shall occur until a new automatic fee adjustment rule is promulgated pursuant to the Oklahoma Administrative Procedures Act.

(3) For purposes of this subsection, "Consumer Price Index" or "CPI" means the Consumer Price Index - All Urban Consumers (U.S. All Items, Current Series, 1982-1984=100, CUUR0000SA0) published by the United States Department of Labor. The CPI for a calendar year is the figure denoted by the Department of Labor as the "Annual" index figure for that calendar year.

252:616-3-4. Applications

(a) **Form.** Applications for new industrial wastewater system permits or to renew existing industrial wastewater permits shall be:

(1) submitted on the appropriate DEQ approved forms;

(2) complete and legible;

(3) signed by the:

(A) owner; and

(B) operator, if different than the owner; and

(4) accompanied by the applicable application fees set forth in 252:616-3-3.

(c) **Construction plans.** The applicant shall submit construction plans to the DEQ at least one hundred twenty (120) days before starting on-site construction or modifying any new or existing surface impoundment or industrial wastewater system. The construction plans shall include the proposed wastewater characteristics, treatment processes and other pertinent information.

(d) **Construction certification.**

(1) An Engineer must certify that tank systems and surface impoundments have been designed and constructed according to this Chapter. The certification must include:

(A) a chronological description of major construction activities;

(B) plans and specifications of record for each industrial wastewater unit;

(C) a description of quality control tests, results and inspections;

- (D) a statement that the wastewater system will protect humans, aquatic life, wildlife and the environment; and
 - (E) for surface impoundments, certification that the liner was constructed properly and not damaged by freezing, desiccation or other damage during construction.
- (2) An engineer certification is not required for a single cell total retention surface impoundment system that holds only Class III wastewater designed pursuant to the requirements of Appendix D of this Chapter.
- (e) **Construction report.** For tank systems and surface impoundments that will contain Class III, Class IV or V wastewater, the owner/operator shall submit a written report that construction was completed in accordance with the requirements of the permit. It is not required that this report be prepared by an engineer.
- (f) **Financial responsibility.** The applicant must demonstrate to the satisfaction of the DEQ the financial capability for operation, maintenance, replacement and closure for the facility.
- (g) **Transfer.** Applications and unexpired permits may be transferred upon showing the transferee has legal authority and financial accountability, and that both parties agree to the transfer.
- (h) **Permit.** Applicants must comply with the terms of the permits that are issued. Permits shall contain a description of all wastewater treatment units to be constructed at the facility. Permits may contain provisions more stringent than these rules in order to meet Oklahoma Water Quality Standards.

252:616-3-5. Terms and conditions of permits

Where practicable and as deemed appropriate by the DEQ and as applicable according to circumstances, any industrial wastewater system individual permit, or authorization under a general permit, to operate an industrial wastewater system pursuant to DEQ rules and regulations, may contain appropriate terms, conditions, limitations, and requirements related to protection of groundwater, for remediation of pollution, or for implementation of other programs under the jurisdiction of the DEQ.

SUBCHAPTER 5. GENERAL STANDARDS

Section

- 252:616-5-1. Site and system
- 252:616-5-2. Maintenance and Operation Plan (MOP)
- 252:616-5-3. Reporting
- 252:616-5-4. Monitoring

252:616-5-1. Site and system

- (a) **Location and construction.** Locate and construct industrial wastewater systems in a manner which will minimize adverse impacts to waters of the State and the environment. Do not locate in floodways. If located in a flood plain, the crest elevation of dikes must be at least one foot above the 100-year flood elevation and the DEQ may require additional erosion controls.
- (b) **Separation distances.** The following separation distances are required:
- (1) Tank systems and surface impoundments must be separated at least 50 feet from private water wells (100 feet if the ground slopes towards the well) or surface water supplies, and 300 feet from public water supply wells. Separate tank systems by 5 feet and surface impoundments by 10 feet from property lines.
 - (2) Land application must not occur:
 - (A) in designated wellhead delineation areas of private or public water supplies;
 - (B) within one-half mile of an outstanding resource water or its tributaries or a high quality water as identified in Appendix A of the Oklahoma Water Quality Standards;
 - (C) within one-quarter mile of a water listed in Appendix B of the Oklahoma Water Quality Standards;
 - (D) within 250 feet of a well used for a potable water supply or within 100 feet of any

surface water of the state not otherwise referenced in (3) or (4) of this paragraph; or
(E) within two feet of the highest measured groundwater elevation at the site.

(c) **Site security.** Restrict access to industrial wastewater systems and land application sites by fences, secured gates or other reasonable means. Post a sign listing the name of the facility operator, an emergency telephone number and the DEQ permit number.

(d) **Site protection.** Do not allow wastewater to escape, unless specifically authorized in the permit through lateral lines or through a discharge permit. Construct and maintain facilities to prevent contamination of the surrounding soil and ground water.

(e) **System protection.** Protect tank systems from vehicular traffic, and prevent vehicular traffic over lateral fields. Provide soil, gravel or splash pads to protect surface impoundment liners during routine operation and maintenance.

(f) **Purpose.** All industrial wastewater systems must be designed for a specific treatment purpose (such as settling, biological degradation, beneficial reuse or final disposal), and shall be maintained and operated to produce optimum treatment results.

(g) **Site specific.** The DEQ may impose specific construction, operation and maintenance requirements based on wastewater type and environmental compatibility, on a case-by-case basis.

252:616-5-2. Maintenance and Operation Plan (MOP)

For tanks and surface impoundments that contain Class I and Class II wastewater, there must be a written Maintenance and Operation Plan (MOP). A MOP may be required for other wastewater classifications based on site specific information. The MOP must be followed, updated annually, if necessary, kept on-site and be available to the DEQ. The MOP must contain the following items:

(1) **Maintenance.** The MOP must discuss maintenance procedures including methods to protect impoundments and liner integrity, procedures for solids removal as well as other procedures (such as tank repair or control of soil erosion, removal of deep-root vegetation, and prevention of liner desiccation).

(2) **Operation.** The MOP must discuss operation procedures used to protect tank or surface impoundment and liner integrity, as well as other procedures (e.g., influent and effluent flow, sludge removal, sludge storage, changes in waste composition, and freeboard control). Describe procedures to notify the DEQ at the time of a spill or bypass.

(3) **Monitoring.** The MOP must discuss the scope and frequency of monitoring activities (such as parameters sampled, sampling frequency, sampling methods, and reporting schedule).

(4) **Personnel.** Include the name and phone number of all personnel responsible for maintenance, operation and monitoring activities.

252:616-5-3. Reporting

(a) Monitoring reports, plans and other reports provided to the DEQ must contain data analysis and sample results prepared by a laboratory certified by the DEQ under OAC 252:300.

(b) Monitoring and sampling information shall be supplied to the DEQ on self monitoring report (SMR) forms, other appropriate forms approved by the DEQ and developed for the specific purpose or in such other form and format as may be specified by the DEQ.

(c) An owner or operator must give notice to the DEQ within 24 hours of any wastewater spill or release, followed by written notice to the DEQ within 7 days. This includes violations of permit limits, application or loading rates, or mistimed application at land application sites. Within ten (10) days of notice of excessive loading, the owner or operator must submit a corrective action plan and must perform it when approved. The DEQ may also require corrective action for too frequent or mistimed applications.

252:616-5-4. Monitoring

The DEQ may require groundwater monitoring for wastewater contaminants when there is a potential for groundwater contamination. This section describes the criteria for monitoring when required by the DEQ.

(1) **Groundwater flow direction.** Determine the hydrologic gradient or groundwater flow direction with at least three wells spaced in a triangular pattern, an appropriate distance apart. Hydrologic connections to surface water bodies may also be used to estimate the direction of groundwater flow.

(2) **Wells.** Install at least one well or borehole upgradient and at least two wells or boreholes downgradient. Install a sufficient number of wells or boreholes to insure prompt and reliable detection of wastewater. The total depth of each well or borehole and the screened interval of each well shall be subject to prior DEQ approval. Design, install and plug all wells and boreholes according to the OWRB rules, OAC 785:35.

(3) **Monitoring plan.** Submit a detailed monitoring plan to the DEQ before constructing or installing any wells or boreholes. Do not install them until the plan is approved. Notify the DEQ five days before installing or plugging any wells or boreholes so that a DEQ representative may observe the work. The monitoring plan must:

(A) Describe the purpose and scope of the monitoring system;

(B) Locate all wells and boreholes on a map, and provide the rationale used to determine the locations. The monitoring system may include existing wells and boreholes if they are properly located and constructed; and

(C) Describe all sampling and analysis methods, including the sample type (such as liquid, sludge, composite or grab) and the purpose of each sample type (e.g., waste stratification, waste composition, extent of contamination); the location and depth of each type of sample, and the frequency of sampling; the type of equipment used for each type of sample (e.g., hand-held, truck mounted drilling rig; split-spoon or auger); the EPA-approved analytical method number (see 40 CFR Part 136) for each type of sample and parameter analyzed; and the laboratory name and certification number and evidence that the parameters analyzed are included in the laboratory certification.

(4) **Split samples.** When requested by the DEQ, provide five days prior notice to the DEQ of the next sampling schedule so that a DEQ representative may be present to collect split samples and observe sampling methods.

(5) **Additional land application monitoring criteria.**

(A) **Parameters.** Sample and analyze the soil, surface water and/or groundwater (site-specific monitoring) of a land application site for the same parameters for which the wastewater or sludge is tested.

(B) **Form 2-L.** Include the information required in form 2-L.

(C) **Well data.** Include the number, total depth, depth of completion, and screened intervals of monitoring wells proposed for or existing on a land application site, including well logs or drillers logs, if available, and the elevation of each well as surveyed, the depth to static water level and the date the level was measured.

SUBCHAPTER 7. SURFACE IMPOUNDMENT STANDARDS

Section

252:616-7-1. Construction and maintenance

252:616-7-2. General liner requirements

252:616-7-3. Compacted clay liners

252:616-7-4. Synthetic liners

252:616-7-5. Composite liners

252:616-7-6. Soil and bentonite liners

252:616-7-7. Concrete liners

252:616-7-1. Construction and maintenance

All industrial surface impoundments must comply with the construction and maintenance requirements of this section.

(1) **Stormwater.** All surface impoundments, except those designed specifically for stormwater runoff, shall be constructed to prevent the entrance of runoff waters.

- (2) **Slope.** Inner and outer dike slopes shall not be steeper than 1 vertical to 3 horizontal (1:3). Steeper slopes will be considered where surface construction is of material, such as soil cement, that will prohibit the growth of vegetation. Concrete or rock face surface impoundments may be exempted from this requirement by the DEQ on a case by case basis.
- (3) **Berms and dikes.** Construct berms and dikes to provide a flat surface wide enough to provide safe access for inspection and maintenance of the surface impoundment.
- (4) **Depth to groundwater.** The bottom of any surface impoundment shall be a minimum of 15 feet above the historic maximum groundwater table.
- (A) Perched water is considered groundwater.
- (B) If a distance of (15) feet is not physically possible, a lesser distance may be approved by the DEQ depending on the wastewater and impoundment classification, use of liners or other means which will protect waters of the state.
- (5) **Erosion control.** Protect all earthen surface impoundment dikes and berms against erosion by using soil, gravel, concrete pads, shallow-root vegetation or other methods. Trees and deep-root vegetation shall not be used as erosion control and shall be removed in a timely manner to maintain the integrity and stability of the impoundment. Protect inner dikes from wave action and outer dikes from runoff and floodwaters.
- (A) **Seeding.** Where riprap is not used, apply at least 4 inches of fertile top soil to dikes to establish an adequate vegetative cover. Before prefilling, establish vegetation on dikes from the outside toe to 2 feet above the surface impoundment bottom on the interior as measured on the slope. Specify perennial, low-growing grasses that spread rapidly. Alfalfa or other long-rooted grasses should not be used for seeding since the roots of this type are apt to impair the water holding efficiency of the dikes.
- (B) **Additional protection.** Provide extra protection where inner dikes may be subjected to severe wind action, such as surface impoundments larger than 5 acres and where the surface impoundment surface will often be exposed to strong winds. Also protect areas of turbulence in aerated cells and all pipe penetrations. Install riprap, soil cement or other recognized material. Protect the inner dikes from 1 foot vertically above the high water elevation to 2 feet vertically below the minimum operating elevation. Place riprap on a filter bed at least 6 inches thick, and use material that will stay in place and resist erosion.
- (6) **Holding capacity.** Total retention surface impoundments shall be sized to contain the design flow of wastewater (including sludge) plus expected rainfall plus 3 feet of freeboard. Where total retention is obtained by surface evaporation, the required area shall be based on design flow plus 90th percentile rainfall less the pan evaporation rates for the area where the impoundment will be located. See supplemental information Table of Rainfall and Evaporation Data.
- (7) **Freeboard.** Maintain at least 3 feet of freeboard on all surface impoundments unless otherwise specified in a permit.
- (8) **Liner systems.** All surface impoundments shall be constructed with a liner system appropriate for the classification of wastewater from normal daily operation and when applicable, wastewater due to spill, by-pass or unit process failure.
- (9) **Liner materials.** The chemical and physical properties of liner materials must ensure that such structures and barriers do not fail to contain or control seepage or release of waste and wastewater because of:
- (A) pressure gradients;
- (B) physical contact with wastewater;
- (C) chemical reactions with wastewater;
- (D) the stress of installation;
- (E) the stress of daily operation and maintenance; and
- (F) exposure to sunlight, temperature and climatic extremes, freeze/thaw cycles, and wet/dry cycles.
- (10) **Total retention.** Total retention surface impoundments shall not have outfall structures which may allow or cause the release of wastewater to the environment (such as

pipes, man-made trenches, erosion-induced trenches, or impoundment overflow).

(11) **Flow-through.** Flow-through surface impoundment systems shall have a device that can immediately shut-off influent or effluent flows in the event of a spill, bypass, unit process failure or other emergency.

252:616-7-2. General liner requirements

(a) After installation, the project manager must determine that the liner meets the requirements for the type of liner installed; and the project manager, or independent soils lab for a compacted clay or bentonite liner, must certify this in writing to the DEQ.

(b) A native soil liner, not compacted in lifts, makes the least protective liner system and is only appropriate for compatible Class III or V wastewaters.

(c) The DEQ will consider liner systems other than those described in this Subchapter, on a case-by-case basis.

252:616-7-3. Compacted clay liners

(a) **Suitability.** A clay liner, of native or imported clay soils compacted in lifts, is a moderately protective liner system, appropriate for compatible Class II, III and V wastewaters.

(b) **Pre-construction requirements.** Before construction, classify and test all liner material and submit the following with the industrial wastewater treatment permit application:

(1) soil classification name(s) for all soils used to construct the surface impoundment and a list of source(s) of any imported soil;

(2) particle size distribution, Atterberg limits, and shrink/swell potential, according to ASTM test methods;

(3) compaction curves indicating the moisture/density relationship with saturated hydraulic conductivity for a practical range of density and moisture values;

(4) optimum moisture content of the soil at various compaction densities; and

(5) saturated hydraulic conductivity of a representative compacted sample using water and actual or synthetic wastewater.

(c) **Construction requirements.** Construct a compacted-clay liner system:

(1) with a water content-density range to assure a maximum saturated hydraulic conductivity of 1×10^{-7} cm/sec, verified by an independent soil testing laboratory;

(2) in lifts that are not more than nine inches thick uncompacted, and six inches thick compacted. Examine each lift before compaction and remove rocks, debris, or foreign matter greater than one inch in diameter. Also remove and repair lenses, cracks, channels and root holes that could adversely affect hydraulic conductivity;

(3) with bottom seal and dike cores relatively incompressible and compacted at a water content up to 4 percent above the optimum and to at least 90% Standard Proctor Density.

(4) by scarring the soils between lifts for good bonding;

(5) by performing two tests per lift to monitor the lift thickness, the water content, the compaction density and the saturated hydraulic conductivity of the liner;

(6) with at least two feet thick with at least four lifts. Depending on the wastewater class, impoundment purpose, groundwater depth, and other criteria, the DEQ may require a thicker liner.

(7) by protecting the soil liner from cracking during and after construction due to desiccation or freezing, and document the procedures; and

(8) by protecting the liner with at least 12 inches of soil.

252:616-7-4. Synthetic liners

(a) **Suitability.** A liner system constructed using a soil subbase, a specially prepared subgrade, a synthetic liner, and a protective soil cover can be considered a highly protective liner system and may be appropriate for Class I, II, III or V wastewater and may be required for certain wastewater.

(b) **Pre-construction requirements.** Before construction, classify and test all liner material and submit the following with the industrial wastewater treatment permit application:

- (1) design specifications with suitable physical properties of the liner material for percent elongation, strength tests (tensile, tear, breaking, shear, and bonded seam), hydrostatic resistance, percent volatile losses, and reactions to water (absorption and extraction);
- (2) design specifications with suitable chemical properties of the liner material for chemical resistance to wastewater, ultraviolet light resistance, and protection against biological decay;
- (3) show the liner will maintain physical properties under all prolonged and varying conditions expected at the facility, included but not limited to, temperature variation, UV radiation, biological attack, and waste or wastewater composition; and
- (4) show the liner will perform as a physical barrier to waste and wastewater seepage into groundwater.

(c) **Construction requirements.** Construct a synthetic liner system by:

- (1) protecting the liner membrane from physical damage by a specially prepared bedding material free of rocks, roots, debris, sharp objects, or foreign matter of a size or shape that could damage the liner;
- (2) preventing settlement or stability problems of the subgrade under maximum operational conditions. Vent the subgrade with perforated pipe to reduce gas and hydrostatic pressure;
- (3) inspecting each roll of liner material in the field before and during placement by a manufacturer-qualified inspector to meet manufacturer specifications against leaks;
- (4) installing liners using commonly accepted industry techniques and practices for bedding and subgrade preparation, anchor trenches of 6-inch minimum depth and placement 9 to 12 inches beyond the dike slope break, synthetic liner installation and seaming, and field QA/QC inspections and seam testing;
- (5) inspecting seams visually and conduct pressure tests, vacuum tests or other non-destructive seam tests to monitor the effectiveness of personnel and equipment;
- (6) maintaining side-slope stability. Exterior side slopes shall be a minimum of 2:1 (horizontal to vertical distance). Internal side slopes shall be between 2.5:1 and 4:1. Use the interfacial friction angle between the soil and the liner material to determine the maximum side-slope angle. All side-slope angles shall be less than the interfacial friction angle; and
- (7) taking adequate measures to protect the integrity of the liner. On dike slopes, backfill should consist of at least a 3-inch layer of sand or finely textured soil and covered with at least a 3-inch layer of heavier cobble, coarse gravel, or small riprap.

252:616-7-5. Composite liners

- (a) **Suitability.** A liner system constructed with both a clay liner and a synthetic liner is the most protective liner system and is appropriate for Class I, II, III or V wastewater and may be required for Class I wastewater.
- (b) **Construction requirements.** Construct composite liners according to the compacted clay liner and synthetic liner provisions of this Subchapter. Smooth the surface of the constructed clay liner until uniform to prevent a zone of high permeability under the synthetic liner.

252:616-7-6. Soil and bentonite liners

- (a) **Suitability.** A liner system constructed using an admixture of bentonite with native or imported soils is a moderately protective liner system and may be used to contain compatible Class II, III and V wastewater.
- (b) **Pre-construction requirements.** Before construction, classify and test all liner material and submit the following with the industrial wastewater treatment permit application:
 - (1) test the proposed soil and bentonite mixture for both physical and chemical properties showing the wastewater and liner are compatible;
 - (2) measure the hydraulic conductivity of a representative compacted sample using water and actual or synthetic wastewater; and
 - (3) use bentonite that is high swelling, free flowing, and has a particle size distribution favorable for uniform application with minimal wind drift effects.
- (c) **Construction requirements.** Construct a soil and bentonite liner as follows:
 - (1) use equipment designed for spreading fine grained soils or bentonite mixtures with

minimal wind losses;

(2) apply one-half of the mixture in one direction and the remaining half perpendicular. Several lifts may be required in each direction to achieve the design thickness of the soil and bentonite liner;

(3) mix the bentonite into the soil to a uniform depth of at least six inches, unless the soil and bentonite are mixed before application using a pugmill;

(4) construct within a water content-density range to assure a maximum hydraulic conductivity of 1×10^{-7} cm/sec, verified by an independent soils testing laboratory;

(5) apply the bentonite in the field at a rate that is at least 125% of the minimum rate determined in laboratory tests needed for stability and maximum hydraulic conductivity;

(6) test the application rate, water content, density, and hydraulic conductivity of the liner at least twice per lift or per acre;

(7) protect the liners with at least 12 inches of soil; and

(8) hydrate the liner before adding wastewater and maintain the moisture content of the liner at or above optimum water content until the surface impoundment is filled.

252:616-7-7. Concrete liners

(a) **Suitability.** A liner system constructed with a soil subbase, a specially prepared subgrade, and reinforced concrete is a highly protective liner system and may be used for Class I, II, III, and V wastewater.

(b) **Pre-construction requirements.** Before construction, classify and test all liner material and submit the following with the industrial wastewater treatment permit application:

(1) test the concrete liner material for both chemical and physical properties that show the concrete is compatible with the wastewater by using actual or synthetic wastewater; and

(2) determine an appropriate water-cement ratio based on maximum strength requirements and operational conditions.

(c) **Construction requirements.** Construct a concrete liner as follows:

(1) prepare the subgrade to prevent differential settling under maximum operational conditions;

(2) mix the concrete with water free of oil, grease, acids and alkalis, and under 2000 ppm turbidity with minimal sulfates;

(3) pour concrete liners monolithically, at least six inches thick and reinforced for impoundment stability and to prevent cracking or fracturing during maximum operating conditions; and

(4) construct concrete liners with 3000 pounds per square inch compressive strength concrete as determined after 28 days curing time by standard concrete compression test.

SUBCHAPTER 9. TANK SYSTEM STANDARDS

Section

252:616-9-1. Authorized use of tank systems

252:616-9-2. Tank system materials

252:616-9-3. Tank system requirements

252:616-9-1. Authorized use of tank systems

The use of tank systems for all wastewater classifications is authorized as follows:

(1) Existing tank systems without subsurface absorption trenches or lateral lines can be used for the treatment of Class I, II, III, and V wastewater.

(2) Existing tank systems with subsurface absorption trenches or lateral lines are subject to the Underground Injection Control permitting process.

(3) To ensure the protection of groundwater in accordance with OAC 785:45-7, new tank systems shall not utilize subsurface absorption trenches or lateral lines for disposal or dispersal of industrial wastewater.

252:616-9-2. Tank system materials

Tank systems are classified according to their material, as follows:

- (1) **Concrete.** Concrete tanks shall be constructed of 3,000 pounds per square inch compressive strength concrete as determined after 28 days curing time by standard concrete compression test. Tanks may be poured in place or precast and mechanically vibrated. The bottom of all concrete tanks shall be integral with or monolithically poured with the walls.
- (2) **Metal.** Materials that are corrosion resistant, have protective coatings, or cathodic protection shall be used for metal underground pipe, fittings, and all tanks installed in areas where the soil resistivity is less than 12,000 ohms/centimeter. All tanks, pipes, and fittings shall be resistant to the wastewater and to their environment.
- (3) **Plastic and fiberglass.** Plastic and fiberglass tanks may be approved by the DEQ based on their wastewater and environmental compatibility on a case by case basis.

252:616-9-3. Tank system requirements

Tank system construction. The following minimum construction and maintenance requirements apply to all industrial tank systems regardless of wastewater classification:

- (1) **Lateral lines.** Tanks with lateral lines must have at least two compartments operated in series, with the discharge to the lateral lines from the final compartment.
- (2) **Integrity testing.** If the DEQ has reasonable grounds to believe that any pipes, fittings, or other parts of a tank system may be a source of contamination, the DEQ shall require the owner or operator to conduct tests demonstrating the integrity of the system and to provide the results of such tests to the DEQ. The integrity testing requirement shall be performed according to current techniques as set out in the National Fire Protection Association publication 329 (See "Recommended Practices for Handling Underground Leakage of Flammable and Combustible Liquids," NFPA 329, 1999, Batterymarch Park, Quincy, Mass.) or by other generally accepted procedures approved by the DEQ.
- (3) **Percolation or soil profile tests.** Before constructing an industrial tank system with lateral lines, conduct percolation tests or soil profile tests according to the procedure in OAC 252:641. The results of a soil profile test shall supercede the results of any percolation test completed in the same proposed absorption field area.

SUBCHAPTER 11. LAND APPLICATION STANDARDS

Section

- 252:616-11-1. Restrictions
- 252:616-11-2. Rates and frequencies
- 252:616-11-3. Operation restrictions
- 252:616-11-4. Site management
- 252:616-11-5. Recordkeeping
- 252:616-11-6. Dust suppression
- 252:616-11-7. Sludge management plans
- 252:616-11-8. Heavy Metals

252:616-11-1. Restrictions

- (a) **Beneficial use.** No person may land apply sludge or wastewater except for the purpose of beneficial use.
- (b) **Manner.** Land apply sludge and wastewater in a manner to prevent surface runoff and to control objectionable odors. Incorporate sludge into the soil before the end of each working day (material from impoundments that is recovered as product is exempt). Do not store or land apply, or allow to runoff, sludge or wastewater to wetlands or waters of the State. Discharges to waters of the State are prohibited without a discharge permit under OAC 252:606.
- (c) **Storage.** Store industrial sludge as specified in the MOP. Industrial sludge shall not be stored for greater than six (6) months without prior written approval from the DEQ and in no case for longer than one (1) year.

(d) **Endangered or threatened species.** Do not land apply if it is likely to adversely affect a threatened or endangered species listed under section 4 of the federal Endangered Species Act, 16 U.S.C. 1533(c), or the critical habitat of such species.

(e) **Topography.** A land application site shall have minimal slope or be contoured to prevent ponding and soil erosion. No application shall occur on land having a slope exceeding five percent (5%) unless erosion and runoff control provisions are implemented, except that land having a slope of ten percent (10%) or less. Land having a slope greater than ten percent (10%) may be utilized for land application only with Department approval. For land application for dust suppression on roadways, clean wastewater hauling vehicles prior to leaving the site with provisions for disposition of rinse water.

(f) **Waste classification.** Do not land apply Class I or II wastewaters.

(g) **Scenic river basin prohibition.** Do not land apply industrial sludge in a scenic river basin as defined by OAC 785:45 Oklahoma's Water Quality Standards.

252:616-11-2. Rates and frequencies

(a) **Loading restrictions.** The loading requirements shall be subject to the following factors and criteria.

(1) **Hydraulic loading rates.** Determine hydraulic loading rates by performing a water balance that includes precipitation rates, evapotranspiration data and properties of the soil and vegetation involved. Hydraulic loading shall not result in ponding or surface water runoff.

(2) **Concentration or mass loading rates.** Concentration or mass loading rates at a minimum shall not exceed the assimilative capacity of the soils as determined on a site-specific basis.

(3) **Nutrient loading.** The amount of nitrogen to be applied to the soil (lbs/acre/year) shall be determined using the amount of plant available nitrogen (PAN) in the applied wastewater or sludge and the nitrogen uptake rate of the vegetation. Maintain Nitrogen and Phosphorus loading rates to minimize infiltration or transfer of nutrients in concentrations which may impact groundwater or surface water.

(4) **Organic Loading.** Loading rates shall be below levels where clogging of the soil could occur. Rest periods are required between successive applications.

(5) **Application rate and frequency of application.** The rates and maximum frequency of land application are determined by the DEQ based on site-specific data (e.g., runoff and erosion controls, average precipitation rates and temperatures, assimilative capacity and infiltration rates of the soil), loading rates, sludge or wastewater characteristics and the proposed method(s) of application.

252:616-11-3. Operation restrictions

(a) **Uniform application.** Land application shall be uniform over each plot (a predetermined portion of the land application site) unless otherwise permitted by the DEQ.

(b) **Prevention of toxicity.** Annual land application shall not exceed permit limits set for each constituent and shall not be applied in rates that result in toxicity to site vegetation.

(c) **Soil and vegetation.** Land application shall occur on soils which exhibit physical and chemical properties that promote assimilation and treatment of the wastewater or sludge (e.g., infiltration rate, storage capacity, or other properties) and which support vegetation (e.g., native grasses) or in order to prevent erosion of the soil (such as dust suppression). Add minerals and other materials to ensure levels of oxygen, pH, nutrients and moisture as needed to sustain native vegetation.

(d) **Soil profile.** The soil profile depth to bedrock shall be three (3) times the depth of incorporation or three (3) feet, whichever is greater unless prior written approval is obtained from the DEQ.

252:616-11-4. Site management

(a) **Surface water runoff.** Control the land application rate to prevent runoff. Do not land

apply during rainfall, or when saturated or frozen soil hinders absorption.

(b) **Buffer zone.** The owner or operator must have the right to control the use of the land application site and shall maintain at least 10-foot-wide setbacks on the boundaries of each site, and take other actions necessary to prevent runoff and aerosols from leaving the site as required by the DEQ. A buffer is not required between adjacent sites.

(c) **Stormwater run-off.** Divert stormwater run-off around land application sites.

252:616-11-5. Recordkeeping

(a) **Records.** The permittee shall keep the following land application records on site and available to DEQ upon request:

- (1) location, day and hour land application began and ended, and the method of application;
- (2) analytical data, volume and source(s) of wastewater or industrial sludge applied;
- (3) loading rates;
- (4) weather conditions during the application period;
- (5) type of crop, grass or vegetation grown on site;
- (6) monitoring records, including the date, time and exact place of the sampling or measurement, the name of the sampler, when analysis began, the name of the certified laboratory and the analytical results;
- (7) for industrial sludge generated outside the State of Oklahoma, test results demonstrating the quality of the sludge, including samples of each load of sludge performed by an independent laboratory approved by the DEQ and an agreement that the DEQ may perform random quality assurance sampling at the site of the generation of the industrial sludge;
- (8) In the case of dust suppression (OAC 252:616-11-6), the following records must be maintained:
 - (A) location, day and hour land application began and ended, and the method of application;
 - (B) volume and source(s) of wastewater applied; and
 - (C) weather conditions during the application period.

(b) **Reporting to DEQ.**

- (1) The permittee shall submit reports of required effluent and sludge monitoring and land application records by month on a quarterly basis. The quarterly reports will be due on or before the last working day of the month following the close of each quarter (i.e., April, July, October and January). Monitoring information shall be submitted to the DEQ on self-monitoring report (SMR) forms or other forms provided or approved by the DEQ.
- (2) The permittee shall submit reports of land application records on a yearly basis. The yearly reports shall be due on or before January 31. Monitoring information shall be submitted to DEQ on self-monitoring report (SMR) forms or other forms provided or approved by DEQ.

(c) **Notice of changes.** An owner or operator shall give advance notice to the DEQ of any change in sludge or wastewater source(s), treatment or characteristics, method(s) of land application, or the addition of any specific land application site not previously approved in his/her permit. Such change may require a major modification of the permit.

252:616-11-6. Dust Suppression

(a) **Wastewater usage.** Class III wastewater, where the pollutant of concern is TSS, can be used for dust suppression where fugitive dust control would otherwise be an air quality problem, in a manner which does not pollute or tend to pollute waters of the state of Oklahoma, the environment or pose a risk to human health.

(b) **Restrictions.** No Class III wastewater can be used for dust suppression during periods of precipitation or when soil is saturated or frozen. Runoff of wastewater used for dust suppression is prohibited.

(c) **Rule exemptions.** Wastewater land applied for dust suppression under this section is exempted from certain provisions of this rule as follows:

- (1) haul roads are not required to be fenced or contain signage, unless other safety or

environmental circumstances dictate otherwise (OAC 252:616-5-1(c)).

(2) haul roads are not required to have groundwater monitoring conditions (OAC 252:616-5-4).

252:616-11-7. Sludge Management Plans

Any facility that produces and land applies industrial sludge must develop and submit to the DEQ for approval a sludge management plan. This section does not apply to the land application of drilling wastes from oil and gas production or salt water disposal facilities under the jurisdiction of the Oklahoma Corporation Commission. A sludge management plan must include the following:

- (1) a breakdown of the anticipated types and volumes of industrial sludge generated;
- (2) daily generation and annual production of semi-solids, solids as total volume and percent solids converted to dry tons;
- (3) laboratory analysis showing whether the industrial sludge is hazardous and the chemical and physical properties of industrial sludge to be land applied including concentrations of metals (listed and other), and any other pollutants. A TCLP need only be conducted once a year, unless there is a change in the process for the development of the industrial sludge;
- (4) the amount of industrial sludge from each source expected to be used or disposed during each year of operation;
- (5) identification of specific sites and identifying name for each;
- (6) documentation of the applicant's right to use the site, including time restrictions, if any;
- (7) land use descriptions of adjacent property;
- (8) finding descriptions, legal descriptions, and latitude and longitude of each site;
- (9) distance to nearest residence;
- (10) topography of the site;
- (11) soil types, permeability, infiltration and drainage patterns;
- (12) proposed methods of tillage, crop types and patterns, crop utilization, expected yield and final use of crop;
- (13) irrigation practices, if any;
- (14) depth to groundwater, including highest seasonal groundwater level, and any other data available;
- (15) records of previous land application conducted at the site, including data on the cumulative metal loading;
- (16) results of any sampling, analyses or monitoring previously performed by the applicant at the site, including metal and nutrient assessment, based on an annual and lifetime use;
- (17) access controls;
- (18) narrative description of buffer zones and other methods to be used to control surface drainage, stormwater runoff, and erosion at each site;
- (19) narrative description of proposed land application method and related details including depth and frequency of incorporation or injection;
- (20) estimated application rate, frequencies, rest periods between applications, and estimated life of the site. Include calculations on which estimates are based for cumulative metal loading rates;
- (21) NRCS soil map of each specific site which shows soil classification, suitability, and soil profiles to a depth of sixty (60) inches;
- (22) quadrangle topographic map or maps that is an original U.S.G.S. 7.5 minutes series (or 15 minute series if the 7.5 series has not yet been printed) with the following clearly marked:
 - (A) boundary of the site;
 - (B) public water supply sources and treatment facilities;
 - (C) pipelines and utility easements;
 - (D) oil or gas wells or drilling sites;
 - (E) wellhead delineation areas;
 - (F) groundwater flow direction;
 - (G) waters of the state with special emphasis for "scenic rivers";

- (H) parks, recreation areas and any government owned land dedicated for special purposes (for example, wildlife refuges)
- (I) identification of the 100-year flood plain or floodway if it affects the proposed site;
- (J) any area inhabited by an endangered or threatened wildlife or plant species listed under Section 4 of the federal Endangered Species Act, 16 U.S.C. 1533(c); and
- (K) any additional information determined necessary by the DEQ.

252:616-11-8. Heavy Metals

The DEQ shall not approve the land application of industrial sludge that contains heavy metals above the concentration ranges normal to sludges with a demonstrated effectiveness on Oklahoma soils, unless the permittee provides a study on the effects of the sludge on a variety of Oklahoma soils and crops found at the location of the proposed land application site. Said study shall:

- (1) be conducted by a qualified research institute familiar with crops and soils in Oklahoma and approved by the DEQ;
- (2) be included with the sludge management plan; and
- (3) demonstrate the effect of the sludge during four (4) growing seasons.

SUBCHAPTER 13. CLOSURE STANDARDS

Section

- 252:616-13-1. Termination of activities
- 252:616-13-2. Pre-closure sampling and analysis plan
- 252:616-13-3. Closure plan submittal and amendment
- 252:616-13-4. Closure performance and certification
- 252:616-13-5. Post-closure maintenance plan (PCMP)

252:616-13-1. Termination of activities

(a) **Intent to close.** The owner or operator shall notify the DEQ, in writing, of intent to close a surface impoundment, tank system or land application site at least 90 days before closing operation of the treatment unit. Failure to comply with the operational and/or maintenance requirements contained in this chapter may be construed as “intent to close” and require closure of the surface impoundment, tank system or land application site. Closure activities cannot begin without written DEQ approval.

(b) **Contents of notice.** Notice of intent to close must include:

- (1) the name, address and title of person(s) who will remain in charge of or otherwise have continuing management responsibility of the facility or site and who will retain an ownership interest in personal or real property affected by the permitted operation;
- (2) a detailed schedule of proposed closure activities; and
- (3) the forwarding addresses and names of each present owner or operator under the current permit.

(c) **Waiver of closure requirements.** Closure requirements may be waived under the following conditions:

- (1) **Facilities subject to federal closure regulations.** The DEQ may waive some or all closure requirements if the surface impoundment(s), tank system(s) or land application site(s) must be closed under federal regulations (e.g., RCRA regulations). When such a waiver is requested, the owner or operator must submit a copy of the closure plan to the Water Quality Division.
- (2) **Other facilities.** The DEQ may waive some closure requirements on a case by case basis according to the characteristics of the industrial wastewater system and the wastewater or sludge contained within it or land applied. The owner or operator must, in the notice of intent to close, describe the intended closure activities and specify the closure requirements to be considered for waiver. Following review, the DEQ will notify the owner or operator in

writing which closure requirements are waived. If a waiver of any closure requirements is granted, certification of closure must follow the requirements of 252:616-13-4(d).

252:616-13-2. Pre-closure sampling and analysis plan

A pre-closure sampling and analysis plan shall be submitted to the DEQ at least 30 days prior to any pre-closure sampling. The plan shall include a copy of the monitoring plan and any monitoring data. Pre-closure sampling activities shall not begin until the facility has received written approval from the DEQ.

252:616-13-3. Closure plan submittal and amendment

(a) **Closure plan required.** A written closure plan shall be submitted to the DEQ at least 90 days prior to commencing closure, unless a lesser amount of time is granted by the DEQ.

(b) **Closure plan amendment.** Closure activities shall occur as specified in the closure plan. Any amendments to the closure plan shall be submitted, in writing, to the DEQ for review and approval before any closure activity is altered, replaced, or deleted.

(c) **Commencement of closure activities.** Closure activities shall not commence until the closure plan and all amendments thereto have been reviewed and approved by the DEQ.

(d) **Content.** The written closure plan shall include the following information, except as specifically waived by the DEQ in accordance with OAC 252:616-13-1(c):

(1) **General information.** The following general information shall be provided in all closure plans:

(A) purpose of closure indicating the reason why the surface impoundment, tank system or land application site is no longer in use and whether wastewater or sludge will be closed in place (in-place closure) or removed (clean closure);

(B) the DEQ Industrial Wastewater Treatment Permit number for the facility. If the facility has not been permitted, submit a completed application for a DEQ Industrial Wastewater Treatment Permit;

(C) the name, address, and telephone number of all record owner(s) of the land upon which the surface impoundment, tank system or land application site is located;

(D) if the operator is not the sole record owner of the land, surface property interests and all water rights, they must provide a written document from each owner(s) indicating consent to on-site or off-site disposal of the contents of the surface impoundment, tank system, or land application site and any other activities associated with closure;

(E) provide a time schedule indicating the major closure activities, approximate time to complete each activity, and the estimated date of final completion of all closure activities; and

(F) the closure plan shall include certification by a Registered Professional Engineer, except for Class III impoundments closed pursuant to the specifications contained in Appendix E of this Chapter.

(2) **Site assessment.** The following minimum information about the site shall be provided in the closure plan.

(A) **Soil information.** Identify the type of soil(s) by soil series name impacted and include a description of the soil profile and the depth to bedrock. List chemical and physical properties of the soil, and their average values for the site, that predict transport and fate of the wastewater contained in the surface impoundment, tank system, or land application.

(B) **Groundwater information.** Identify major and minor aquifers, recharge areas, depth to ground water for both shallow aquifer and drinking water sources, local and regional direction of flow, and estimated or background water quality.

(C) **Surface water information.** Identify surface water bodies that may be hydrologically connected to the groundwater or are immediately downgradient of the surface impoundment, tank system or land application site. Trace the drainage to the nearest major watercourse on a topographic map.

(D) **Plans and specifications.** Provide plans and specifications of the

impoundment(s), or tank system(s) to be closed indicating the dimensions of the surface impoundment(s), or tank system(s), location of inflow and outflow piping, location and thickness of sludge, and depth of wastewater in the impoundment.

(3) **Wastewater characterization.** The following minimum information about the wastewater shall be included in the closure plan. Additional information may be required.

(A) **Inventory of wastewater.** Provide an inventory of the types and concentrations of wastewater discharged to the surface impoundment, or tank system. Indicate the frequency and volume of each wastewater that was or may have been discharged to or otherwise placed in the tank system or impoundment.

(B) **Chemical analysis.** When requested by the DEQ, provide a chemical analysis of representative sample(s) of the sludges, sediments, bottom sediments, liners, or other media.

(4) **Sampling, analysis, and monitoring plans.** Sampling, analysis, and monitoring used before, during, and after closure shall be proposed to the DEQ in a written plan as follows:

(A) **Sampling and analysis.** Design a sampling and analysis plan that includes all requirements listed in OAC 252:616-5-4.

(B) **Monitoring.** Design a monitoring plan that will adequately monitor groundwater, soil vapor, or other media according to OAC 252:616-5-4.

(C) **Sampling and monitoring locations.** Indicate on a facility map the location of each sampling site, each monitoring site, the direction of groundwater flow, and the wells used to determine groundwater flow direction.

(5) **Treatment, removal, and disposal.** The closure plan shall include the following minimum discussion of treatment, removal, and disposal activities, as well as any additional information requested by the DEQ:

(A) **Treatment.** Describe all methods to be used to treat or reduce any wastewater or sludge from the surface impoundment or tank system (such as chemical or physical treatment, phase separation, waste stabilization, or other method). Provide a written rationale for each treatment method to be used and sufficient evidence of its effectiveness.

(B) **Removal.** Describe all removal activities for all wastewaters, sludges, liner materials, and subsoils (e.g., volume removed, equipment used, dust control, and other activities).

(C) **Backfill.** If the impoundment is to be closed by backfilling with soil, estimate the volume of soil needed. Include discussion of the material to be used as backfill, sampling used to determine the characteristics of the backfill, the method of compaction, and other methods to be used.

(D) **Disposal.** Provide the name and location of any off-site facility to be used to dispose of the tank system, the lateral lines, the piping and fittings, the contents of the tank system or the impoundment, liner materials, or subsoils, and provide the name of the issuing agency, permit number or other information necessary to determine authorization obtained for such disposal.

(6) **In-place closure requirements.** The following additional requirements apply for in-place closure:

(A) If the pollutants cannot be physically removed or must otherwise be closed in-place, the closure plan shall include:

(i) a discussion of remediation alternatives (e.g., clean closure, waste reduction, or chemical, physical, or biological treatment) and documentation as to effectiveness of each alternative;

(ii) a discussion of containment alternatives, (e.g., waste stabilization, impervious cap, or other system) and documentation as to the effectiveness of the containment measure; and

(iii) a proposal of which remediation or containment alternative(s) will be implemented for each surface impoundment or tank system site.

(B) When impervious caps or covers are proposed to be constructed as a method of

closure in connection with a closure plan, the following requirements shall be met:

- (i) compacted clay caps used to contain wastes in closed surface impoundments shall have a maximum hydraulic conductivity of 1×10^{-7} cm/sec and shall be protected by covering with a soil layer. The clay cap shall be designed and constructed according to the requirements of Subchapter 5 relating to clay liners;
 - (ii) caps containing synthetic liners used to contain wastes in closed impoundments shall be installed according to requirements of Subchapter 5 relating to synthetic liners in addition to manufacturer's and installer's specifications and accepted industry practices and shall be protected by covering with a composite soil and gravel layer;
- and
- (C) address post-closure activities, as required by the DEQ, such as groundwater monitoring, water or land use restrictions, or deed restrictions.
- (7) **Clean closure requirement.** The following additional requirements apply for clean closure:
- (A) provide an evaluation of the feasibility of clean closure of the surface impoundment, tank system site including a discussion of available technology, extent of contamination, and other factors; and
 - (B) discuss target clean-up levels of wastewater, the possible risks at those levels, and the methods to be used to determine that clean closure has been achieved.

252:616-13-4. Closure performance and certification

(a) **Performance.** Within six (6) months after obtaining DEQ's written approval of a closure plan, an owner or operator shall begin closure activities unless a shorter period is required by the DEQ.

(b) **Liability.** No cessation or site closure, transfer or abandonment shall release the owner or operator or named responsible party from liability to the State for environmental damages occurring as a result of the land application.

(c) **Failure to complete closure or take corrective action.** Failure of an owner or operator to complete closure or perform corrective action related to industrial land application shall be grounds for revocation of the authorizing permit and issuance of an enforcement action.

(d) **Certification.** A closure shall not be considered complete until the DEQ has received written Certification of Closure that shall include the following:

- (1) all activities listed in the DEQ approved closure plan were performed.
- (2) list of all closure activities performed and discuss all QA/QC inspections, sampling and analysis, and other information requested by the DEQ.
- (3) the signature and seal of a registered professional engineer for Class I and Class II wastewater.
- (4) the DEQ has provided the owner/operator a letter indicating formal acceptance of the Closure Certification documentation.

252:616-13-5. Post-closure maintenance plan (PCMP)

When requested by the DEQ, the owner or operator shall submit a written post-closure maintenance plan (PCMP) to the DEQ. At a minimum, the PCMP shall include the following information, as well as other information requested by the DEQ:

- (1) Name, address, and telephone number of the person(s) responsible for the facility and a contact person for the site;
- (2) Discussion of all procedures for maintaining the site (e.g., erosion control, such as vegetative cover, surface contouring, and surface water drainage) and post-closure use of the site;
- (3) Description of post-closure monitoring, as requested by the DEQ, including parameters sampled, frequency, location of monitoring sites, and reporting of monitoring data; and
- (4) Procedures used to protect impervious caps, covers, or other methods used to treat and contain the waste for in-place closure.

**APPENDIX A. APPLICATION FOR PERMIT TO DISCHARGE AND/OR TREAT
INDUSTRIAL WASTEWATER OF SLUDGE GENERAL INFORMATION [REVOKED]**

**APPENDIX B. APPLICATION FOR PERMIT TO DISCHARGE AND/OR TREAT
INDUSTRIAL WASTEWATER OR SLUDGE SURFACE IMPOUNDMENTS AND
SEPTIC TANKS [REVOKED]**

APPENDIX C. TABLE OF RAINFALL AND EVAPORATION DATA [NEW]

County	Rainfall * (in inches)	Average Pan Evaporation (in inches)	Average Lake Evaporation (in inches)	County	Rainfall * (in inches)	Average Pan Evaporation (in inches)	Average Lake Evaporation (in inches)
Adair	59.90	65	47	LeFlore	62.01	65	48
Alfalfa	38.12	90	62	Lincoln	46.13	80	57
Atoka	61.45	75	53	Logan	46.06	85	60
Beaver	28.57	90	62	Love	51.56	80	58
Beckham	32.86	90	64	McClain	48.08	85	60
Blaine	38.17	90	62	McCurtain	67.41	65	49
Bryan	55.60	75	54	McIntosh	59.39	70	52
Caddo	39.15	90	63	Major	35.22	90	63
Canadian	44.44	90	62	Marshall	55.70	75	55
Carter	50.87	80	58	Mayes	56.42	70	49
Cherokee	61.28	70	48	Murray	55.89	80	58
Choctaw	61.42	70	52	Muskogee	56.82	80	50
Cimarron	21.70	90	58	Noble	47.27	85	59
Cleveland	46.59	85	60	Nowata	50.93	70	51
Coal	64.06	75	55	Okfuskee	51.62	75	55
Comanche	42.08	90	64	Oklahoma	44.53	85	60
Cotton	44.22	90	64	Okmulgee	56.29	75	53
Craig	59.59	70	49	Osage	50.81	75	54
Creek	52.16	75	55	Ottawa	64.92	65	47
Custer	39.05	90	64	Pawnee	46.58	80	56
Delaware	62.82	65	47	Payne	44.24	80	52
Dewey	33.48	90	63	Pittsburg	54.33	75	58
Ellis	29.83	90	64	Pontotoc	49.44	75	56
Garfield	43.26	90	61	Pottawatomie	47.71	80	58
Garvin	45.02	80	59	Pushmataha	65.61	70	50
Grady	44.55	90	62	Roger Mills	35.52	90	64
Grant	44.11	90	60	Rogers	54.57	70	51
Greer	37.31	90	64	Seminole	52.15	75	55
Harmon	36.93	90	64	Sequoyah	55.66	65	48
Harper	29.66	90	62	Stephens	44.28	85	62
Haskell	61.04	70	49	Texas	24.53	90	62
Hughes	53.92	75	54	Tillman	41.14	90	64
Jackson	39.39	90	64	Tulsa	49.54	75	53
Jefferson	42.08	85	61	Wagoner	52.50	70	51
Johnston	61.46	75	55	Washington	49.79	70	53
Kay	46.96	80	58	Washita	40.55	90	64
Kingfisher	40.77	90	62	Woods	35.42	90	62
Kiowa	35.84	90	64	Woodward	31.93	90	62
Latimer	73.97	70	50	* Rainfall data is the 90 th percentile			

Source of data: OGS average rainfall data for 1970 – 2004; evaporation data from 1976 OSDH Design Guidelines

APPENDIX D. CLASS III SURFACE IMPOUNDMENT DESIGN

Facilities that wish to dispose of Class III wastewater into a single total retention surface impoundment may opt to use the design shown in this Appendix in lieu of hiring a Professional Engineer. This option is not available for designs of multiple or flow-through impoundment systems. To qualify for the use of this design, you must demonstrate that:

A. The bottom of the impoundment shall be a minimum of fifteen feet (15') from groundwater. This information must be submitted with the plan documents outlined below. If there is no water well data available, the facility must determine the depth of the groundwater and submit that data with the plan documents outlined below.

B. The proposed impoundment site must have a one foot (1 ft.) compacted soil liner for the bottom and the sides of the impoundment that has a permeability of 5.4×10^{-7} cm/sec or less. A soil test result that documents the permeability of the impoundment site must be submitted with the plan below.

C. If a facility is able to comply the requirements of A and B above, then it can opt to use the design shown on the diagram on the following page. To use this Impoundment Design:

1. Send an attachment to the permit application stating an intent to use the following design and document the ability to meet the two qualifications shown above. Also submit the proposed wastewater flow in gallons/day.

2. Determine the top dimensions of a square or rectangle impoundment by using the Industrial Wastewater sizing Chart on the following pages. If constructing a rectangle impoundment, the length shall be no more than double of the width. If the proposed flow falls in between two flow values on the table, go the next highest flow value to determine the impoundment dimensions.

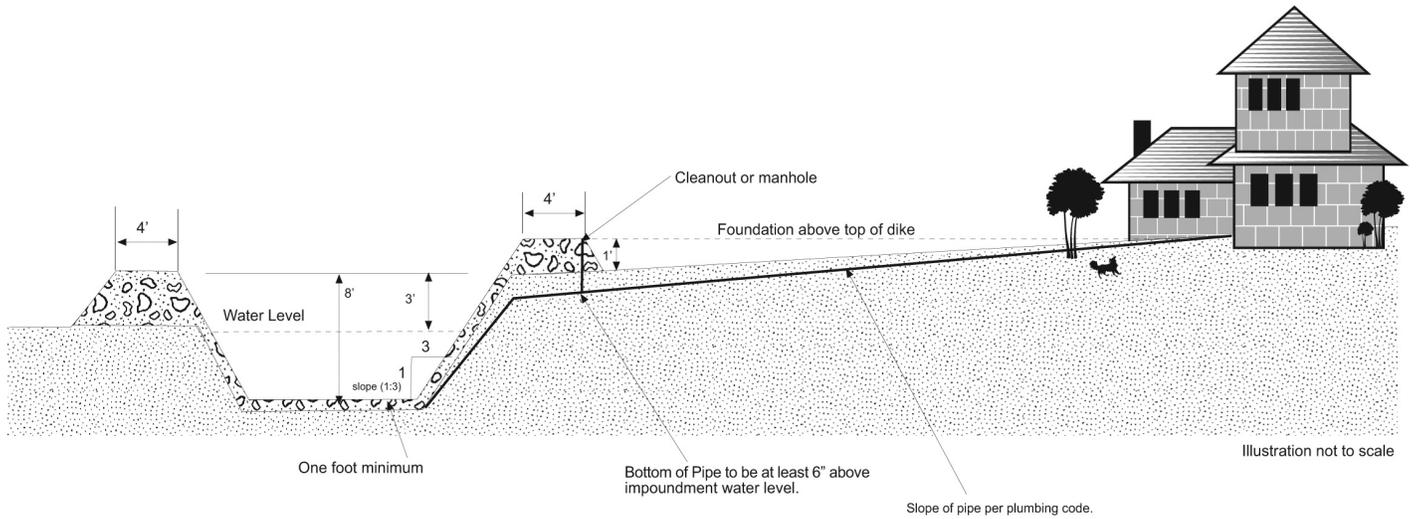
3. Copy the diagram shown on the following page. Write or type in the appropriate dimensions on the diagram. Submit this with the attachment. Design parameters include:

- i. Minimum three feet of freeboard;
- ii. Inner and outer dike slopes shall be 1 vertical to 3 horizontal (1:3);
- iii. Total depth of eight feet;
- iv. The top of the dikes shall be at least one foot above surrounding terrain to divert surface runoff;
- v. Berms and dikes will be a minimum of four feet wide and provide a flat surface to facilitate inspection and maintenance;
- vi. A one foot (1') liner thickness for the impoundment; and
- vii. The liner shall have a coefficient of permeability of 5.4×10^{-7} cm/sec or less.

4. After receiving approval from the DEQ to construct the impoundment, the impoundment should be built exactly as indicated on this plan. Once construction is completed a signed certification must be sent to the DEQ stating the impoundment was constructed in accordance with this plan. Facilities that need to deviate from this design in any way must contract the services of a professional engineer and notify the DEQ accordingly.

D. If a facility is not able to comply with the requirements of A, B and C above, then the facility must retain the services of a Registered Professional Engineer, licensed by the State of Oklahoma to design the impoundment(s).

CLASS III IMPOUNDMENT DESIGN DIAGRAM



Compacted soil

Permeability of 5.4×10^{-7} cm/sec or less Dimension at water level: ____ ft x ____ ft



Undisturbed soil

When using this chart to size a rectangular impoundment, calculate the area of a square impoundment and then modify the length and width of the sides of the impoundment to maintain the calculated area of the square impoundment, ensuring that the length of the impoundment is no more than double the width of the impoundment.

EXAMPLE:

If you are in Lincoln County and have 50 gallons per day design flow, as per the chart a square impoundment would have minimum dimensions of 70 feet.

The area of this impoundment would be 4900 square feet.

Your site's limiting width dimension would allow a minimum top dimension of 50 feet so:

4900 square feet divided by 50 ft. will equal 98 ft.

So a rectangular impoundment of 50 ft. by 98 ft. is equivalent.

The length to width ratio of 2 to 1 is not exceeded so the impoundment dimensions are acceptable.

INDUSTRIAL WASTEWATER IMPOUNDMENT SIZING CHART

Minimum Top Dimensions in Feet

County	Wastewater flow into the impoundment in gallons/day																			
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
Adair	16	17	17	18	19	20	20	21	22	22	23	23	24	24	25	25	26	26	27	275
Alfalfa	57	64	70	75	80	84	88	92	96	99	10	10	10	11	11	11	11	12	12	126
Atoka	96	4	2	8	4	0	5	0	5	9	3	15	16	16	17	17	17	17	18	186
Beaver	48	55	61	66	71	75	78	82	85	88	91	94	97	99	10	10	10	10	11	114
Beckham	55	62	68	73	77	82	86	89	93	96	99	10	10	10	11	11	11	11	12	123
Blaine	57	64	70	75	80	84	88	92	95	99	2	5	8	1	3	6	8	1	3	126
Bryan	10	11	11	12	13	13	14	14	15	15	16	16	16	17	17	18	18	18	19	194
Caddo	54	61	67	72	77	81	85	88	92	95	98	10	10	10	10	11	11	11	11	122
Canadian	61	68	74	80	84	89	93	97	10	10	10	11	11	11	11	12	12	12	12	132
Carter	79	87	93	99	10	11	11	11	12	12	13	13	13	14	14	14	15	15	15	160
Cherokee	11	12	13	14	14	15	15	16	16	17	17	18	18	19	19	20	20	20	21	216
Choctaw	11	12	13	13	14	15	15	16	16	17	17	18	18	18	19	19	20	20	20	212
Cimarron	48	53	58	63	68	72	75	79	82	85	88	91	93	96	98	10	10	10	10	110
Cleveland	67	75	81	87	92	96	1	5	9	2	6	9	2	5	8	1	4	7	0	142
Coal	11	12	13	14	14	15	15	16	16	17	17	18	18	19	19	19	20	20	21	214
Comanche	60	67	73	78	83	87	91	95	99	10	10	10	11	11	11	12	12	12	12	130
Cotton	58	66	72	77	82	86	90	94	97	1	4	7	0	3	5	8	1	3	6	128
Craig	90	99	6	3	9	5	0	5	0	4	9	3	7	0	4	8	1	5	8	181
Creek	81	89	96	10	10	11	11	12	12	13	13	13	14	14	15	15	15	16	16	166
Custer	61	68	74	79	84	89	93	97	10	10	10	11	11	11	12	12	12	12	12	132
Delaware	13	13	14	15	16	16	17	18	18	19	19	20	20	21	21	22	22	22	23	236
Dewey	53	60	66	71	75	80	83	87	90	94	97	10	10	10	11	11	11	11	11	120
Ellis	50	58	63	68	73	77	81	84	88	91	94	97	10	10	10	10	11	11	11	117
Garfield	57	64	70	76	80	85	88	92	96	99	10	10	10	11	11	11	11	12	12	126
Garvin	71	79	86	92	97	10	10	11	11	11	12	12	12	13	13	13	14	14	14	150
Grady	62	69	75	81	86	90	94	98	2	5	8	2	5	8	0	3	6	8	1	133
Grant	58	65	71	76	81	85	89	93	96	10	10	10	10	11	11	11	12	12	12	127
Greer	57	64	70	76	80	85	89	92	96	99	2	5	8	1	4	7	9	12	12	127
Harmon	55	62	68	73	77	82	86	89	93	96	99	10	10	10	11	11	11	11	11	123
Harper	46	53	59	64	69	73	76	80	83	86	89	92	94	97	10	10	10	10	10	111
Haskell	12	13	14	15	16	16	17	17	18	18	19	19	20	20	21	21	21	22	22	231
Hughes	10	11	12	13	13	14	14	15	15	16	16	17	17	18	18	18	19	19	19	202
Jackson	60	67	73	78	83	87	91	95	99	10	10	10	11	11	11	12	12	12	12	130
Jefferson	58	66	72	77	82	87	91	94	98	2	5	8	1	4	7	0	2	5	7	130
Johnston	73	81	88	94	99	4	9	3	8	2	5	9	3	6	9	2	6	9	1	154
Kay	64	71	78	84	89	93	98	10	10	10	11	11	12	12	12	13	13	13	13	140
Kingfisher	57	64	70	75	80	84	88	92	96	99	2	5	8	1	4	6	9	1	4	126
Kiowa	54	61	67	72	77	81	85	89	92	96	99	2	5	7	0	3	5	8	0	122
Latimer	21	22	23	23	24	25	26	26	27	27	28	29	29	30	30	31	31	32	32	331

County	Wastewater flow into the impoundment in gallons/day																			
	50	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
LeFlore	183	192	201	209	217	224	231	238	244	250	256	261	267	272	277	282	287	292	296	301
Lincoln	70	77	84	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170
Logan	75	83	89	95	100	105	110	115	120	125	130	135	140	145	150	155	160	165	170	175
Love	82	90	97	103	109	115	121	127	133	139	145	151	157	163	169	175	181	187	193	199
McClain	71	79	85	91	96	101	106	111	116	121	126	131	136	141	146	151	156	161	166	171
McCurtain	285	295	304	313	321	329	337	345	353	361	369	377	385	393	401	409	417	425	433	441
McIntosh	111	120	127	135	141	147	153	159	165	171	177	183	189	195	201	207	213	219	225	231
Major	49	56	62	67	71	75	79	83	86	89	92	95	98	100	103	105	108	111	113	115
Marshall	109	117	125	131	138	144	150	156	161	167	172	178	183	188	193	198	203	208	213	218
Mayes	86	95	102	109	115	121	127	133	139	145	151	157	163	169	175	181	187	193	199	205
Murray	93	101	108	115	121	127	133	139	145	151	157	163	169	175	181	187	193	199	205	211
Muskogee	92	100	107	114	120	126	132	138	144	150	156	162	168	174	180	186	192	198	204	210
Noble	62	69	76	81	86	91	95	99	103	107	111	115	119	123	127	131	135	139	143	147
Nowata	88	97	104	111	117	123	129	135	141	147	153	159	165	171	177	183	189	195	201	207
Okfuskee	103	111	119	125	131	137	143	149	155	161	167	173	179	185	191	197	203	209	215	221
Oklahoma	61	69	75	80	85	90	94	98	102	106	110	114	118	122	126	130	134	138	142	146
Okmulgee	89	98	105	112	118	124	130	136	142	148	154	160	166	172	178	184	190	196	202	208
Osage	97	105	112	119	125	131	137	143	149	155	161	167	173	179	185	191	197	203	209	215
Ottawa	106	114	121	128	134	140	146	152	158	164	170	176	182	188	194	200	206	212	218	224
Pawnee	68	76	83	88	94	98	103	108	113	118	123	128	133	138	143	148	153	158	163	168
Payne	70	78	85	91	96	101	106	111	116	121	126	131	136	141	146	151	156	161	166	171
Pittsburg	111	120	127	134	140	146	152	158	164	170	176	182	188	194	200	206	212	218	224	230
Pontotoc	89	97	104	111	117	123	129	135	141	147	153	159	165	171	177	183	189	195	201	207
Pottawatomie	72	80	86	92	97	102	107	112	117	122	127	132	137	142	147	152	157	162	167	172
Pushmataha	135	144	151	158	164	170	176	182	188	194	200	206	212	218	224	230	236	242	248	254
Roger Mills	56	63	69	74	79	83	87	90	94	97	100	103	106	109	112	115	118	121	124	127
Rogers	112	121	128	134	140	145	150	155	160	165	170	175	180	185	190	195	200	205	210	215
Seminole	95	103	110	117	123	129	135	141	147	153	159	165	171	177	183	189	195	201	207	213
Sequoyah	175	184	191	198	204	210	216	222	228	234	240	246	252	258	264	270	276	282	288	294
Stephens	67	74	80	86	91	96	100	104	108	112	116	120	124	128	132	136	140	144	148	152
Texas	44	51	57	62	66	70	74	77	80	83	86	89	92	94	97	99	101	103	105	108
Tillman	58	65	71	76	81	85	89	93	97	100	103	106	109	112	115	118	121	124	127	130
Tulsa	77	86	93	99	104	109	114	119	124	129	134	139	144	149	154	159	164	169	174	179
Wagoner	98	107	114	121	127	133	139	145	151	157	163	169	175	181	187	193	199	205	211	217
Washington	79	87	95	101	107	112	117	122	127	132	137	142	147	152	157	162	167	172	177	182
Washita	55	62	68	73	78	82	86	89	93	96	99	102	105	108	111	114	117	120	123	126
Woods	54	61	67	72	77	81	85	88	92	95	98	101	104	107	110	113	116	119	122	125
Woodward	50	55	60	65	70	74	78	81	84	87	90	93	96	99	101	104	107	110	113	116

APPENDIX E. GENERIC CLOSURE PLAN FOR CLASS III IMPOUNDMENTS

Facilities that have permits for impoundments that contain Class III wastewater and that have not received wastewater generated by washing vehicles or equipment may opt to use the following closure plan in lieu of contracting the services of a professional engineer.

To use the plan:

A. Notify the DEQ in writing at least 90 days before initiating closure of the intent to close and the intent to use this generic plan. This notification will include a proposed schedule for closure and the name of the person responsible for overseeing the closure.

B. Submit the closure plan. The plan shall include the following:

1. Background: Describe the activity that took place at the site during the life of the impoundment. Describe the current condition of the impoundment, including the amount of water remaining and an estimate of the amount of sludge remaining.

2. Proposed Closure Activities: Please indicate what will be done with the water and sludge remaining in the impoundments:

a. Water in surface impoundments (select those that apply):

- will be allowed to evaporate
- will be pumped out and disposed of into a POTW
- will be pumped out and used in an industrial process
- will be used for dust suppression (gallon limit)
- will be left in place (convert to a farm/stormwater pond-for quarries/sand mining facilities only)

b. Sludge in impoundments (select those that apply)

- will be removed and taken to a landfill
- will be removed and taken to a company for recycling
- will remain in place (for quarries/sand mining facilities only)

3. Backfill: If no visible cracks are seen, the liner will be filled in with dirt from _____ . (Put N/A if converting to a farm/stormwater pond).

4. Disposal: All piping going to the impoundments will be removed. These materials will be sent to _____ (name of offsite facility being used for disposal of the piping and fittings).

C. Certification of Closure: Upon receiving approval from the DEQ, the facility may complete closure per the plan. After completion of the above activities, the DEQ will be notified via a signed certification that all closure activities were completed in accordance with this plan as required by OAC 252:616-13-4(d).

D. If there is a need to deviate from this plan in any way, or the closure plan is not approved by the DEQ, then the closure of the facility must be submitted by a Registered Professional Engineer, licensed by the State of Oklahoma.

Table of Rainfall and Evaporation Data by County

County	Rainfall *	Average Pan	Average Lake	County	Rainfall *	Average Pan	Average Lake
Adair	60.16	65	47	LeFlore	62.22	65	48
Alfalfa	39.50	90	62	Lincoln	45.12	80	57
Atoka	54.83	75	53	Logan	51.58	85	60
Beaver	28.31	90	62	Love	52.40	80	58
Beckham	36.66	90	64	McClain	49.04	85	60
Blaine	39.07	90	62	McCurtain	67.76	65	49
Bryan	56.75	75	54	McIntosh	55.66	70	52
Caddo	35.74	90	63	Major	29.32	90	63
Canadian	43.46	90	62	Marshall	58.62	75	55
Carter	50.54	80	58	Mayes	47.79	70	49
Cherokee	57.00	70	48	Murray	56.81	80	58
Choctaw	56.33	70	52	Muskogee	56.72	80	50
Cimarron	24.24	90	58	Noble	41.73	85	59
Cleveland	46.07	85	60	Nowata	48.74	70	51
Coal	60.94	75	55	Okfuskee	56.98	75	55
Comanche	42.29	90	64	Oklahoma	41.19	85	60
Cotton	40.86	90	64	Okmulgee	52.33	75	53
Craig	49.49	70	49	Osage	55.04	75	54
Creek	48.68	75	55	Ottawa	50.98	65	47
Custer	43.38	90	64	Pawnee	44.11	80	56
Delaware	55.88	65	47	Payne	45.52	80	52
Dewey	34.38	90	63	Pittsburg	59.27	75	58
Ellis	31.37	90	64	Pontotoc	52.13	75	56
Garfield	39.58	90	61	Pottawatomie	46.49	80	58

Garvin	46.32	80	59	Pushmataha	60.50	70	50
Grady	44.52	90	62	Roger Mills	37.90	90	64
Grant	40.07	90	60	Rogers	55.99	70	51
Greer	39.67	90	64	Seminole	54.34	75	55
Harmon	36.71	90	64	Sequoyah	61.50	65	48
Harper	25.46	90	62	Stephens	45.65	85	62
Haskell	59.46	70	49	Texas	22.07	90	62
Hughes	58.60	75	54	Tillman	40.43	90	64
Jackson	42.18	90	64	Tulsa	46.88	75	53
Jefferson	38.33	85	61	Wagoner	52.10	70	51
Johnston	94.89	75	55	Washington	44.65	70	53
Kay	40.74	80	58	Washita	36.93	90	64
Kingfisher	39.36	90	62	Woods	35.92	90	62
Kiowa	36.24	90	64	Woodward	27.26	90	62
Latimer	68.60	70	50	* Rainfall data is the 90 th percentile			

Source of data: OGS average rainfall data for 1988 & 1998; evaporation data from 1976 OSDH Design Guidelines