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**Rules of**  
**Department of Natural Resources**  
**Division 80—Solid Waste Management**  
**Chapter 3—Solid Waste Disposal Areas-Sanitary,**  
**Demolition, and Special Waste Landfills**

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**Title 10—DEPARTMENT OF  
NATURAL RESOURCES**

**Division 80—Solid Waste Management  
Chapter 3—Solid Waste Disposal  
Areas-Sanitary, Demolition, and Special  
Waste Landfills**

**10 CSR 80-3.010 Design and Operation**

*PURPOSE: This rule pertains to the design and operation of solid waste disposal areas, specifically sanitary, demolition, and special waste landfills. This rule addresses the siting, groundwater monitoring, gas monitoring, liner, and cover design, seismic design, and the design and operation of leachate collection systems and methane recovery systems. This rule incorporates American Society for Testing and Materials International standards, and the Environmental Protection Agency standards by reference and sets forth additional state standards.*

*PUBLISHER'S NOTE: The secretary of state has determined that the publication of the entire text of the material which is incorporated by reference as a portion of this rule would be unduly cumbersome or expensive. This material as incorporated by reference in this rule shall be maintained by the agency at its headquarters and shall be made available to the public for inspection and copying at no more than the actual cost of reproduction. This note applies only to the reference material. The entire text of the rule is printed here.*

(1) General Provisions.

(A) This rule is intended to provide for sanitary, demolition, and special waste landfill operations that will have minimal impact on the environment. The rule sets forth requirements and the method of satisfactory compliance to ensure that the design, construction, and operation of these landfills will protect human health and meet applicable environmental standards. If techniques other than those listed are used, it is the obligation of the landfill owner/operator to demonstrate to the department in advance that the techniques to be employed will satisfy the requirements. Procedures for the techniques shall be submitted to the department in writing and approved by the department in writing prior to being employed. Notwithstanding any other provision of these rules, when it is found necessary, the department may require by permit amendment changes in design and/or operation to protect human health and the environment. The department may require changes in design, operation, or maintenance of any operating or closed land-

fill to meet the objectives of the subsections of this chapter.

(B) This rule applies to new sanitary, demolition, and special waste landfill construction and operating permits issued on or after the effective date of this rule and those facilities in operation on the effective date of this rule. Prior to January 1, 2020, all operating sanitary, demolition, and special waste landfills shall demonstrate compliance with 10 CSR 80-3.010. Construction and operation of landfills shall be conducted in accordance with the engineering plans and specifications approved by the department. Approved permit documents shall be available on site per section (20). Notwithstanding any other provision of these rules, when it is found necessary, the department may require by permit amendment changes in design and/or operation to protect human health and the environment.

(C) The standards set forth in ASTM, ASTM method D422-63(2007), 2007, ASTM Test D2487-11, and ASTM D6391-11 Standard Test Method, 2011, ASTM D-5084-16, 2016, ASTM D1140-17 and ASTM method D4318-17, 2017, as published by ASTM International, West Conshohocken, PA 19428, are incorporated by reference. The standards set forth in the Methods Innovation Rule, 2005, and Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities, 2009 as published by the EPA, Washington, D. C. 20004 are incorporated by reference. The standards set forth in the Engineer Manual 1110-2-1906, as published by the Department of the Army Office of the Chief Engineers, Washington, D. C. 20314 are incorporated by reference. This rule does not incorporate any subsequent amendments or additions.

(2) Solid Wastes Accepted and Excluded.

(A) Acceptable Wastes. To determine whether a waste may be accepted for disposal, the landfill owner/operator shall consider the landfill design, material, and chemical properties of the landfill liner and environmental control systems, the quantity of the waste, the physical and chemical characteristics of the waste, the equipment and operational procedures to be utilized, the safety of the landfill employees and the general public using the landfill, and the protection of human health and the environment.

1. The landfill's design and operating plans submitted to the department for approval shall specify the following:

A. The types of waste to be accepted for disposal;

B. The handling and disposal procedures for each type of waste; and

C. The procedures to be used to review and approve special waste disposal requests at a sanitary landfill, determine when laboratory testing of special waste will be required, determine whether special handling of the waste may be required, and inspect the waste upon arrival at the landfill for disposal.

2. Disposal of special wastes which have been approved in a sanitary landfill's construction permit shall be conducted in accordance with the approved design and operating plans along with any additional procedures determined by the department to be necessary to protect human health and the environment.

3. For each special waste accepted for disposal—

A. The landfill owner/operator shall require the waste generator to complete a special waste disposal request form provided by the department;

B. The landfill owner/operator shall require the waste generator to provide all information necessary to describe the source and physical and chemical characteristics of the special waste, including laboratory test results on representative samples, prior to accepting the material for disposal. The information shall be attached to the request form;

C. The form shall be signed by the waste generator and the owner/operator of the landfill prior to acceptance and disposal of the waste; and

D. The completed request form and supporting information shall be retained on site in the landfill's operating record in accordance with section (20).

4. The owner/operator shall inspect each load of special waste upon its arrival at the landfill for disposal. The inspection shall be in a manner necessary to ensure that unacceptable and unapproved wastes do not enter the landfill.

5. To the extent practical, special waste shall be managed in a manner that minimizes the disruption of normal landfill operations.

6. The owner/operator shall ensure that each special waste is segregated from other waste with which it could be chemically incompatible.

7. If the landfill owner/operator anticipates accepting more than one (1) load of a specific type of special waste from the same source in a relatively short period of time, or the waste will be accepted from the same source on a routine, ongoing basis, only one (1) special waste disposal request form is required. However, if laboratory testing of the waste was initially required, the



owner/operator must obtain yearly confirmation through testing or other documentation that the contaminant levels of concern have not increased or new contaminants of concern have not emerged. Should test results change a new special waste disposal request form shall be completed and kept on file.

8. Any special waste that requires handling procedures significantly different from typical municipal solid waste shall be handled in accordance with the landfill operating manual and any special procedures established by the landfill operator during the special waste approval process. The department reserves the right to require revisions to the landfill operating manual and landfill operations for special waste that may adversely affect the health and safety of landfill personnel or may be extremely difficult to handle.

9. Waste generated from the clean-up of a former manufactured gas plant (FMGP) site is considered to be a special waste. Prior to accepting FMGP waste for disposal, the landfill owner/operator shall have representative samples of the waste tested using the SW-846 test method 1311 toxicity characteristic leaching procedure (TCLP), Waste Management System: Testing and Monitoring Activities: Final Rule: Methods Innovation Rule (MIR) 2005. The waste shall not be accepted for disposal unless the concentrations of the following contaminants are below the regulatory levels listed in 40 CFR 261.24(b), Table 1:

A. All metals listed in Table 1, with the exception of barium;

B. Cresol, o-cresol, m-cresol, and p-cresol; and

C. Benzene.

10. Bulky waste and other waste that is accepted at the landfill and has the potential to puncture the membrane liner shall be excluded from the first layer of waste placed above a composite liner.

11. Large quantities of containerized liquids shall be solidified prior to disposal at a sanitary landfill. Bulk containerized or non-containerized liquid waste is banned from being placed in a sanitary landfill unless—

A. The waste is household waste other than septic waste; or

B. The waste is leachate or gas condensate generated within the permitted boundary and is placed in the on-site sanitary landfill designed with a composite liner and leachate collection system as described in this rule, and the facility has departmental approval to recirculate leachate or gas condensate.

12. Radioactive material used in or resulting from medical processes or liquid radioactive material may be accepted if the

material has a half-life of less than thirty (30) days.

13. Naturally Occurring Radioactive Material (NORM) may be accepted with prior written approval from the department.

14. Accelerator-produced radioisotopes with a half-life of less than thirty (30) days may be accepted.

15. Smoke detectors, electron tubes, luminous wristwatches and clocks, luminous lock illuminators, luminous automobile shift quadrants, luminous marine compasses, and luminous thermostat dials and pointers in quantities less than ten (10) items from any single source may be accepted.

16. For a demolition landfill, the owner/operator shall prominently display a sign at the entrance of the landfill that lists the wastes that are approved for acceptance, in accordance with this rule and the landfill's approved operations plan.

(B) Excluded Wastes.

1. Any wastes not specifically listed in a proposed permit or a modification to an existing permit and approved by the department are excluded from disposal. The owner/operator shall describe in the operating plan of the sanitary, demolition, or special waste landfills the procedures for screening and removing excluded wastes, including, but not limited to:

A. At a minimum, random inspections of incoming waste loads unless the owner/operator takes other steps to ensure that incoming solid wastes do not contain wastes excluded from disposal at the landfill;

B. Records of any load inspections; and

C. Procedures that will be implemented to train appropriate landfill personnel in the identification and proper handling of radioactive materials, regulated hazardous waste, infectious waste, asbestos containing material, and other waste prohibited from disposal.

2. The owner/operator shall screen and inspect loads of incoming waste per the approved operations plan and notify the department immediately upon receiving any of the following types of excluded waste at the landfill:

A. Regulated hazardous waste;

B. Radioactive materials;

C. Regulated quantities of polychlorinated-biphenyls (PCB);

D. Explosives;

E. Highly flammable or volatile substances;

F. Any regulated asbestos containing material (RACM) that has been improperly transported to the site, such as RACM delivered to the landfill in improper packaging or

containers, without proper shipment records, or RACM that has otherwise been transported in violation of the 40 CFR 61, Subpart M, National Emission Standards for Hazardous Air Pollutants (NESHAP) for Asbestos (2004); or

G. Infectious waste.

3. For a sanitary landfill, the owner/operator shall prominently display a sign at the site entrance stating the following about excluded wastes: "Regulated hazardous waste, radioactive materials, polychlorinated biphenyls (PCBs), bulk liquids, highly flammable or volatile substances, septic tank pumpings, major appliances, waste oil, lead-acid batteries, whole scrap tires, yard waste, explosives, and regulated infectious waste are excluded from disposal."

(3) Site Selection.

(A) Prior to submitting an application for a construction permit for a new sanitary, demolition, or special waste landfill or a horizontal expansion of an existing landfill, the owner shall perform an evaluation of the proposed site and surrounding area, and a study of the geologic and hydrologic conditions at that site location. Applications for a landfill construction permit received on or after the effective date of this rule shall document compliance with all applicable siting restriction requirements contained in paragraphs (3)(B)1. through 7. of this rule for sanitary landfills and (3)(B)2. through 7. of this rule for demolition and special waste landfills.

(B) Location Restrictions.

1. Airport safety.

A. Owners/operators of sanitary landfills that are located within ten thousand feet (10,000') of any airport runway end used by turbojet aircraft or within five thousand feet (5,000') of any airport runway end used by only piston-type aircraft shall demonstrate to the department that the sanitary landfills are designed and operated so that the landfill does not create or pose a bird hazard to aircraft.

B. Owners/operators proposing to site new sanitary landfills and horizontal expansions of existing sanitary landfills within a five- (5-) mile radius of any airport runway end used by turbojet aircraft or piston-type aircraft shall notify the affected airport and the Federal Aviation Administration (FAA).

2. Wetlands.

A. Landfills shall not be located in wetlands, unless the owner/operator makes the following demonstrations to the department:

(I) The presumption that a practicable alternative to the proposed landfill is



available which does not involve wetlands is clearly rebutted;

(II) The construction and operation of the landfill will not:

(a) Cause or contribute to violations of any applicable state water quality standard;

(b) Violate any applicable toxic effluent standard or prohibition under section 307 of the federal Clean Water Act;

(c) Jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of a critical habitat, protected under the Endangered Species Act of 1973; and

(d) Violate any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary;

(III) The landfill will not cause or contribute to significant degradation of wetlands. The owner/operator shall demonstrate the integrity of the landfill and its ability to protect ecological resources by addressing the following factors:

(a) Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the landfill;

(b) Erosion, stability, and migration potential of dredged and fill materials used to support the landfill;

(c) The volume and chemical nature of the waste disposed of in the landfill;

(d) Impacts on fish, wildlife, and other aquatic resources and their habitat from potential release of solid waste from the landfill;

(e) The potential effects of contamination of the wetland and the resulting impacts on the environment; and

(f) Any additional factors, as necessary, to demonstrate that ecological resources in the wetland are sufficiently protected;

(IV) Steps have been taken to attempt to achieve no net loss of wetlands (as defined by acreage and function) by first avoiding impacts to wetlands to the maximum extent practicable as required by subparagraph (3)(B)2.A. of this rule, then minimizing unavoidable impacts to the maximum extent practicable, and finally offsetting remaining unavoidable wetland impacts through all appropriate and practicable compensatory mitigation actions (for example, restoration of existing degraded wetlands or creation of man-made wetlands); and

(V) The requirements of paragraph (3)(B)2. may be satisfied by the owner/operator obtaining a United States Army Corps of Engineers permit for construction in a wetland or by demonstrating that the wetland is

not regulated by the United States Army Corps of Engineers, or other appropriate agency.

3. Floodplains. Owners/operators of landfills located within the one hundred- (100-) year floodplains shall demonstrate to the department that the landfill will not restrict the flow of the one hundred- (100-) year flood, reduce the temporary water storage capacity of the floodplain, or result in washout of solid waste so as to pose a hazard to human health or the environment.

4. Fault Areas. Landfills located in the seismic impact zone shall not be located within two hundred feet (200') of a fault that has had displacement in Holocene time unless that owner/operator demonstrates to the department that an alternative setback distance of less than two hundred feet (200') will prevent damage to the structural integrity of the landfill and will be protective of human health and the environment.

5. Seismic Impact Zones. Landfills shall not be located in seismic impact zones, unless the owner/operator demonstrates to the department that all containment structures, including liners, final covers, leachate collection systems, and surface water control systems, are designed to resist permanent cumulative earthquake displacements not to be greater than six inches (6"), resulting from the maximum credible Holocene time earthquake event's acceleration versus time history.

6. Unstable Areas. Landfills located in an unstable area shall demonstrate to the department that the landfill's design ensures that the integrity of the structural components of the landfill will not be disrupted. The owner/operator shall consider the following factors, at a minimum, when determining whether an area is unstable:

A. On-site or local rock or soil conditions that may result in failure or significant differential settling;

B. On-site or local geologic or geomorphologic features; and

C. On-site or local human-made features or events (both surface and subsurface).

7. Placement Above the Uppermost Aquifer. Landfills permitted after the effective date of this rule, including horizontal expansions, must be constructed with a base (i.e., the subgrade prior to placing the compacted clay liner) that is located above the upper limit of the uppermost aquifer, or must demonstrate that there will not be an intermittent, recurring, or sustained hydraulic connection between any portion of the base of the landfill and the uppermost aquifer due to normal fluctuations in groundwater elevations (including the seasonal high water table).

(4) Design and Operations per the Permit Application. Plans, addendums, as-built drawings, or other documents which describe the design, construction, operation, or closure of a sanitary, demolition, or special waste landfill, or which request an operating permit modification for the landfill shall be prepared, sealed, and signed by a professional engineer and submitted to the department for review and approval. Procedures for testing, site evaluation and preparation, and construction of the landfill shall be included with the application and performed as described in the plans approved by the department. Plans, addendums, as-built drawings, or other documents which describe the design, construction, operation, or closure of a landfill, or which request an operating permit modification for the landfill shall be kept available for use and reference on-site.

(A) Plans accompanying the permit application for a sanitary, demolition, or special waste landfill that are submitted to the department shall include:

1. A map showing initial and proposed topographies at contour intervals of five feet (5') or less utilizing a scale of not less than one inch (1") equal to one hundred feet (100'). If the entire site cannot be illustrated on one (1) plan sheet, an additional map with appropriate horizontal and vertical scales that allows the site to be shown on one (1) standard plan sheet is required;

2. A map having a scale of not less than one inch (1") equals four hundred feet (400') identifying the land use and zoning within one-fourth (1/4) mile of the landfill including location of all known residences, buildings, wells, water courses, springs, lakes, rock outcroppings, caves, sinkholes, and soil or rock borings. All known electric, gas, water, sewer, and other utility easements or lines that are located on, under or over the landfill shall be shown on the map;

3. A description of the projected use of the closed landfill. In addition to maintenance programs and provisions, where necessary for monitoring and controlling decomposition gases and leachate, address the following ultimate use criteria:

A. Structures. Enclosed structures are not allowed on the waste footprint of a landfill. If major structures are to be built outside of waste within the permitted area of any landfill, the structure must be approved by the department. A professional engineer shall approve the design and construction of the structure, including provisions for protection against potential hazards of solid waste decomposition gases; and



B. Other uses. Appropriate design, construction and operating provisions for the landfill shall be specified;

4. An evaluation of the characteristics and quantity of available soil on or off site with respect to its suitability for landfill construction and operation. The engineering properties and quantity estimates of the soil on site shall be discussed and include:

A. Texture. Sieve and hydrometer analyses shall be performed to determine grain size distribution of representative soil samples. Texture may be determined by using the procedures described in ASTM method D422-63(2007) ASTM International 100 Barr Harbor, West Conshohocken, PA 19428, Publication date 2007 or the procedures described in Appendix D of Engineer Manual 1110-2-1906, prepared by the United States Army Corps of Engineers;

B. Plasticity. The liquid limit, plastic limit and plasticity index of representative soil samples shall be determined. Plasticity may be determined by using the procedures described in ASTM method D4318-17 ASTM International, 100 Barr Harbor, West Conshohocken, PA 19428 Publication date 2017 or the procedures described in Appendix III of Engineer Manual 1110-2-1906, prepared by the United States Army Corps of Engineers;

C. Hydraulic conductivity. Perform laboratory hydraulic conductivity tests upon undisturbed representative soil samples using a flexible wall permeameter (ASTM D-5084-16) ASTM International, 100 Barr Harbor, West Conshohocken, PA 19428 Publication date 2016. If an aquifer is found to be laterally continuous across the anticipated limit of the proposed landfill, the hydraulic conductivity of each significant continuous geologic unit must be determined. Examples of accepted field tests are slug or pump tests which isolate the geologic unit of interest; and

D. Areal extent and depth. Determine the areal extent and depth of soil suitable for landfill construction, clearly describing any variations in soil depth.

5. Provisions for a minimum one hundred foot (100')-buffer zone between the outer edge of the landfill liner and any property line(s) or any right-of-way(s) of adjoining road(s) when the property line(s) is inside the right-of-way(s) to provide room for assessment and/or corrective actions;

6. An operating manual describing the various tasks performed during a typical shift, including routine and regular tasks (i.e., monitoring and inspections) performed throughout the life of the landfill;

7. A demonstration of how adverse geologic and hydrologic conditions may be

altered or compensated for via surface water drainage diversion, underdrains, sumps, and other structural components, and detail all necessary site alterations in the plans;

8. Site-specific precipitation, evapotranspiration and climatological conditions; and

9. All computer models used in the landfill design, and list the limitations and assumptions of each model.

(B) Stability analyses shall be performed for all stages of landfill construction, all liner and leachate system components, and on all final cover system components, as well as an evaluation of the effect of waste settlement on the final cover system components, side slope liner system components, and surface water management system components. Results shall be submitted from all analyses and evaluations.

(C) Settlement and bearing capacity analysis shall be performed on the in-place foundation material beneath the disposal area, and the results submitted in the design plan.

(D) Analyze the effect of foundation material settlement on the liner and leachate collection system, and include the analytical results in the plan.

(E) Analyze leachate collection pipe material and drainage media to demonstrate that these components possess structural strength to support maximum loads imposed by overlying waste materials and equipment, and include the results in the plan.

(F) Sump and side slope riser designs must consist of at least SDR 17 piping and be not less than eighteen inches (18") in diameter.

(G) Submit typical phase development drawings with the plan.

(H) Submit proposed cross-section drawings with the application that show groundwater elevations in relation to liner and final landfill height.

(I) Liner System Requirement. All landfills applying for a construction permit after the effective date of this rule shall have a composite liner as follows:

1. A composite liner must consist of two (2) components; the upper component consisting of, at a minimum, a thirty (30) mil geomembrane liner (GM), and the lower component consisting of at least a two foot (2') layer of compacted soil with a hydraulic conductivity of no more than  $1 \times 10^{-7}$  centimeters per second (cm/sec). GM components consisting of high density polyethylene (HDPE) must be at least sixty (60) mil thick. The GM or upper liner component must be installed in direct and uniform contact with the compacted soil or lower liner component. The compacted soil liner component at a minimum shall be—

A. Constructed of six to eight inch (6–8") loose lifts of unfrozen soil;

B. Compacted to ranges of density and moisture such that are shown to provide for the liner to have a hydraulic conductivity no more than  $1 \times 10^{-7}$  cm/sec.;

C. Protected from the adverse effects of desiccation or freeze/thaw cycles after construction, but prior to placement of waste;

D. Composed of soils that meet following minimum specifications:

(I) Be classified under the Unified Soil Classification Systems as CL, CH, or SC (ASTM Test D2487-11) ASTM International, 100 Barr Harbor, West Conshohocken, PA 19428 Publication date 2011;

(II) Allow more than thirty percent (30%) passing a number two hundred (200) sieve;

(III) Have a liquid limit equal to or greater than twenty (20) (ASTM Test D4318-17) ASTM International, 100 Barr Harbor West Conshohocken, PA 19428, Publication date 2017; and

(IV) Have a plasticity index equal to or greater than ten (10) (ASTM Test D4318-17) ASTM International, 100 Barr Harbor, West Conshohocken, PA 19428, Publication date 2017; and

E. Installed so that the minimum bottom slope in any direction of flow is at least one percent (1%).

2. A test pad shall be constructed at the site and tested to verify that the proposed soils, construction equipment, and construction and quality control (QC) procedures are adequate to ensure that the soil component of the composite liner system will meet the requirements listed above.

A. Quality assurance (QA)/QC procedures and construction methods to be used during test pad construction shall be described in detail in the approved engineering report, and shall be identical to those proposed for liner construction with the following additions:

(I) At least two (2) laboratory hydraulic conductivity tests shall be performed on undisturbed samples of the completed test pad;

(II) At least five (5), with one (1) in-situ, hydraulic conductivity tests (ASTM D6391-11 Standard Test Method for Field Measurement of Hydraulic Conductivity Using Borehole Infiltration, ASTM International, 100 Barr Harbor West Conshohocken, PA 19428, Publication date 2011), shall be performed on the completed test pad; and



(III) At least two (2) test pits shall be excavated into the completed test pad to observe inter-lift bonding.

B. If test pad construction and testing shows that the proposed methods are not sufficient to meet the requirements of this rule, a new test pad shall be constructed using revised procedures approved by the department.

C. For phased construction, only one (1) test pad will be required for a particular soil source, soil type, and equipment type.

D. A final report shall be submitted to the department that describes in detail the construction and QC procedures which were used to achieve satisfactory test pad performance.

(I) The report must be approved by the department prior to beginning construction of the soil component of the composite liner system in the disposal area.

(II) The report shall serve as guidance for construction of the soil component of the composite liner system.

E. The requirement for a test pad may be waived provided the applicant can demonstrate to the department's satisfaction the construction and QC procedures are identical to those described in the approved engineering report and will result in construction of a liner which meets the requirements of this rule, and the soils proposed for liner construction meet the following minimum specifications:

(I) Have a plasticity index greater than fifteen (15) and less than thirty (30) (ASTM test D4318-17 ASTM International, 100 Barr Harbor, West Conshohocken, PA 19428, Publication date 2017);

(II) Allow more than fifty percent (50%) passage through a number two hundred (200) sieve (ASTM D1140-17 ASTM International, 100 Barr Harbor, West Conshohocken, PA 19428, Publication date 2017); and

(III) Allow less than ten percent (10%) by weight particle sizes greater than two millimeters (2 mm).

(J) Requests for using Alternative Composite Liners will be considered for approval on a site-by-site basis.

(K) The leachate collection and removal system at the landfill shall be designed, constructed, operated, and maintained to collect and remove leachate from the landfill as long as leachate is being generated.

1. The leachate collection and removal system shall be—

A. Designed and operated to maintain less than a thirty (30) centimeter (1 foot) depth of leachate over the liner system;

B. Constructed of materials that are chemically resistant to the waste managed in the landfill and the leachate expected to be generated, and of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying waste, waste cover materials, and equipment used at the landfill; and

C. Designed and operated to minimize clogging during the active life and post-closure care period.

2. Leachate flow quantities shall be estimated and the method(s) of leachate management outlined in the application submittal.

3. Leachate storage facilities shall comply with all currently applicable requirements of the Missouri Clean Water Law and corresponding rules.

4. Minimum design criteria for leachate collection systems shall include the following:

A. Ponds and/or tanks of sufficient capacity to store, equalize flow to disposal systems, and allow system/operating flexibility;

B. Collection systems designed and operated so that any leachate formed will flow by gravity into collection areas from which the leachate can be removed, treated if necessary, and disposed;

C. That proposed leachate management by application on the working face or by recirculation within the permitted fill area shall be conducted in accordance with an approved engineering method and designed, constructed, and operated to minimize off-site impacts; and

D. Any leachate collection system open to precipitation must be designed to prevent discharge during a twenty-four (24) hour, twenty-five (25) year storm event. Plans shall include the calculations detailing the design. At a minimum, sites using leachate pond(s) shall maintain an operational freeboard of no less than two feet (2') during normal operation, with a minimum freeboard of no less than one foot (1') after a twenty-four (24) hour, twenty-five (25) year storm event.

5. Design plans shall include a description of leachate management activities by the landfill owner/operator under normal operating conditions. The plans shall also describe actions the landfill owner/operator shall take when the emergency level of less than two feet (2') of freeboard occurs in any pond, including at a minimum, how leachate will be removed from the pond and transported to a treatment or disposal facility, if necessary, a description of any testing requirements necessary prior to disposal, and a schedule by which time the leachate levels will be

returned to the normal operating range, with at least two feet (2') of freeboard; the plans shall also include a contingency plan for leachate management in the event the on-site system becomes inoperable and leachate must be taken off-site for proper disposal.

(5) Quality Assurance/Quality Control (QA/QC).

(A) The construction, operation, corrective action, and closure of the sanitary, demolition, or special waste landfill shall include QA/QC measures to ensure compliance with approved plans and all applicable federal, state, and local requirements. The permittee shall be responsible for ensuring that the QA/QC supervision is conducted by a qualified professional.

(B) QA/QC plans shall include a detailed description of the QA/QC testing procedures that will be used for every major phase of construction. This description must include, at a minimum, the frequency of inspections, field testing, laboratory testing, equipment to be utilized, the limits for test failure, a description of the procedures to be used upon test failure, and a detailed procedure for the reporting and recording of QA/QC activities and testing results.

1. The QA/QC plan shall include the following components:

A. Leachate collection system. Reports prepared or approved by the professional engineer transmitting the results of the QA/QC procedures and stating that the leachate collection system was constructed according to the approved design or describing any deviations from the approved design; and

B. Liner. The liner specified by section (4) of this rule shall be constructed in accordance with the approved design specifications. The QA/QC procedures shall include:

(I) Evidence that the liner material(s) utilized meet(s) the minimum design specifications;

(II) Evidence that field construction techniques meet the minimum design specifications (for example, soil density test);

(III) Evidence that the liner construction is proceeding as designed through routine verification observations using a predetermined system of horizontal and vertical survey controls; and

(IV) Oversight of the liner construction and QA/QC procedures by a qualified professional, including submission of reports to transmit the results of the QA/QC procedures. Additionally, the report shall state that the liner was constructed according



to design and describe any deviations from the approved design.

(C) At a minimum, QA/QC testing shall include:

1. Testing of each lift of the soil component of the final cover and landfill liner for field density and field moisture once per every ten thousand (10,000) square feet and providing relatively uniform coverage over the landfill surface;

2. Laboratory testing for Atterberg Limits (ASTM D-4318) and hydraulic conductivity of the soil used for liner construction once for every five thousand (5,000) cubic yards excavated;

3. Routine visual classification of borrow soil during landfill construction with oversight by an approving professional engineer;

4. Measuring the elevations of the final cover and the landfill liner on a maximum spacing of one hundred-foot (100') centers and at one hundred-foot (100') intervals along each line where a break in slope occurs;

A. Landfill liner. Measuring the elevations of the top and bottom of both the landfill liner and leachate collection systems;

B. Final cover. Measuring the elevations of the top and bottom of the landfill cover—

(I) The compacted clay layer; and

(II) The soil layer supporting vegetative growth;

5. For a geomembrane:

A. Nondestructive testing of all seams of the geomembrane in the landfill liner and final cover; and

B. Random destructive testing of the seams with results consistent with Geosynthetic Institute (GM 19a or GM 19b) 2017 of the geomembrane liner in the landfill liner and final cover on an average frequency of at least one (1) every five hundred (500) linear feet of seam.

(D) All testing shall be performed with oversight by an approving professional engineer for every major phase of construction.

(E) All QA/QC reports shall be reviewed, approved, and submitted by a professional engineer.

(6) Survey Control. Benchmarks, horizontal controls, and boundary markers at the landfill shall be established by a land surveyor registered in the state of Missouri to check and mark the location and elevations of the landfill ensuring compliance with design plans, phasing plans, and applicable conditions within the approved construction permit.

(A) At a minimum, a survey of the entire permitted acreage shall be conducted in accordance with the current Minimum

Standards for Property Boundary Surveys 2 CSR 90 and include the establishment of a permanent monument used as a benchmark.

(B) All site survey information shall be reported in State Plane Coordinate System and North America Vertical Datum 1988.

(7) Water Quality.

(A) All permits and approvals necessary to comply with requirements of the Missouri Clean Water Law and corresponding rules shall be obtained from the department prior to commencement of operations at any landfill.

(B) The owner/operator of an existing or new landfill or any horizontal expansion shall design, construct, operate, and maintain—

1. On-site drainage, collection and control structures and channels for all stages of development to accommodate, at a minimum, the stormwater volume from a twenty-four (24)-hour, twenty-five (25)-year storm. The engineering calculations and assumptions shall be included and explained in the engineering report submitted to the department with the permit application; and

2. Surface water runoff diversion and control structures to minimize infiltration, erosion, ponding, run-on at the working face, and off-site transport of water and sediment (i.e. through ditches, berms, grading, etc.);

(C) The quantity of water coming in contact with solid waste shall be minimized by the daily operational practices.

1. Water which comes in temporary contact with the waste shall be managed in accordance with the approved stormwater management plans.

2. Water that passes through or emerges from waste and contains soluble, suspended, or miscible materials removed from such waste shall be managed in accordance with the approved leachate management plan.

(8) Leachate Management.

(A) Leachate collection media designated for use in the system must be of a material and placed in a manner that will not damage the liner (i.e. no sharp rocks and wires from tire chips).

(B) Leachate dispersion on the working face for purposes of waste compaction and densification is allowed in accordance with operational plans approved by the department.

(C) Leachate generated by the landfill shall be controlled on site, collected in a manner to protect the integrity of any containment system, and not be allowed to—

1. Enter the stormwater infrastructure, including ponds, where it will mix with stormwater;

2. Overtop its containment basin;

3. Discharge off of the landfill property;

4. Discharge into the waters of the state, except as allowed in the approved plans and through a permit under the Missouri Clean Water Law and corresponding rules; and

5. Blow or drift off the lined areas of the facility from spray dispersal, or mist evaporative methods employed for leachate management.

(9) Groundwater Monitoring.

(A) The owner/operator of a sanitary, demolition, or special waste landfill shall implement a groundwater monitoring program capable of determining the landfill's impact on the quality of groundwater underlying the landfill.

1. Landfills permitted on or after the effective date of this rule must be in compliance with all of the groundwater monitoring requirements of this section before an operating permit is issued.

2. The department may require landfills permitted prior to the effective date of this rule to comply with part or all of this section, if it is determined necessary by the department to protect human health or the environment.

3. The owner/operator of a landfill shall establish the potential for migration of fluid generated by the landfill into the groundwater by an evaluation of—

A. A water balance of precipitation, evapotranspiration, runoff, and infiltration;

B. At a minimum, the following characteristics:

(I) Geologic materials;

(II) Description of soil and bedrock to a depth adequate to allow evaluation of water quality protection provided by the soil and bedrock;

(III) Groundwater elevation;

(IV) Proposed separation between the lowest point of the lowest cell and the maximum water table elevation;

(V) Proximity of the landfill to water supply wells or surface water;

(VI) Rate and direction of groundwater flow; and

(VII) Current and projected use of water resources in the potential zone of influence of the landfill.

4. Groundwater monitoring wells shall be installed so that the number, spacing, and depths of the wells shall be determined based upon site-specific technical information that shall include a thorough characterization of—

A. Aquifer thickness, groundwater flow rate, groundwater flow direction including seasonal and temporal fluctuations in groundwater flow; and



B. Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to, thicknesses, stratigraphy, lithology, hydraulic conductivities, and porosities. If the lower confining unit is one hundred feet (100') or more below the top of the uppermost aquifer, borings verifying the lower confining layer will not be required. The upper fifty feet (50') of uppermost aquifer will be characterized.

5. Groundwater monitoring wells shall be capable of yielding groundwater samples for analysis, effectively monitoring the site, and consisting of at least one (1) well installed hydraulically up gradient; that is, in the direction of increasing static head from the landfill and at least three (3) wells installed hydraulically downgradient; that is, in the direction of decreasing hydraulic head from the landfill. The numbers, locations, and depths shall be sufficient to yield groundwater samples that are—

A. Representative of background water quality in the groundwater near the landfill;

B. Capable of detecting any significant amounts of fluids generated by the landfill that migrate from the landfill to the groundwater; and

C. Monitoring wells, or clusters of monitoring wells, shall be capable at a minimum, of monitoring all saturated zones down to and including the uppermost aquifer. The maximum distance a monitoring well may be located from the waste boundary is one hundred fifty meters (150 m) or four hundred ninety-two feet (492').

6. The design and installation of groundwater monitoring well systems shall be observed, supervised, and certified by a qualified groundwater scientist and approved by the department.

(B) Sampling and Reporting.

1. Each landfill's groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results provide an accurate representation of groundwater quality at monitoring wells installed in compliance with this section. The owner/operator shall submit the sampling and analysis program to the department for approval. The program shall include procedures and techniques for—

A. Monitoring well maintenance;

B. Monitoring well redevelopment;

C. Monitoring well depth measurement and hydraulic levels;

D. Monitoring well purging and sampling utilizing dedicated equipment;

E. Equipment calibration;

F. Decontamination and field blanks;

G. Sample and duplicate sample collection;

H. Sample preservation;

I. Sample labeling;

J. Sample handling;

K. Field measurements;

L. Field documentation;

M. Chain of custody control;

N. Sample shipment;

O. Analytical procedures;

P. QA/QC control—field and laboratory; and

Q. Statistical testing strategy for each parameter's concentrations.

2. Each groundwater monitoring program shall include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure monitoring constituents in groundwater samples, as required by the Detection Monitoring List in Appendix I or an alternative detection monitoring list approved by the department, that includes the anticipated parameters of concern for the specific facility. Analysis shall be performed on unfiltered samples.

3. The owner/operator shall determine the rate and direction of groundwater flow each time groundwater is sampled. Groundwater elevations in wells which monitor the same solid waste disposal area shall be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow direction.

(C) Baseline/Background Monitoring.

1. The owner/operator of a new sanitary or demolition landfill shall establish background groundwater quality for each of the monitoring constituents required in Appendix I for sanitary landfills and Appendix III for demolition landfills.

2. To establish background, a minimum of eight (8) quarterly samples of statistically independent sample data shall be obtained and analyzed from all monitoring wells. Additional background samples may be required based upon the statistical methodology used.

3. Landfills may begin accepting waste upon completion of a minimum of four (4) independent baseline/background sampling events of constituents in Appendix I for sanitary landfills and Appendix III for demolition landfills.

4. Background concentrations also shall be established for monitoring constituents listed in Appendix II for sanitary landfills and

Appendix IV for demolition landfills, and two (2) sets of samples shall be obtained prior to accepting waste. If constituents in Appendix II for sanitary landfills and Appendix IV for demolition landfills are not detected after two (2) background events, the background concentrations may be established as the detection limit for those organic constituents.

(D) Detection Monitoring.

1. The owner/operator of a sanitary or demolition landfill shall obtain and analyze water samples from the groundwater monitoring wells during the months of March through May and September through November of each calendar year unless an alternative schedule is approved by the department. Sampling events must be six (6) months apart or an alternative schedule approved by the department.

2. The following constituents shall be analyzed each time a sample is obtained:

A. For a sanitary landfill, all constituents listed in Appendix I of this rule.

B. For a demolition landfill, all constituents listed in Appendix III of this rule.

C. The water level in each well shall be measured at the sanitary or demolition landfill at the time the sample is taken.

3. The sample results, and any results of statistical analysis determining statistically significant increases for any constituent shall be submitted to the department in one (1) report within ninety (90) days of when samples are collected. All groundwater data shall be submitted electronically, in the format and method as prescribed by the department.

4. In the case of all detection monitoring requirements previously listed, the department may specify an appropriate alternative frequency for repeated sampling and analysis during the active life of the landfill (including closure) and the post-closure period. The department may add additional constituents or delete constituents on a site-by-site basis through an evaluation of waste and leachate characteristics of the landfill.

(E) Statistical Method. The owner/operator of a sanitary, demolition, or special waste landfill shall specify statistical methods to be used in evaluating groundwater monitoring data for each monitoring constituent. These methods shall be in compliance with the EPA Unified Guidance, Statistical Analysis of Groundwater Monitoring Data at RCRA Facilities-March 2009.

(F) Response to Detection Monitoring Statistical Analysis.

1. If the statistical comparison shows a statistically significant increase (or pH change) over background, and attributes it to the landfill, the owner/operator of the



sanitary, demolition, or special waste landfill shall submit this information to the department and conduct confirmation sampling during the next semiannual monitoring event.

2. If the results of the statistical analysis reveal a statistically significant increase (or pH change) over background, the owner/operator must demonstrate to the department within ninety (90) days that a source other than the landfill caused the contamination or that the statistically significant increase resulted from an error in sampling, analysis, statistical evaluation, or natural variation. If the statistical methodology used by the owner/operator requires a confirmation sample or second confirmation sample, then the next required sampling event can be used as the confirmation sampling event.

(G) Assessment Monitoring.

1. If the owner/operator cannot make this demonstration to the department, the owner/operator shall submit a groundwater assessment monitoring plan and implement the plan upon approval by the department. The assessment monitoring plan shall specify the following:

A. The number, location, and depth of wells;

B. Sampling and analytical methods for the monitoring constituents listed in Appendix II or IV of this rule, as applicable;

C. Evaluation procedures, including any use of previously gathered groundwater quality information;

D. The rate and extent of migration of a contaminant plume in the groundwater; and

E. The concentrations of the contaminant plume in the groundwater.

2. After obtaining the results from the initial or subsequent sampling events, the owner/operator shall—

A. Within fourteen (14) days, advise the department which constituents have been detected;

B. Within ninety (90) days, and on a semi-annual basis after that, resample all wells and conduct analysis for all constituents listed in Appendix I and Appendix II that were detected during the initial or subsequent sampling events of assessment monitoring for the sanitary landfill, and Appendix III and IV that were detected during the initial or subsequent sampling events of assessment monitoring for the demolition landfill. Samples shall be analyzed for the complete list of Appendix II or Appendix IV constituents at least once every five (5) years for all wells in assessment monitoring. A minimum of one (1) sample from each well sampled shall be collected and analyzed during these sampling events;

C. Establish background concentra-

tions for any new constituents detected during subsequent monitoring events;

D. Establish groundwater protection standards for all new constituents detected during subsequent monitoring events. For the purposes of this subparagraph, the site-specific groundwater protection standards shall be the maximum contaminant level (MCL) established under the National Primary Drinking Water Regulations sections 141.62 (June 29, 2004) and sections 141.66 (December 7, 2000), provided that if no MCL has been established or the site-specific background value is higher than the MCL, then the groundwater protection standards shall be the site-specific background value;

E. If the concentrations of all constituents listed in Appendix II or IV of this rule are shown to be at or below background levels as established in this rule for two (2) consecutive sampling periods, the owner/operator may reinstate detection monitoring;

F. If the concentrations of any constituents listed in Appendix II or IV of this rule are above background values, but all concentrations are below the groundwater protection standard established under this rule using the statistical procedures approved by the department for the landfill, the owner/operator shall notify the department and the department may require the owner/operator to—

(I) Continue assessment monitoring; or

(II) Develop a corrective action plan, or both;

G. If one (1) or more constituents listed in Appendix I, II, III, or IV of this rule are detected at levels above the groundwater protection standard, the owner/operator shall—

(I) Provide the department with a report assessing potential corrective actions as outlined in section (10);

(II) Characterize the nature and extent of the release by installing additional monitoring wells as necessary to determine the rate and extent of groundwater contamination, and notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off-site as indicated by sampling of wells; and

(III) Continue assessment monitoring as per the groundwater quality assessment plan and implement the approved corrective action program specified in this rule; and

H. The results of implementation of the assessment monitoring program shall be submitted to the department at the end of each year or an alternate time period approved by the department.

(10) Corrective Action. Owners and operators of a sanitary, demolition, or special waste landfill that shows one (1) or more constituents listed in Appendix I, II, III, or IV of this rule being detected at levels above the groundwater protection standard as established, and determined to be a result of a release of leachate or landfill gas from the facility, shall in consultation with the department either proceed with corrective actions or submit a corrective action plan as outlined in subsections (10)(A) through (C).

(A) Assessment of Corrective Action(s).

1. Within ninety (90) days of finding that any of the constituents listed in Appendix II or IV of this rule have been detected at a statistically significant level exceeding the groundwater protection standards, the owner/operator shall initiate an investigation and assessment of potential corrective actions. This assessment shall be completed within a reasonable period of time, and a report describing the assessment of corrective actions shall be submitted to the department.

2. The owner/operator shall continue to monitor in accordance with the assessment monitoring program as specified in this rule.

3. The assessment shall include an analysis of the effectiveness of potential corrective actions in meeting all of the requirements and objectives of the remedy as described in this rule, addressing at least the following:

A. The performance, reliability, ease of implementation, and potential impacts of appropriate potential corrective action(s), including safety impacts, cross-media impacts, and control of exposure to any residual contamination;

B. The time required to begin and complete the action(s);

C. The costs of implementation; and

D. The institutional requirements such as state or local permit requirements or other environmental or human health requirements that may substantially affect implementation of the corrective action(s).

4. The owner/operator shall discuss the results of the corrective action(s) assessment, prior to the selection of a remedy, in a public meeting with interested and affected parties.

(B) Selection of Corrective Action(s).

1. Based on the results of the potential corrective action(s) assessment, the owner/operator shall propose a corrective action(s) plan. The owner/operator shall submit to the department, within fourteen (14) days of selecting a proposed corrective action(s) plan, a report describing the proposed corrective action(s) and how the proposed plan meets the standards of this rule.

2. Corrective action(s) shall—



A. Be protective of human health and the environment;

B. Attain the groundwater protection standard; and

C. Control the source(s) of releases so as to reduce or eliminate, to the maximum extent practicable, further releases of constituents listed in Appendix I, II, III, or IV of this rule into the environment that may pose a threat to human health or the environment.

3. In proposing a corrective action, the owner/operator shall include the following evaluation factors:

A. The long- and short-term effectiveness and protectiveness of the potential action(s), along with the degree of certainty that the remedy will prove successful based on consideration of the following:

(I) Magnitude of reduction of existing risks;

(II) Magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of the proposed remedy;

(III) The type and degree of long-term management, including monitoring, operation, and maintenance;

(IV) Short-term risks that might be posed to the community, workers, or the environment during implementation of the corrective action(s), including potential threats to human health and the environment associated with excavation, transportation and redispal, or containment;

(V) Time until full protection is achieved;

(VI) Potential for exposure of humans and environmental receptors to remaining waste, considering the potential threat to human health, and the environment associated with excavation, transportation, redispal, or containment;

(VII) Long-term reliability of the engineering and institutional controls; and

(VIII) Potential need for replacement of the corrective action(s);

B. The effectiveness of the corrective action(s) in controlling the source to reduce further releases based on consideration of the following factors:

(I) The extent to which containment practices will reduce further releases; and

(II) The extent to which treatment technologies may be used;

C. The ease or difficulty of implementing the potential corrective action(s) based on consideration of the following types of factors:

(I) Degree of difficulty associated with constructing the corrective action(s) technology;

(II) Expected operational reliability of the proposed technologies;

(III) Need to coordinate with and obtain necessary approvals and permits from other agencies;

(IV) Availability of necessary equipment and specialists; and

(V) Available capacity and location of needed treatment, storage, and disposal services; and

D. The degree to which community concerns are addressed by the proposed corrective action(s).

4. The owner/operator shall specify as part of the proposed corrective action(s) a schedule(s) for initiating and completing corrective action(s). This schedule shall require the initiation of corrective action(s) within a reasonable period of time. The owner/operator shall include the following factors in selecting corrective action(s):

A. Extent and nature of contamination;

B. Practical capabilities of remedial technologies in achieving compliance with groundwater protection standards pursuant to this rule and other objectives of the remedy;

C. Availability of treatment or disposal capacity for wastes managed during implementation of the corrective action(s);

D. Desirability of utilizing technologies that are not currently available, but which may offer significant advantages over already available technologies in terms of effectiveness, reliability, safety, or ability to achieve remedial objectives;

E. Potential risks to human health and the environment from exposure to contamination prior to completion of the corrective action(s);

F. Resource value of any affected aquifer including:

(I) Current and future uses;

(II) Proximity and withdrawal rate of users;

(III) Groundwater quantity and quality;

(IV) The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to the waste constituent;

(V) The hydrogeologic characteristic(s) of the facility and surrounding land;

(VI) Groundwater removal and treatment costs; and

(VII) The cost and availability of alternative water supplies;

G. Practicable capability of the owner/operator; and

H. Other relevant factors.

5. The department may determine that remediation of a release of any constituent

listed in Appendix I, II, III, or IV of this rule from a landfill is not necessary if the owner/operator demonstrates to the satisfaction of the department that—

A. The groundwater is additionally contaminated by substances that have originated from a source other than the landfill and those substances are present in concentrations such that cleanup of the release from the landfill unit would provide no significant reduction in risk to actual or potential receptors;

B. The constituent(s) is present in groundwater that—

(I) Is not a current or potential source of drinking water; and

(II) Is not hydraulically connected with waters to which the hazardous constituents are migrating or are likely to migrate in a concentration(s) that represents a statistically significant increase over background concentrations;

C. Remediation of the release(s) is technically impracticable; or

D. Remediation would result in unacceptable cross-media impacts.

6. A determination by the department pursuant to paragraph (10)(B)5. of this rule shall not affect the authority of the state to require the owner/operator to undertake source control measures or other measures that may be necessary to eliminate or minimize further releases to the groundwater, to prevent exposure to the groundwater, or to remediate the groundwater to concentrations that are technically practicable and which significantly reduce threats to human health or the environment.

(C) Implementation of the Corrective Action(s) Program.

1. Based on the schedule established for initiation and completion of corrective action(s), the owner/operator shall—

A. Establish and implement a corrective action(s) groundwater monitoring program that—

(I) At a minimum, meets the requirements of an assessment monitoring program of this rule;

(II) Indicates the effectiveness of the corrective action(s); and

(III) Demonstrates compliance with the groundwater protection standard.

B. Implement the corrective action(s) selected; and

C. Take any interim corrective action(s) necessary, any action(s) determined to be necessary by the department, or both, to ensure the protection of human health and the environment. Interim corrective action(s) shall, to the greatest extent practicable, be consistent with the objectives of and contribute to



the performance of any action(s) selected. The following factors shall be considered by an owner/operator, and will be considered by the department, in determining whether interim action(s) is necessary:

(I) Time to develop and implement a final remedy;

(II) Actual or potential exposure of nearby populations or environmental receptors to hazardous constituents;

(III) Actual or potential contamination of drinking water supplies or sensitive ecosystems;

(IV) Further degradation of the groundwater that may occur if a corrective action(s) is not initiated expeditiously;

(V) Weather conditions that may cause hazardous constituents to migrate or be released;

(VI) Risks of fire, explosion, or potential for exposure to hazardous constituents as a result of an accident or failure of a container or handling system; and

(VII) Other situations that may pose threats to human health and the environment.

2. The department may determine, based on information developed after implementation of the corrective action(s) has begun, or other information, that compliance is not being achieved through the action(s) selected. In those cases, the owner/operator shall implement other methods or techniques that will achieve compliance with the requirements, unless the department makes the determination under paragraph (10)(C)3. of this rule.

3. If the department determines that compliance cannot be practically achieved with any currently available methods, the owner/operator shall—

A. Obtain the certification of a qualified groundwater scientist and approval from the department that compliance cannot be practically achieved with any currently available methods;

B. Implement alternative corrective action(s) to control exposure of humans or the environment to residual contamination, as necessary, to protect human health and the environment;

C. Implement alternative corrective action(s) for control of the sources of contamination, or for removal or decontamination of equipment, units, devices, or structures that are—

(I) Technically practicable; and

(II) Consistent with the overall objective of the corrective action(s); and

D. Submit a report to the department justifying the alternative corrective action(s).

The alternative action(s) must be approved by the department prior to implementation.

4. All solid wastes that are managed pursuant to a corrective action(s) plan or an interim corrective action(s) plan shall be managed in a manner—

A. That is protective of the human health and the environment; and

B. That complies with all applicable state and federal requirements.

5. Remedies selected pursuant to this rule shall be considered complete when—

A. The owner/operator complies with the groundwater protection standards established under this rule at all points within the plume of contamination;

B. Compliance with the groundwater protection standards has been achieved by demonstrating that concentrations of all constituents listed in Appendix I, II, III, or IV of this rule have not exceeded the groundwater protection standard(s) for a period of three (3) consecutive years using the approved statistical procedures and performance standards. The department may specify an alternative length of time during which the owner/operator shall demonstrate that concentrations of all constituents listed in Appendix I, II, III, or IV of this rule have not exceeded the groundwater protection standard(s) taking into consideration—

(I) Extent and concentration of the release(s);

(II) Behavioral characteristics of the hazardous constituents in the groundwater;

(III) Accuracy of monitoring or modeling techniques, including any seasonal meteorological, or other environmental variabilities that may affect the accuracy; and

(IV) Characteristics of the groundwater; and

C. All actions required to complete the corrective action(s) plan have been completed.

6. Upon completion of the corrective action(s), the owner/operator shall submit a certification to the department within fourteen (14) days after the corrective action(s) has been completed and shall place a copy of the certification in the facility's operating record. The certification shall be signed by the owner/operator and by a qualified groundwater scientist and approved by the department.

7. When, upon completion of the certification, the owner/operator and the department determine that the corrective action(s) has been completed, the owner/operator shall be released from the requirements for financial assurance for corrective action under 10 CSR 80-2.030(4)(C).

(11) Air Quality.

(A) The design, construction, and operation of the sanitary, demolition, or special waste landfill shall minimize impacts or hazards to human health or the environment and shall comply with applicable ambient air quality and source control regulations.

(B) Design and operational plans shall include a description of efforts to be taken to prevent off-site emissions, including an effective dust and odor control program.

(C) Operation and maintenance of the landfill gas collection and control system shall be in accordance with the Missouri Solid Waste Management Law and Missouri Clean Air Law.

(D) The landfill owner/operator shall take steps to prevent excessive odors or dust or any leachate spray from application to the working face, from leaving the landfill property.

(E) Burning at the landfill shall be conducted in accordance with Chapter 643, RSMo, the corresponding rules, the terms and conditions, or both, of the plans, permits, or both, and all local requirements. Burning within the permitted boundary of a sanitary or demolition landfill shall be limited to tree trunks, tree limbs, and vegetation resulting from land clearing related to landfill operation/development. Burning of all other solid waste is prohibited on the landfill property.

(12) Landfill Gas Monitoring.

(A) The sanitary or demolition landfill owner/operator shall implement a landfill gas monitoring program as outlined in subsection (12)(C) prior to receiving an operating permit. Requirements for implementing a landfill gas monitoring plan at special waste landfills will be determined by the department on a case-by-case basis.

(B) The department may apply some or all of the requirements of this section to the design and maintenance of any landfill that has ceased accepting waste if the department determines there is evidence of an existing or potential safety concern or an existing or potential environmental impact, either of which that can be attributed to the adverse effects of landfill gas migrating from the landfill.

(C) Owners/operators of sanitary or demolition landfills receiving waste on or after the effective date of this rule shall develop a landfill gas monitoring plan prepared by an independent professional engineer capable of detecting landfill gases in the most likely zone(s) of migration to ensure concentrations of methane gas do not exceed limits set out in this rule. The plan shall describe the monitoring systems, equipment, and procedures



that will be utilized to detect methane that is generated in the landfill and may accumulate in structures or migrate through the subsurface beyond the landfill property boundary.

1. The landfill gas monitoring plan shall include the following:

A. Provisions for monitoring the subsurface for migration of methane utilizing a network of landfill gas compliance monitoring wells installed within the permitted boundary.

(1) Gas monitoring well and well network – design and construction.

(a) Wells shall be designed and installed to monitor all unsaturated zones down to an elevation equal to the bottom elevation of waste at the lowest point in the landfill and include all site-specific information used as a basis for the design, construction, installation, and monitoring of the wells.

(b) The maximum spacing between landfill gas compliance monitoring wells shall be five hundred feet (500') at any two (2) adjacent well locations, unless the department approves documentation provided in the landfill gas monitoring plan that a hydrologic or topographic barrier to methane migration exists in a specific area of the site.

(c) The owner/operator shall assess the need for a closer well spacing to provide monitoring for:

I. Enclosed structures located within one thousand feet (1,000') of the permitted boundary;

II. Underground utility lines, trenches, vaults, manholes, and any other potential confined spaces that are located within the permitted boundary or within one thousand feet (1,000') of the permitted boundary, and may require entry by a worker or property owner, or that could act as a conduit for landfill gas flow;

III. Any known natural subsurface gas migration pathways, based on documentation of the geologic, hydrologic, and topographic conditions of the site and the surrounding property located within one thousand feet (1,000') of the permitted boundary;

IV. Any known manmade subsurface gas migration pathways, based on knowledge of the site and the surrounding property; and

V. Any area of the site that was subject to historical methane migration assessments or investigation.

(d) The department may waive the requirement to install landfill gas compliance monitoring wells within a specific defined area provided the landfill owner/operator demonstrates to the department that a hydrologic or topographic barrier

exists between the landfill waste footprint and the permitted boundary within the defined area. The demonstration(s) shall be submitted to the department with, or as an addendum to, the landfill gas monitoring plan, and shall address the following:

I. Hydrologic barrier. This requires the owner/operator to submit documentation to the department, reviewed, signed, and sealed by an independent registered geologist, that hydrologic conditions exist within the defined area that preclude the migration of landfill gas onto an adjacent property. To be classified as a hydrologic barrier, the hydrologic conditions must meet the following criteria:

a. The subsurface is continuously saturated in a zone defined by a vertical surface that exists between the landfill footprint and the permitted boundary and extends horizontally the entire width of the defined area, and extends vertically from an elevation equal to or lower than the bottom elevation of waste at the lowest point within the landfill footprint to an elevation equal to or greater than the elevation of the highest point along the permitted boundary within the defined area; and

b. The saturated conditions are permanent (i.e. not seasonal or weather dependent) within the defined area; and

II. Topographic barrier. This requires the owner/operator to submit documentation to the department, reviewed, signed, and sealed by an independent professional engineer, that the ground surface elevation along a continuous contour line between the landfill footprint and the permitted boundary and extending the entire width of the defined area, is below the bottom most elevation of any waste located within one thousand feet (1,000') of the defined area.

B. Provisions for monitoring for methane in each enclosed structure or confined space located within the permitted boundary of the landfill.

(D) Landfill Gas Monitoring Well Network – Operation and Maintenance.

1. Wells shall be constructed, installed, maintained, and plugged in accordance with the Missouri Monitoring Well Construction Code, 10 CSR 23-4.

2. The survey coordinates and the top-of-casing elevation for each well shall be established using conventional or GPS surveying techniques and submitted to the department with the monitoring system as-built drawings.

3. Each well shall be marked clearly in the field with a permanent placard or sign showing its identification number.

4. Each well shall be equipped with a sampling port to allow sampling without removal of the well cap.

5. All monitoring wells shall be protected from unauthorized access and kept locked and secured at all times.

6. The landfill owner/operator shall sample all landfill gas compliance monitoring wells at least quarterly, or more frequently if required by the department to protect human health or guide corrective actions.

7. The landfill owner/operator shall measure the following constituents in each landfill gas compliance monitoring well during each sampling event:

A. Methane concentration (percent methane by volume);

B. Oxygen concentration (percent oxygen);

C. Carbon dioxide concentration (percent carbon dioxide);

D. Atmospheric (barometric) pressure (inches Hg); and

E. Other constituents if the department determines that conditions at the landfill warrant the need for additional information to protect human health.

8. The landfill owner/operator shall submit all monitoring results electronically to the department within seven (7) days of collection—

A. At least quarterly, or more frequently if required due to detection of methane above limits specified in subsection (13)(C); and

B. In a format and manner prescribed by the department.

(13) Landfill Gas Collection and Control. Landfills accepting waste with the potential to generate methane shall be designed to prevent the migration of methane gases generated by the waste fill through an active gas collection and control system to avoid posing a hazard to the health and safety of the public and landfill personnel, or creating a negative impact to the environment. The department may apply some or all of the requirements of this section to the design of any landfill that has ceased accepting waste, if the department determines there is evidence of an existing or potential human health concern or an existing or potential environmental impact, either of which can be attributed to the adverse effects of landfill gas migrating from the landfill. Unless notified otherwise by the department, owners/operators of landfills that are inactive or officially closed shall design the landfill to control methane in accordance with the regulations in effect at the time the landfill ceased receiving waste.

(A) Design.



1. Owners/operators of landfills receiving waste on or after the effective date of this rule shall submit to the department a design for an active landfill gas collection and control system to service areas of the landfill that warrant control, unless such design for an active landfill gas collection and control system has already been submitted and approved by the department. The system shall be designed to prevent the migration of methane through the subsurface into enclosed structures within the permitted boundary and/or onto surrounding properties.

2. The plans for the design and operation of the landfill gas collection and control system shall, at a minimum, include the following:

A. Drawings that show the layout and locations of all landfill gas, gas condensate, and, if applicable, pneumatic control system components and equipment, specifications of all piping systems, locations of all components, trench specifications, and system connections and piping configurations for all components;

B. Calculations verifying design and flow capacity over the intended use of the gas collection and control system;

C. Design specifications for all materials, components, and equipment used in the landfill gas collection and control system;

D. A landfill gas collection well schedule indicating, for each well, the approximate elevation of the landfill surface at the location of the well, the proposed elevation of the top of base liner at the location of the well, the proposed length of slotted and solid pipe in the well, and the proposed depth of the well;

E. A well construction diagram (cross-section drawing) illustrating the design details for a typical landfill gas collection well, and showing the diameter of the borehole, the material specifications for the well riser, the dimensions and material specifications for the borehole seals, the dimensions and material specifications for the filter pack, and the type of surface completion;

F. Construction diagrams illustrating the design details for all collection points, including, but not limited to, the horizontal collection trenches, passive systems, or surface collection components;

G. A description of when the system is to be installed in each phase or cell of the landfill, with respect to overall landfill development. Showing the conceptual sequence of installation of the landfill gas collection and control system on the phase development drawings pursuant to subsection (4)(G) of this rule satisfies this requirement; and

H. All applicable permits and approvals necessary to comply with the requirements of the Missouri Air Conservation Law and rules.

3. All landfill gas collection wells installed in waste shall be designed such that the bottom of the well borehole is not less than ten feet (10') above the top of the landfill liner.

4. The owner/operator also shall submit to the department a detailed operating and maintenance plan for the landfill gas collection and control system installed within the landfill footprint, and any landfill gas collection and control systems external to the landfill footprint. The operating and maintenance plan shall address the system(s) in its entirety and each system component individually.

5. The department may approve the use of an alternative gas system design on a case-by-case basis.

(B) Operation.

1. The owner/operator of a landfill shall control landfill gas on site so that it will not accumulate in explosive or toxic concentrations and migrate laterally from the waste footprint to endanger the health of landfill employees or the public, or pose a threat to the environment.

2. The department may require landfill owners to install portions of the approved landfill gas collection and control system, or to install an interim landfill gas collection and control system, in specific areas of the landfill as necessary to control landfill gas.

3. The system shall be adjusted (tuned) as needed to optimize performance. The landfill owner/operator shall, in a timely manner, investigate the reason for reduced performance and make any necessary adjustment to, repair of, or replacement of a system component or components to return the system performance to optimal levels.

4. The system shall be maintained in accordance with the approved operating and maintenance plan(s).

5. The owner/operator shall inspect all components and portions of the system at least monthly.

6. The leachate level in landfill gas collection wells installed in the waste mass shall be checked and controlled at least quarterly to prevent methane migration and odors and ensure efficient operation of the collection wells.

(C) Methane shall not be allowed to accumulate above the following concentrations:

1. Twenty-five percent (25%) of the lower explosive limit (LEL) or one and one-quarter percent (1.25%) methane by volume in air in enclosed structures within the permitted boundary;

2. Fifty percent (50%) of the LEL or two and one-half percent (2.5%) by volume for methane in the soil at the permitted boundary of the landfill;

3. For purposes of this section, LEL means the lowest percent by volume of a mixture of explosive gases in air that will propagate a flame at twenty-five degrees Celsius (25°C) and atmospheric pressure.

(14) Landfill Gas Corrective Action. In the event methane or other landfill gases are detected migrating from the landfill waste footprint and accumulating above the concentrations specified in this rule, the landfill owner/operator shall take immediate action to protect the health and safety of the public and landfill personnel and any threat to the environment. The owner/operator shall then take appropriate and timely corrective actions to control the landfill gas and alleviate the migration of methane onto any surrounding properties, or into enclosed structures or underground utility structures, as the situation warrants.

(A) Corrective Action. The landfill owner/operator shall take the following actions upon detection of elevated methane concentrations in structures and in the soil at the property boundary of the landfill.

1. Once the determination has been made to keep people out of any structure or away from any area, immediately notify the following parties that methane gas exceedance has been discovered:

A. Fire department or local emergency management personnel;

B. The department; and

C. Owners and occupants of properties within one thousand feet (1,000') of any compliance monitoring well exhibiting concentrations above the limit(s) provided in (13)(C) of this rule.

2. For concentrations of landfill gas(es) detected in on- or off-site enclosed structures above the limit(s) provided in (13)(C) of this rule, immediately take all appropriate actions to mitigate the effects of landfill gas accumulation in those structures until a permanent remediation is completed. These corrective actions may include, but are not limited to:

A. Emergency actions required by the fire department or local emergency management personnel, as needed, to protect employee, and human health and safety;

B. Ventilate any confined spaces that may trap landfill gases or install landfill gas detectors in confined spaces that may accumulate landfill gases; and

C. Establish a temporary landfill gas monitoring program in affected structures



using an increased monitoring frequency from the frequency in (12)(D)8. of this rule.

3. Once methane migration has been confirmed, the department may establish alternative, more frequent, schedules for monitoring, notification, and implementation of corrective actions, as needed, to protect the health and safety of landfill employees, the public, and the environment.

4. Within seven (7) days of detection, submit to the department a report describing the notification process and steps taken to protect employee and public health and safety;

5. Within forty-five (45) days of detection, submit to the department for approval a corrective action plan designed by a professional engineer to address the gas migration. The plan shall investigate the reason for the migration, describe the nature and extent of the migration, and propose a remedy to correct the migration. The department shall approve or disapprove the plan within fourteen (14) days of receipt.

6. If the landfill is experiencing ongoing methane gas migration, the owner/operator shall notify the department—

A. Within twenty-four (24) hours of discovering that the landfill gas collection and control system has been damaged, that a complete failure has occurred, or that a significant portion of the system has been taken out of service as a result of a malfunction; and

B. At least seven (7) days in advance of any scheduled activity that requires taking all or part of the landfill gas collection and control system off line or out of service for longer than twenty-four (24) hours if the landfill has methane gas migration.

7. If upon completion of the department's review of the corrective action plan, the department finds the plan does not provide sufficient data to support the corrective actions proposed in the plan, the department shall deny the plan. The landfill owner/operator shall submit a revised corrective action plan within thirty (30) days of the department's denial of the original corrective action plan.

8. Once the corrective action plan has been approved by the department, the landfill owner/operator shall implement the plan within one hundred twenty (120) days or an alternative timeframe approved by the department, monitor results of corrective actions taken, analyze and report to the department on the impact of corrective actions taken, and continue to propose and implement approved corrective actions until the methane gas concentrations fall to within compliance limits.

9. When the methane concentrations in all landfill gas compliance wells fall to below

limits provided in (13)(C) of this rule and remain there for longer than one (1) month's time, the department will allow the resumption of a gradually reduced monitoring frequency. After one (1) year of methane concentrations remaining below the limits provided in (13)(C) of this rule, the landfill owner/operator may petition and receive approval from the department to return to a quarterly landfill gas monitoring schedule.

(15) Vectors. The landfill owner/operator shall operate and maintain the landfill in a manner that is unfavorable for the harboring, feeding, and breeding of vectors and immediately implement those procedures when vectors are first observed. The landfill operating manual shall include contingency plans for vector control, and the owner/operator shall be prepared to immediately implement those procedures when vectors are observed.

(16) Aesthetics.

(A) The sanitary, demolition, or special waste landfill owner/operator shall operate the landfill in an aesthetically acceptable manner.

(B) Wastes that are easily moved by wind shall be covered, as necessary, to prevent becoming airborne and scattered, and the landfill shall employ effective litter control methods and best management practices to prevent litter from leaving the permitted area of the landfill.

(C) On-site vegetation should be cleared only as necessary. Natural windbreaks, such as green belts, should be maintained where they will reduce noise, dust, and odors, and improve the appearance and operation of the landfill.

(17) Cover.

(A) Cover shall be applied at the landfill to minimize fire hazards, infiltration of precipitation, odors and blowing litter; control gas venting and vectors; discourage scavenging; and provide a pleasing appearance.

(B) The owner/operator shall include in the landfill's operating plan a description of daily and intermediate cover at the landfill and also submit a written closure/post-closure plan that includes the design and construction of a final cover system over each phase or cell as it reaches the approved final elevation, in accordance with this rule.

1. The operating plan shall include:

A. The proposed cover sources, quantities, and soil classifications (Unified Soil Classification System or United States Department of Agriculture classification system). Soil classification is not necessary for soils used for daily and intermediate cover;

B. The capability of the cover to perform the functions listed above; and

C. Design, construction, and operations that ensure active, intermediate, and final slopes shall not exceed thirty-three and one-third percent (33 1/3%);

2. The closure/post-closure plan shall include:

A. A description of how the operating plan shall prepare the landfill for closure and the procedures to establish and maintain vegetative growth to combat erosion and improve appearance of idle and completed areas, including fertilizer rate, soil conditioning rate, seeding rate, and provisions for mulching;

B. Procedures to maintain cover integrity, for example, regrading and recovering;

C. Methods for borrow areas to be reclaimed on site so as to restore aesthetic qualities and prevent excessive erosion;

D. Provisions for construction of the final slope of the top of the landfill to have a minimum slope of five percent (5%);

E. A design of the final side slopes to minimize infiltration, promote run off without excessive erosion, and not to exceed twenty-five percent (25%), unless it has been demonstrated in a detailed slope stability analysis approved by the department that the slopes can be constructed and maintained throughout the entire operational life and post-closure period of the landfill;

F. Shear failure analyses where intermediate or final slopes exceed twenty-five percent (25%). However, the department will waive the analysis for slopes of twenty-five percent (25%) or less, except in seismic impact zones;

G. The design and installation of the geomembrane liner, which is to be in intimate contact with the underlying compacted clay;

H. The design and installation of the final cover system(s) and provisions for slope stability; and

I. A final cover system installation schedule as each phase of the landfill reaches approved elevations.

3. For landfills with composite liners, final cover shall be designed and constructed in composite layers, in order from top to bottom, as follows:

A. Two feet (2') of soil capable of sustaining vegetative growth;

B. A drainage layer;

C. A geomembrane liner at least as thick as the minimum thickness specified in subsection (4)(I); and

D. One foot (1') of compacted soil with a coefficient of permeability of  $1 \times 10^{-5}$  cm/sec or less;



4. For existing landfills without composite liners, the final cover shall consist of at least two feet (2') of compacted soil with a coefficient of permeability of  $1 \times 10^{-5}$  cm/sec or less and overlaid by at least one foot (1') of soil capable of sustaining vegetative growth.

(C) Operations – Cover.

1. For sanitary landfills, no less than six inches (6") of cover shall be applied by the end of each operating day, regardless of weather, unless an alternative is approved by the department. The practice of peeling back and reusing cover is an approved practice so long as the method and practice is contained in the operating plan. Sanitary landfills operating twenty-four (24) hours per day shall cover the waste at least once every twenty-four (24) hours.

2. For demolition landfills, no less than twelve inches (12") of cover shall be applied at least once at the end of each operating week or immediately before the facility closes if the facility is to be closed for more than twenty-four (24) hours.

3. Alternative daily cover.

A. An alternative daily cover may be approved by the department on a site-specific basis, if the landfill owner/operator demonstrates that the alternative material controls stormwater run-on and runoff and prevents disease, vectors, fires, odors, and blowing litter, without presenting a threat to human health and the environment.

B. In the event the use of an alternative daily cover is approved by the department, the landfill owner/operator shall make all efforts to ensure that the use of alternative daily cover does not contribute to increased odor generation, leachate generation, litter blowing from the working face, or attraction of vectors.

4. Surface grades and side slopes shall be constructed and maintained to promote runoff without excessive erosion.

5. Re-grading and recovering shall be performed as necessary, followed by re-establishing vegetation, to maintain landfill cover, slope, and integrity.

6. In areas of the landfill where waste has not been accepted for more than sixty (60) days, cover shall be increased to a total thickness of at least one foot (1') of compacted cover, and steps taken to seed and encourage vegetative growth.

7. All final side slopes and the slope of the top of the landfill shall be constructed with provisions for slope stability and subsequently maintained to comply with the landfill's approved closure/post-closure plan.

8. Final cover at the landfill shall be constructed and installed in accordance with

the landfill's approved closure/post-closure plan.

9. The department may approve the use of an alternative final cover system provided that the owner/operator can demonstrate to the department that the alternative design will be at least equivalent to the final cover system described in this rule.

10. Borrow areas shall be reclaimed in accordance with the approved plans.

11. Vegetation shall be established within one (1) year or other schedule approved by the department and maintained and re-established as necessary to achieve greater than eighty percent (80%) coverage to protect the landfill final cover and prevent surface water infiltration.

(18) Compaction.

(A) In order to conserve sanitary, demolition, or special waste landfill site capacity, thereby preserving land resources and minimizing moisture infiltration and settlement, solid waste and cover shall be compacted to the smallest practicable volume.

(B) The size of the working face shall be kept to a minimum.

(C) Equipment shall be maintained on site or readily available to ensure uninterrupted operations.

(19) Safety. The sanitary, demolition, or special waste landfill shall be designed, constructed, and operated to protect the health and safety of landfill personnel and the public.

(A) The landfill's operating plan shall include provisions to control access to and traffic on to the landfill in a manner that is compatible with the surrounding land use.

(B) Provisions shall be included in the plans to control dust, address emergency situations, and promote orderly operations. These provisions shall be revised as necessary to keep them up-to-date and relevant to the current landfill operations.

(C) Scavenging is prohibited at all times at the landfill.

(D) The landfill owner/operator shall employ dust control provisions as necessary for safety purposes and to prevent a nuisance to the surrounding area.

(E) Adequate communications equipment shall be available for use by landfill personnel.

(F) The landfill owner/operator shall prepare a plan of procedures to implement in the event of emergencies that occur at the landfill, including but not limited to, slope failure or firefighting. The owner/operator shall make the plan available to landfill personnel to provide them with the appropriate emer-

gency contact information and delegation of authority to implement during each such emergency event.

(G) A fire extinguisher shall be provided on all waste handling equipment.

(H) A hot load area shall be established to contain loads that arrive with hotspots or open flames.

(I) Any fires discovered in wastes delivered to the landfill shall be extinguished away from the working face, whenever possible.

(J) Any surface fire discovered at the working face or subsurface fire, oxidation, or smoldering event shall be extinguished immediately; the landfill owner/operator shall notify the department as soon as it has been discovered.

(20) Records.

(A) The owner/operator of a landfill shall maintain records and monitoring data as specified by the department and file appropriate documents with the county recorder(s) of deeds.

1. The landfill owner/operator shall describe the methods for creating and maintaining records of operations and monitoring at the landfill.

2. Current records shall be maintained at the landfill office. Records five (5) years old or older may be stored electronically or off-site at an alternate site if approved by the department; such records must be made available to the department upon request.

3. The landfill files may be maintained on electronic media and shall include the following records, at a minimum:

A. Copies of approved permit documents and current permits;

B. Major operational problems, complaints, or difficulties; and any corrective actions taken;

C. Gas monitoring results from monitoring and any corrective action plans being implemented;

D. Any demonstration, certification, finding, monitoring, testing, or analytical data;

E. Housekeeping records to summarize efforts taken for vector, dust, odor, and litter control;

F. Quantitative measurements of the solid waste handled and an estimate of the air space left at the facility. By January 31st, on even numbered years the owner/operator shall submit to the department two (2) copies of a topographic map prepared during the previous calendar year, prepared under the direction of a land surveyor or by aerial photography, showing the current horizontal and vertical boundaries of solid waste in the landfill, the boundaries of the landfill and a form



provided by the department listing airspace filled in the preceding period;

G. Description, source, and volume of special wastes that are received;

H. Any landfill design documentation for recirculation of leachate or gas condensate in a landfill, as applicable;

I. Closure and post-closure care plans and any associated monitoring, testing, or analytical data;

J. Most recently approved cost estimates and financial assurance documentation;

K. Inspection records and training procedures including screening for excluded wastes;

L. Records associated with tonnage fee; and

M. On or before January 31 of each calendar year and annually thereafter each solid waste disposal area shall submit a report to the department specifying the amount of solid waste received for disposal from states other than Missouri.

(B) Once a landfill ceases accepting waste, the landfill owner shall record the existence of the landfill with the recorder(s) of deeds in the county(ies) where the landfill is located. The owner may request permission from the department to remove the notation from the deed if all wastes are removed from the landfill.

1. After the landfill ceases accepting waste, the owner/operator shall obtain a land surveyor to prepare a survey and plat meeting the requirements of the current Minimum Standards of Property Boundary Survey 2 CSR 90 and a detailed description of the landfill. The survey plat and detailed description, at a minimum, shall contain the following information:

A. The name of the property owner as it appears on the property deed;

B. The detailed description of the property;

C. The general types and location of the solid wastes and the depth(s) of fill within the property;

D. The location of any leachate collection system, gas collection and control system, and existing gas, surface water, ground-water monitoring system(s) which shall be maintained after closure, and the length of time that these systems are to be maintained; and

E. The permitted name and permit number(s) of the landfill.

2. The owner shall—

A. Submit to and obtain approval from the department of the survey plat and detailed description;

B. Have the approved plat notarized by a lawful notary public;

C. File the approved survey plat and detailed description with the county recorder(s) of deeds within thirty (30) days of departmental approval; and

D. Submit to the department within thirty (30) days of the date of filing, two (2) copies of the notarized and properly recorded plat and detailed description showing the recorder(s) of deeds' seal(s) or stamp(s), the book and page numbers, and the date of filing.

(21) Bioreactor Permits and Bioreactor Permit Modifications for Sanitary Landfills.

(A) The department may issue a permit or a permit modification to allow an owner/operator to design, construct, and operate a sanitary landfill as a bioreactor (bioreactor permit), utilizing innovative and new designs and/or operations which vary from specific criteria listed in this rule, provided the landfill systems are designed and operated in a manner protective of human health and the environment.

(B) For a proposed bioreactor at a new sanitary landfill, the design plans shall address all elements of landfill design, construction, and operation outlined in this rule, with special consideration for the effects of increased moisture content of the waste mass.

(C) For a proposed bioreactor at an existing sanitary landfill, the design plans shall include an assessment of all previously approved aspects of design, construction, and operation. Sanitary landfill systems and components shall be redesigned, construction procedures shall be developed, and all operating, monitoring, and quality control plans shall be revised, as necessary, with special consideration for bioreactor operations and the effects of increased moisture content of the waste mass.

(D) In addition, each bioreactor permit application shall include—

1. An explanation of the objectives of the research, development, and demonstration project;

2. Detailed explanations of the methods and procedures that will be used to add liquids, if applicable;

3. Detailed water balance calculations;

4. Detailed construction QA/QC procedures for all liquids addition systems;

5. A detailed operating and maintenance plan prepared as an addendum to the landfill's operating manual which includes:

A. Operating procedures for all bioreactor systems and other systems whose operation could be affected by the increased moisture, including, but not limited to:

(I) All liquids addition systems;

(II) Leachate management systems;

and

(III) Landfill gas collection and control systems; and

B. A detailed plan for inspecting all landfill control and monitoring systems and maintaining accurate records of each inspection;

6. Provisions for leak testing of the geomembrane component of the composite liner system following installation; and

7. Facility designs that maintain a depth of leachate of less than one foot (1') on the landfill liner.

(22) Special Waste Landfills.

(A) Should an owner/operator request to permit a special waste landfill, the owner/operator shall include a list identifying what sections of this rule, and as appropriate 10 CSR 80-2.020, are and are not applicable to the landfill, as well as detailed discussion explaining how that determination was made. For special waste landfills in operation at the time of the effective date of this rule, the facility has until January 31, 2020, to submit a modification stating which parts of this rule are applicable and a detailed discussion explaining the rationale and for excluding certain requirements.

(B) The department may require any special waste landfill owner/operator to design, construct, operate, and maintain the landfill in accordance with any sanitary landfill requirement necessary to ensure the protection of human health and the environment.

#### Appendix I—Constituents for Detection Monitoring

##### Indicator Constituents

Chemical Oxygen Demand (COD in milligrams per liter (mg/l));

Chlorides (Cl, (mg/l)) dissolved;

pH (units);

Specific Conductance (Conductivity at twenty-five degrees Celsius (25°C) in micromhos per centimeter ( $\mu\text{mho/cm}$ ));

Total Dissolved Solids (TDS, (mg/l)); and

##### Inorganic Constituents

Ammonia (NH<sub>3</sub> as N, mg/l)

Antimony (Sb,  $\mu\text{g/l}$ )

Arsenic (As,  $\mu\text{g/l}$ )

Barium (Ba,  $\mu\text{g/l}$ )

Beryllium (Be,  $\mu\text{g/l}$ )

Boron (B,  $\mu\text{g/l}$ )

Cadmium (Cd,  $\mu\text{g/l}$ )

Calcium (Ca, mg/l)

Chromium (Cr,  $\mu\text{g/l}$ )

Cobalt (Co,  $\mu\text{g/l}$ )



Copper (Cu,  $\mu\text{g/l}$ )  
 Fluoride (F,  $\text{mg/l}$ )  
 Hardness (calculated,  $\text{mg/l}$ )  
 Lead (Pb,  $\mu\text{g/l}$ )  
 Magnesium (Mg,  $\text{mg/l}$ )  
 Manganese (Mn,  $\mu\text{g/l}$ )  
 Nickel (Ni,  $\text{mg/l}$ )  
 Nitrate/Nitrite ( $\text{NO}_3/\text{NO}_2$ ,  $\text{mg/l}$ )  
 Phosphorus (total P,  $\text{mg/l}$ )  
 Selenium (Se,  $\mu\text{g/l}$ )  
 Silver (Ag,  $\mu\text{g/l}$ )  
 Sodium (Na,  $\text{mg/l}$ )  
 Sulfate ( $\text{SO}_4$ ,  $\text{mg/l}$ )  
 Thallium (Tl,  $\mu\text{g/l}$ )  
 Total Organic Carbon (TOC,  $\text{mg/l}$ )  
 Vanadium (V,  $\mu\text{g/l}$ )  
 Zinc (Zn,  $\mu\text{g/l}$ )

**Organic Constituents**

Acetone  
 Acrylonitrile  
 Benzene  
 Bromochloromethane  
 Bromodichloromethane  
 Bromoform; Tribromomethane  
 Carbon disulfide  
 Carbon tetrachloride  
 Chlorobenzene  
 Chloroethane; Ethyl chloride  
 Chloroform; Trichloromethane  
 Dibromochloromethane;  
 Chlorodibromomethane  
 1,2-Dibromo-3-chloropropane; DBCP  
 1,2-Dibromoethane; Ethylene dibromide;  
 EDB o-Dichlorobenzene; 1,2-Dichlorobenzene  
 p-Dichlorobenzene; 1,4-Dichlorobenzene  
 trans-1,4-Dichloro-2-butene  
 1,1-Dichloroethane; Ethylidene chloride  
 1,2-Dichloroethane; Ethylene dichloride  
 1,1-Dichloroethylene; 1,1-Dichloroethene;  
 Vinylidene chloride  
 cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene  
 trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene  
 1,2-Dichloropropane; Propylene dichloride  
 cis-1,3-Dichloropropene  
 trans-1,3-Dichloropropene  
 Ethylbenzene  
 2-Hexanone; Methyl butyl ketone  
 Methyl bromide; Bromomethane  
 Methyl chloride; Chloromethane  
 Methylene bromide; Dibromomethane  
 Methylene chloride; Dichloromethane  
 Methyl ethyl ketone; MEK; 2-Butanone  
 Methyl iodide; Iodomethane  
 4-Methyl-2-pentanone; Methyl isobutyl ketone  
 Styrene  
 1,1,1,2-Tetrachloroethane

1,1,2,2-Tetrachloroethane  
 Tetrachloroethylene; Tetrachloroethene;  
 Perchloroethylene  
 Toluene  
 1,1,1-Trichloroethane; Methylchloroform  
 1,1,2-Trichloroethane  
 Trichloroethylene; Trichloroethene  
 Trichlorofluoromethane; CFC-11  
 1,2,3-Trichloropropane  
 Vinyl acetate  
 Vinyl chloride  
 Xylenes

**Appendix II—List of Hazardous Inorganic and Organic Constituents<sup>1</sup>**

Common Name <sup>2</sup>	CAS RN <sup>3</sup>
Acenaphthene	83-32-9
Acenaphthylene	208-96-8
Acetone	67-64-1
Acetonitrile; Methyl cyanide	75-05-8
Acetophenone	98-86-2
2-Acetylamino fluorene; 2-AAF	53-96-3
Acrolein	107-02-8
Acrylonitrile	107-13-1
Aldrin	309-00-2
Allyl chloride	107-05-1
4-Aminobiphenyl	192-67-1
Anthracene	120-12-7
Antimony	(Total)
Arsenic	(Total)
Barium	(Total)
Benzene	71-43-2
Benzo[a]anthracene;	
Benzoanthracene	56-55-3
Benzo[b]fluoranthene	205-99-2
Benzo[k]fluoranthene	207-08-9
Benzo[ghi]perylene	191-24-2
Benzo[a]pyrene	50-32-8
Benzyl alcohol	100-51-6
Beryllium	(Total)
alpha-BHC	319-84-6
beta-BHC	319-85-7
delta-BHC	319-86-8
gamma-BHC; Lindane	58-89-9
Bis(2-chloroethoxy)methane	111-91-1
Bis(2-chloroethyl) ether;	111-44-4
Dichloroethyl ether	
Bis(2-chloro-1-methylethyl) ether;	108-60-1
2,2'-Dichlorodiisopropyl ether;	
DCIP	See Note 3
Bis(2-ethylhexyl) phthalate	117-81-7
Bromochloromethane;	
Chlorobromomethane	74-97-5
Bromodichloromethane;	
Dibromochloromethane	75-27-4
Bromoform; Tribromomethane	75-25-2
4-Bromophenylphenyl ether	101-55-3
Butyl benzyl phthalate;	
Benzy l butyl phthalate	85-68-7

Cadmium	(Total)
Carbon disulfide	75-15-0
Carbon tetrachloride	56-23-5
Chlordane	See Note 4.
p-Chloroaniline	106-47-8
Chlorobenzene	108-90-7
Chlorobenzilate	510-15-6
p-Chloro-m-cresol;	
4-Chloro-3-methylphenol	59-50-7
Chloroethane; Ethyl chloride	75-00-3
Chloroform; Trichloromethane	67-66-3
2-Chloronaphthalene	91-58-7
2-Chlorophenol	95-57-8
4-Chlorophenyl phenyl ether	7005-72-3
Chloroprene	126-99-8
Chromium	(Total)
Chrysene	218-01-9
Cobalt	(Total)
Copper	(Total)
m-Cresol; 3-methylphenol	108-39-4
o-Cresol; 2-methylphenol	95-48-7
p-Cresol; 4-methylphenol	106-44-5
Cyanide	57-12-5
2,4-D; 2,4-Dichlorophenoxyacetic acid	94-75-7
4,4'-DDD	72-54-8
4,4'-DDE	72-55-9
4,4'-DDT	50-29-3
Diallate	2303-16-4
Dibenz[a,h]anthracene	53-70-3
Dibenzofuran	132-64-9
Dibromochloromethane;	
Chlorodibromomethane	124-48-1
1,2-Dibromo-3-chloropropane; DBCP	96-12-8
1,2-Dibromoethane; Ethylene dibromide; EDB	106-93-4
Di-n-butyl phthalate	84-74-2
o-Dichlorobenzene;	
1,3-Dichlorobenzene	95-50-1
m-Dichlorobenzene;	
1,3-Dichlorobenzene	541-73-1
p-Dichlorobenzene;	
1,4-Dichlorobenzene	106-46-7
3,3'-Dichlorobenzidine	91-94-1
trans-1,4-Dichloro-2-butene	110-57-6
Dichlorodifluoromethane;	
CFC 12;	75-71-8
1,1-Dichloroethane; Ethyldidene chloride	75-34-3
1,2-Dichloroethane; Ethylene dichloride	107-06-2
1,1-Dichloroethylene;	
1,1-Dichloroethene; Vinylidene chloride	75-35-4
cis-1,2-Dichloroethylene;	
cis-1,2-Dichloroethene	156-59-2
trans-1,2-Dichloroethylene	
trans-1,2-Dichloroethene	156-60-5
2,4-Dichlorophenol	120-83-2
2,6-Dichlorophenol	87-65-0



1,2-Dichloropropane; Propylene dichloride	78-87-5	Methyl chloride; Chloromethane	74-87-3	1,2,4,5-Tetrachlorobenzene	95-94-3
1,3-Dichloropropane; Trimethylene dichloride	142-28-9	3-Methylcholanthrene	56-49-5	1,1,1,2-Tetrachloroethane	630-20-6
2,2-Dichloropropane; Isopropylidene chloride	594-20-7	Methyl ethyl ketone; MEK;		1,1,2,2-Tetrachloroethane	79-34-5
1,1-Dichloropropene	563-58-6	2-Butanone	78-93-3	Tetrachloroethylene; Tetra- chloroethene; Perchloroethylene	127-18-4
cis-1,3-Dichloropropene	10061-01-5	Methyl methacrylate	80-62-6	2,3,4,6-Tetrachlorophenol	58-90-2
trans-1,3-Dichloropropene	10061-02-6	Methyl methanesulfonate	66-27-3	Thallium	(Total)
Dieldrin	60-57-1	2-Methylnaphthalene	91-57-6	Tin	(Total)
Diethyl phthalate	84-66-2	Methyl parathion; Parathion		Toluene	108-88-3
O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	297-97-2	methyl	298-00-0	o-Toluidine	95-53-4
Dimethoate	60-51-5	4-Methyl-2-pentanone;		Toxaphene	See Note 6.
p-(Dimethylamino)azobenzen	60-11-7	Methyl isobutyl ketone	108-10-1	1,2,4-Trichlorobenzene	120-82-1
7,12-Dimethylbenz[a]ntracene	57-97-6	Methylene bromide;		1,1,1-Trichloroethane;	
3,3'-Dimethylbenzidine	119-93-7	Dibromomethane	74-95-3	Methylchloroform	71-55-6
2,4-Dimethylphenol; m-Xylenol	105-67-9	Methylene chloride;		1,1,2-Trichloroethane	79-00-5
Dimethyl phthalate	131-11-3	Dichloromethane	75-09-2	Trichloroethylene;	
m-Dinitrobenzene	99-65-0	Naphthalene	91-20-3	Trichloroethene	79-01-6
4,6-Dinitro-o-cresol		1,4-Naphthoquinone	130-15-4	Trichlorofluoromethane;	
4,6-Dinitro-2-methylphenol	534-52-1	1-Naphthylamine	134-32-7	CFC-11	75-69-4
2,4-Dinitrophenol;	51-28-5	2-Naphthylamine	91-59-8	2,4,5-Trichlorophenol	95-95-4
2,4-Dinitrotoluene	121-14-2	Nickel	(Total)	2,4,6-Trichlorophenol	88-06-2
2,6-Dinitrotoluene	606-20-2	o-Nitroaniline; 2-Nitroaniline	88-74-4	1,2,3-Trichloropropane	96-18-4
Dinoseb; DNBP;		m-Nitroaniline; 3-Nitroaniline	99-09-2	0,0,0-Triethyl phosphorothioate	126-68-1
2-sec-Butyl-4,6-dinitrophenol	88-85-7	p-Nitroaniline; 4-Nitroaniline	100-01-6	sym-Trinitrobenzene	99-35-4
Di-n-octyl phthalate	117-84-0	Nitrobenzene	98-95-3	Vanadium	(Total)
Diphenylamine	122-39-4	o-Nitrophenol; 2-Nitrophenol	88-75-5	Vinyl acetate	108-05-4
Disulfoton	298-04-4	p-Nitrophenol; 4-Nitrophenol	100-02-7	Vinyl chloride; Chloroethene	75-01-4
Endosulfan I	959-98-8	N-Nitrosodi-n-butylamine	924-16-3	Xylene (total)	See Note 7.
Endosulfan II	33213-65-9	N-Nitrosodiethylamine	55-18-5	Zinc	(Total)
Endosulfan sulfate	1031-07-8	N-Nitrosodimethylamine	62-75-9		
Endrin	72-20-8	N-Nitrosodiphenylamine	86-30-6		
Endrin aldehyde	7421-93-4	N-Nitrosodipropylamine;			
Ethylbenzene	100-41-4	N-nitroso-N-dipropylamine	621-64-7		
Ethyl methacrylate	97-63-2	Di-n-propylnitrosamine	10595-95-6		
Ethyl methanesulfonate	62-50-0	N-Nitrosomethylethylamine	100-75-4		
Famphur	52-85-7	N-Nitrosopiperidine	930-55-2		
Fluoranthene	206-44-0	N-Nitrosopyrrolidine	99-55-8		
Fluorene	86-73-79	5-Nitro-o-toluidine	56-38-2		
Heptachlor	76-44-8	Parathion	608-93-5		
Heptachlor epoxide	1024-57-3	Pentachlorobenzene	608-93-5		
Hexachlorobenzene	118-74-1	Pentachloronitrobenzene	82-68-8		
Hexachlorobutadiene	87-68-3	Pentachlorophenol	87-86-5		
Hexachlorocyclopentadiene	77-47-4	Phenacetin	62-44-2		
Hexachloroethane	67-72-1	Phenanthrene	85-01-8		
Hexachloropropene	1888-71-7	Phenol	108-95-2		
2-Hexanone; Methyl butyl ketone	591-78-6	p-Phenylenediamine	106-50-3		
Indeno(1,2,3-cd)pyrene	193-39-5	Phorate	298-02-2		
Isobutyl alcohol	78-83-1	Polychlorinated biphenyls;			
Isodrin	465-73-6	PCBs;	See Note 5.		
Isophorone	78-59-1	Aroclors			
Isosafrole	120-58-1	Pronamide	23950-58-5		
Kepone	143-50-0	Propionitrile; Ethyl cyanide	107-12-0		
Lead	(Total)	Pyrene	129-00-0		
Mercury	(Total)	Safrole	94-59-7		
Methacrylonitrile	126-98-7	Selenium	(Total)		
Methapyrilene	91-80-5	Silver	(Total)		
Methoxychlor	72-43-5	Silvex; 2,4,5-TP	93-72-1		
Methyl bromide; Bromomethane	74-83-9	Styrene	100-42-5		
		Sulfide	18496-25-8		
		2,4,5-T;			
		2,4,5-Trichlorophenoxyacetic acid	93-76-5		

### Appendix III—Constituents for Detection Monitoring for Demolition Landfills

#### Indicator Constituents

Aluminum (Al, $\mu\text{g/l}$ )
Ammonia (NH <sub>3</sub> as N, mg/l)
Antimony (Sb, $\mu\text{g/l}$ )
Arsenic (As, $\mu\text{g/l}$ )
Barium (Ba, $\mu\text{g/l}$ )
Beryllium (Be, mg/l)
Boron (B, $\mu\text{g/l}$ )
Cadmium (Cd, $\mu\text{g/l}$ )
Calcium (Ca, mg/l)
Chemical Oxygen Demand (COD, mg/l)
Chloride (Cl, mg/l)
Chromium (Cr, $\mu\text{g/l}$ )
Cobalt (Co, $\mu\text{g/l}$ )
Copper (Cu, $\mu\text{g/l}$ )
Fluoride (F <sup>-</sup> , mg/l)
Hardness (calculated, mg/l)
Iron (Fe, $\mu\text{g/l}$ )
Lead (Pb, $\mu\text{g/l}$ )
Magnesium (Mg, mg/l)
Manganese (Mn, $\mu\text{g/l}$ )
Mercury (Hg, $\mu\text{g/l}$ )
Nickel (Ni, mg/l)
pH (units)
Potassium (K, mg/l)
Selenium (Se, $\mu\text{g/l}$ )
Silver (Ag, $\mu\text{g/l}$ )
Sodium (Na, mg/l)



Specific Conductance (Conductivity at 25°C, mho/cm)  
 Sulfate (SO, mg/l)  
 Thallium (Tl, µg/l)  
 Total Dissolved Solids (TDS, mg/l)  
 Total Organic Carbon (TOC, mg/l)  
 Total Organic Halogens (TOX, mg/l)  
 Zinc (Zn, µg/l)

1,1,2,2-Tetrachloroethane  
 Tetrachloroethylene; Tetrachloroethene; Perchloroethylene  
 Toluene  
 1,1,1-Trichloroethane; Methylchloroform  
 1,1,2-Trichloroethane  
 Trichloroethylene; Trichloroethene  
 Trichlorofluoromethane; CFC-11  
 1,2,3-Trichloropropane  
 Vinyl acetate  
 Vinyl chloride  
 Xylenes

1, 1988. Amended: Filed Aug. 15, 1988, effective Dec. 29, 1988. Emergency amendment filed Sept. 29, 1993, effective Oct. 9, 1993, expired Feb. 5, 1994. Amended: Filed May 3, 1993, effective Jan. 13, 1994. Amended: Filed March 17, 1992. \*\* Emergency rescission of the 1992 amendment filed March 19, 1997, effective April 1, 1997, expired Sept. 27, 1997. Amended: Filed Oct. 10, 1996, effective July 30, 1997. Rescission of the 1992 amendment filed April 3, 1997, effective Aug. 30, 1997. Amended: Filed Dec. 15, 1997, effective Aug. 30, 1998. Amended: Filed June 29, 2018, effective Feb. 28, 2019.

\*Original authority: 260.225, RSMo 1972, amended 1975, 1986, 1988, 1990, 1993, 1995.

\*\*The Missouri Supreme Court in *Missouri Coalition for the Environment, et al., v. Joint Committee on Administrative Rules, et al.*, Case No. 78628, dated February 25, 1997, ordered the secretary of state to publish this amendment. The Missouri Department of Natural Resources subsequently filed an emergency rescission of this amendment as well as a proposed rescission of this amendment which became effective August 30, 1997. See the above authority section for filing dates.

*Op. Atty. Gen. No. 42, Frappier (3-20-74). With respect to the Solid Waste Management Law, Senate Bill No. 387, 76th General Assembly, sections 260.200-260.245, RSMo Supp. 1978. Cities and counties are required to provide for the collection and disposal of solid wastes including industrial wastes and may contract for such collection and disposal. Service charges may be imposed if not already imposed under some other law although these charges must be billed and collected directly by the cities or counties. General revenue of the city and federal revenue sharing funds may also be expended for such purposes.*

**10 CSR 80-3.011 Design and Operation**

Emergency rule filed Sept. 29, 1993, effective Oct. 9, 1993, expired Feb. 5, 1994. Emergency rule filed Jan. 28, 1994, effective Feb. 7, 1994, expired June 6, 1994.

**10 CSR 80-3.020 Emergency Landfill Extensions**

Emergency rule filed Sept. 29, 1993, effective Oct. 9, 1993, expired Feb. 5, 1994. Emergency rule filed Jan. 28, 1994, effective Feb. 7, 1994, expired June 6, 1994.

**Appendix IV—Constituents for Assessment Monitoring for Demolition Landfills**

**Inorganic Constituents**

Nitrate/Nitrite (NO3/NO2, mg/l)  
 Phosphorus (total P, mg/l)  
 Vanadium (V, µg/l)  
 Zinc (Zn, µg/l)

**Organic Constituents**

Acetone  
 Acrylonitrile  
 Benzene  
 Bromochloromethane  
 Bromodichloromethane  
 Bromoform; Tribromomethane  
 Carbon disulfide  
 Carbon tetrachloride  
 Chlorobenzene  
 Chloroethane; Ethyl chloride  
 Chloroform; Trichloromethane  
 Dibromochloromethane; Chlorodibromomethane  
 1,2-Dibromo-3-chloropropane; DBCP  
 1,2-Dibromoethane; Ethylene dibromide; EDB  
 o-Dichlorobenzene; 1,2-Dichlorobenzene  
 p-Dichlorobenzene; 1,4-Dichlorobenzene  
 trans-1,4-Dichloro-2-butene  
 1,1-Dichloroethane; Ethylidene chloride  
 1,2-Dichloroethane; Ethylene dichloride  
 1,1-Dichloroethylene; 1,1-Dichloroethene;  
 Vinylidene chloride  
 cis-1,2-Dichloroethylene;  
 cis-1,2-Dichloroethene  
 trans-1,2-Dichloroethylene;  
 trans-1,2-Dichloroethene  
 1,2-Dichloropropane; Propylene dichloride  
 cis-1,3-Dichloropropene  
 trans-1,3-Dichloropropene  
 Ethylbenzene  
 2-Hexanone; Methyl butyl ketone  
 Methyl bromide; Bromomethane  
 Methyl chloride; Chloromethane  
 Methylene bromide; Dibromomethane  
 Methylene chloride; Dichloromethane  
 Methyl ethyl ketone; MEK; 2-Butanone  
 Methyl iodide; Iodomethane  
 4-Methyl-2-pentanone; Methyl isobutyl ketone  
 Styrene  
 1,1,1,2-Tetrachloroethane

**Notes**

1. The regulatory requirements pertain only to the list of substances.

2. Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

3. This substance is often called Bis(2-chloroisopropyl) ether, the name Chemical Abstracts Service applies to its noncommercial isomer, Propane, 2,2'-oxybis, 2-chloro- (CAS RN 39638-32-9).

4. Chlordane: This entry includes alpha-chlordane (CAS RN 5103-71-9), beta-chlordane (CAS RN 5103-74-2), gamma-chlordane (CAS RN 5566-34-7), and constituents of chlordane (CAS RN 57-74-9 and CAS RN 12789-03-6).

5. Polychlorinated biphenyls (CAS RN 1336-36-3); this category contains congener chemicals, including constituents of Aroclor 1016 (CAS RN 12674-11-2), Aroclor 1221 (CAS RN 11104-28-2), Aroclor 1232 (CAS RN 11141-16-5), Aroclor 1242 (CAS RN 53469-21-9), Aroclor 1248 (CAS RN 12672-29-6), Aroclor 1254 (CAS RN 11097-69-1), and Aroclor 1260 (CAS RN 11096-82-5).

6. Toxaphene: This entry includes congener chemicals contained in technical toxaphene (CAS RN 8001-35-2), i.e., chlorinated camphene.

7. Xylene (total): This entry includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330-20-7).

*AUTHORITY: section 260.225, RSMo 2016.\* Original rule filed Dec. 11, 1973, effective Dec. 21, 1973. Amended: Filed July 14, 1986, effective Jan. 1, 1987. Amended: Filed Jan. 5, 1987, effective June 1, 1987. Amended: Filed Jan. 29, 1988, effective Aug.*