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**Rules of**  
**Department of Natural Resources**  
**Division 80—Solid Waste Management**  
**Chapter 3—Sanitary Landfill**

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**Title 10—DEPARTMENT OF  
NATURAL RESOURCES  
Division 80—Solid Waste Management  
Chapter 3—Sanitary Landfill**

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

*PURPOSE: This rule pertains to the design and operation of a sanitary landfill.*

*Editor's Note: The secretary of state has determined that the publication of this rule in its entirety would be unduly cumbersome or expensive. The entire text of the material referenced has been filed with the secretary of state. This material may be found at the Office of the Secretary of State or at the headquarters of the agency and is available to any interested person at a cost established by state law.*

(1) General Provisions.

(A) This rule is intended to provide for sanitary landfill area 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 sanitary landfills will protect the public health, prevent nuisances and meet applicable environmental standards. The requirement subsections contained in this rule delineate minimum levels of performance required of any sanitary landfill operation. The satisfactory compliance subsections are presented as the authorized methods by which the objectives of the requirements can be realized. The satisfactory compliance subsections are based on the practice of sanitary landfilling municipal solid waste. If techniques other than those listed as satisfactory compliance in design or operation are used, it is the obligation of the sanitary 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 to meet objectives of the requirement subsections, the department may require changes in design or operation as the condition warrants.

(B) Owners/operators of sanitary landfills that close after October 9, 1991 and prior to October 9, 1993, and do not apply the final cover and establish vegetation on the sanitary landfill within one hundred eighty (180) days of last receipt of waste, or an alternative time

frame negotiated with the department, are subject to all the requirements of this rule.

(C) Sanitary landfills not in compliance with the requirements of this chapter and of 10 CSR 80-2 are considered to be open dumps, which are prohibited by state law.

(2) Solid Waste Accepted.

(A) Requirement. Only the following solid wastes shall be accepted for disposal in a sanitary landfill: municipal waste; bulky waste; demolition and construction wastes; brush and wood wastes; cut, chipped or shredded tires as defined in 10 CSR 80-8; soil; rock; concrete; related inert solids relatively insoluble in water; and incinerator and air pollution control residues generated from facilities exempted under 10 CSR 80-2.020(9)(A)2.

(B) Satisfactory Compliance—Design. The plans shall specify the types of waste to be accepted for disposal at a sanitary landfill.

(C) Satisfactory Compliance—Operations.

1. Certain bulky solid wastes, such as automobile bodies and furniture shall be crushed on solid ground and then pushed onto the working face near the bottom of the cell. Other bulky items, such as demolition wastes, tree stumps and large timbers shall be pushed onto the working face near the bottom of the cell. Bulky waste shall be excluded from the first layer of waste placed above a composite liner to ensure that the integrity of the liner and leachate collection system has been maintained.

2. Dead animals shall be placed on the working face with other municipal solid wastes and covered immediately with solid waste or soil.

3. The disposal of special wastes which have been approved in the construction permit shall be conducted in accordance with the approved design and operating plans plus any additional procedures determined by the department as necessary to protect the environment.

4. For the disposal of special wastes not specifically approved in the construction permit, a special waste disposal request form shall be completed by the generator of the waste and the operator of the sanitary landfill prior to acceptance and disposal of the waste. The completed request shall be retained in the sanitary landfill operating record. Neither a permit modification nor prior approval is required unless deemed necessary by the department due to the characteristics of the special waste.

(3) Solid Waste Excluded.

(A) Requirement. The following are excluded from disposal:

1. Regulated quantities of hazardous waste;

2. Radioactive materials as follows:

A. The tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content as defined in the Atomic Energy Act of 1954, 42 U.S.C. section 2014(e)(2)(1996);

B. Any radioactively-contaminated material used in or resulting from the cleanup of radioactively-contaminated sites;

C. Any byproduct, source or special nuclear material regulated by the Atomic Energy Act of 1954;

D. Radioactive material used in or resulting from medical processes or liquid radioactive material, unless the material has a half-life of less than thirty (30) days;

E. Naturally Occurring Radioactive Material (NORM) except with prior written approval from the Missouri Department of Natural Resources;

F. Any accelerator-produced radioisotopes, unless the material has a half-life of less than thirty (30) days;

G. 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 greater than ten (10) items from any single source;

H. "Low-level radioactive waste" as defined in section 260.700, RSMo as radioactive waste that is not classified as high-level radioactive waste and that is class A, B, or C low-level radioactive waste as defined in 10 CFR 61.55, as that section existed on January 26, 1983. "Low-level radioactive waste" or "waste" does not include any such radioactive waste that is owned or generated by the United States Department of Energy; by the United States Navy as a result of the decommissioning of its vessels, or as a result of any research, development, testing or production of any atomic weapon; and

I. Any greater-than-class-C radioactive waste;

3. Explosives;

4. Regulated quantities of polychlorinated biphenyls (PCBs);

5. Bulk liquids;

6. Highly flammable or volatile substances;

7. Septic tank pumpings;

8. Major appliances;

9. Waste oil;

10. Lead-acid batteries;

11. Waste tires as provided by 10 CSR 80-8.020;

12. Yard waste; and

13. Infectious waste as provided by 10 CSR 80-7.010.

(B) Satisfactory Compliance—Design.

1. In consultation with the department, the applicant shall determine what wastes are to be accepted and shall identify them in the plan and the application for a construction permit. The criteria used to determine whether the waste can be accepted shall include the design of the landfill, the physical and chemical characteristics of the wastes, the quantity of the wastes, and the proposed operating procedures.

2. The plans shall specify the operating procedures for screening and removal of wastes which are excluded from disposal according to subsection (3)(A) of this rule. Operating procedures for the screening and removal of excluded wastes shall include:

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

B. Records of any inspections;

C. Training of facility personnel to recognize unacceptable wastes; and

D. Immediate notification of the department if a regulated hazardous waste, regulated PCB waste, or infectious waste is discovered at the facility.

(C) Satisfactory Compliance—Operations.

1. A sign with the following wording shall be displayed prominently at the site entrance. "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, waste tires as provided by 10 CSR 80-8, yard waste, explosives and regulated infectious waste are excluded from disposal."

2. The operating procedures for screening of wastes and for removal of wastes which are excluded from disposal according to subsection (3)(A) of this rule shall be implemented.

3. Bulk or noncontainerized liquid waste shall not be 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 derived from the sanitary landfill, and the sanitary landfill is designed with a composite liner and leachate collection system as described in sections (9) and (10). The owner/operator of sanitary landfill conducting recirculation shall submit a request for

departmental approval to recirculate leachate or gas condensate.

4. Containers holding liquid waste may not be placed in a sanitary landfill unless—

A. The container is a small container similar in size to that normally found in household waste; or

B. The waste is household waste.

(4) Site Selection.

(A) Requirement. Site selection and utilization shall include a study and evaluation of geologic and hydrologic conditions and soils at the proposed sanitary landfill and an evaluation of the environmental effect upon the projected use of the completed sanitary landfill. Owners/operators shall document compliance with all applicable siting restrictions and shall submit this documentation to the department by April 9, 1994, for existing sanitary landfills or prior to receiving a construction permit for sanitary landfills permitted after January 1, 1996. Any existing sanitary landfill that cannot demonstrate compliance with paragraphs (4)(B)1. through (4)(B)6. must close by October 9, 1996.

(B) Satisfactory Compliance—Design.

1. Airport safety.

A. Owners/operators of sanitary landfills operating after October 9, 1993, 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 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. Owners/operators of sanitary landfills, operating after October 9, 1993, located in one hundred (100)-year floodplains shall demonstrate to the department that the sanitary 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 public health or the environment.

3. Wetlands.

A. Sanitary landfills permitted after October 9, 1993, and unfilled surfaces of existing sanitary landfills shall not be located in wetlands, unless the owner/operator can make 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 sanitary 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 sanitary landfill will not cause or contribute to significant degradation of wetlands. The owner/operator shall demonstrate the integrity of the sanitary landfill and its ability to protect ecological resources by addressing the following factors:

(a) Erosion, stability and migration potential of native wetland soils, mounds 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 (4)(B)3.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 (4)(B)3. 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.

4. Sanitary landfills permitted after October 9, 1993, and unfilled surfaces of existing sanitary 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 public health and the environment.

5. Sanitary landfills permitted after October 9, 1993, and unfilled surfaces of existing sanitary 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. Owners/operators of sanitary landfills, operating after October 9, 1993, located in an unstable area shall demonstrate to the department that the sanitary landfill's design ensures that the integrity of the structural components of the sanitary 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. Plans shall include:

A. A map showing initial and proposed topographies at contour intervals of five feet (5') or less. This map shall have 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;

B. A map showing the land use and zoning within one-fourth (1/4) mile of the sanitary landfill including location of all residences, buildings, wells, water courses,

springs, lakes, rock outcroppings, caves, sinkholes and soil or rock borings. All electric, gas, water, sewer and other utility easements or lines that are located on, under or over the sanitary landfill shall be shown on the map. This map shall have a scale of not less than one inch (1") equals four hundred feet (400');

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

(I) Structures. It is not recommended practice to construct major structures within the permitted area of a closed sanitary landfill. If major structures are to be built within the permitted area of a closed sanitary landfill, prior written approval from the department is required. A professional engineer shall approve their design and construction, including provision for protection against potential hazards of solid waste decomposition gases; and

(II) Other uses. Appropriate design, construction and operating provisions for the sanitary landfill shall be specified to complement the projected future use; and

D. An evaluation of the characteristics and quantity of available on-site soil with respect to its suitability for sanitary landfilling operations. The engineering properties and quantity estimates of the on-site soil shall be discussed and shall include:

(I) 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 or the procedures described in Appendix D of *Engineer Manual 1110-2-1906*, prepared by the United States Army Corps of Engineers;

(II) 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 D4318-84 or the procedures described in Appendix III of *Engineer Manual 1110-2-1906*, prepared by the United States Army Corps of Engineers;

(III) Hydraulic conductivity. Laboratory hydraulic conductivity tests shall be performed upon undisturbed representative soil samples using a flexible wall permeameter (ASTM D-5084). 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 *in situ* slug or pump tests which isolate the geologic unit of interest; and

(IV) Area extent and depth. The area extent and depth of soil suitable for landfill construction shall be determined. Variations in soil depth shall be clearly described.

8. If the base of the landfill liner will be in contact with groundwater, the applicant shall demonstrate to the department's satisfaction that the groundwater will not adversely impact the liner.

(C) Satisfactory Compliance—Operations.

1. The sanitary landfill shall be accessible to vehicles which the sanitary landfill is designed to serve by all-weather roads leading from the public road system; temporary roads shall be provided as needed to deliver wastes to the working face.

2. The sanitary landfill shall not be located in an area where the public roads or access roads to the sanitary landfill may be flooded preventing use of the sanitary landfill unless an alternate sanitary landfill is available.

(5) Design.

(A) Requirement. Plans, addendums, as-built drawings, or other documents which describe the design, construction, operation, or closure of a sanitary landfill or which request an operating permit modification for the sanitary landfill shall be prepared or approved by a professional engineer. These documents shall be stamped or sealed by the professional engineer and submitted to the department for review and approval.

(B) Satisfactory Compliance—Design.

1. Plans submitted as part of an application for a construction permit after the effective date of this rule shall provide for the maintenance of a 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 remedial actions.

2. The plan shall include an operating manual describing the various tasks that shall be performed during a typical shift.

3. Owners/operators of sanitary landfills shall demonstrate how adverse geologic and hydrologic conditions may be altered or compensated for via surface water drainage diversion, underdrains, sumps, and other structural components. All alterations of the site shall be detailed in the plans.

A. Precipitation, evapotranspiration and climatological conditions shall be considered in site selection and design.

B. Engineering plans and specifications that have computer models attached to them shall list the limitations and assumptions of each model used in the application.

4. Plans shall include stability analyses for all stages of landfill construction.

A. Settlement and bearing capacity analysis shall be performed on the in-place foundation material beneath the disposal area. The effect of foundation material settlement on the liner and leachate collection system shall be evaluated.

B. Stability analysis shall be performed on all liner and leachate system components.

C. Leachate collection pipe material and drainage media shall be analyzed to demonstrate that these components possess structural strength to support maximum loads imposed by overlying waste materials and equipment.

D. Waste mass stability analysis shall be performed on the disposal area at final waste grade conditions and at intermediate slope conditions.

E. Stability analysis shall be performed on all final cover system components, including an evaluation of the effect of waste settlement on the final cover system components, side-slope liner system components, surface water management system components and gas migration system components.

(C) Satisfactory Compliance—Operations.

1. Construction and operation of the sanitary landfill shall be conducted in accordance with the engineering plans and specifications approved by the department.

2. The operating manual describing the various tasks that shall be performed during a typical shift shall be available to employees for reference and to the department upon request.

3. Phase development drawings shall be included with the application.

(6) Quality Assurance/Quality Control (qa/qc).

(A) Requirement. The construction, operation and closure of the sanitary landfill shall include quality assurance and quality control measures to ensure compliance with approved plans and all applicable federal, state and local requirements. The permittee shall be responsible for ensuring that the quality assurance/quality control supervision is conducted by a qualified professional.

(B) Satisfactory Compliance—Design.

1. Plans shall include:

A. A detailed description of the qa/qc testing procedures that will be used for every major phase of construction. The description must include at a minimum, the frequency of

inspections, field testing, laboratory testing, equipment to be utilized, the limits for test failure, and a description of the procedures to be used upon test failure;

B. A detailed procedure for the reporting and recording of qa/qc activities and testing results; and

C. Continuous visual classification of borrow soil during landfill construction by qualified qa/qc inspector(s) or certifying professional engineer.

2. All qa/qc reports shall be reviewed and approved by a professional engineer.

(C) Satisfactory Compliance—Operations.

1. At a minimum qa/qc testing shall include:

A. 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;

B. Laboratory hydraulic conductivity testing of the soil used for liner construction once for every five thousand (5,000) cubic yards of liner constructed;

C. Continuous visual classification of borrow soil during landfill construction by qualified qa/qc inspector(s) or certifying professional engineer;

D. 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.

(I) Landfill liner. Measuring the elevations of the top and bottom of the landfill liner.

(II) Final cover. Measuring the elevations of the top and bottom of—

(a) The compacted clay layer supporting the geomembrane liner; and

(b) The soil layer supporting vegetative growth;

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

F. Random destructive testing of the seams 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 seams; and

G. Verification of the thickness of the leachate collection media by qualified qa/qc inspector(s) or certifying professional engineer on one hundred-foot (100') centers.

2. All testing shall be performed under the direction of qualified qa/qc inspectors for every major phase of construction.

3. The qa/qc plan shall provide 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 (10) 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 the minimum design specifications;

(II) Evidence that field construction techniques are resulting in the minimum design specifications (for example, soil density tests);

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

(IV) Oversight of the liner construction and qa/qc procedures by a professional engineer. This shall include reports prepared, or approved, by the professional engineer transmitting the results of the qa/qc procedures and stating that the liner was constructed according to design or describing any deviations from the design.

(7) Survey Control.

(A) Requirement. Benchmarks, horizontal controls and boundary markers shall be established by a land surveyor to check and mark the location and elevations of the sanitary landfill. Construction stakes marking an individual section(s) or phase(s) shall be established as necessary to ensure the construction and operation proceed in accordance with approved plans.

(B) Satisfactory Compliance—Design.

1. Boundary survey. A survey of the entire permitted acreage shall be conducted in accordance with the current Minimum Standards for Property Boundary Surveys 10 CSR 30-2.010.

2. Vertical control. The land surveyor shall establish a permanent monument as a benchmark or confirm the prior establishment of a benchmark on or adjacent to the property. The elevation shall be on the North American Vertical Datum, 1929 or similar well documented datum. If no such established datum exists within one (1) mile of the property, a project datum may be assigned to the benchmark. The benchmark shall be clearly shown on the survey plat.

3. Horizontal control. The land surveyor shall establish three (3) permanent monuments as horizontal control stations. These

stations shall form a triangle whose sides shall not be less than one thousand feet (1000'). The location of the horizontal control will be shown on the survey plat.

4. The land surveyor shall establish boundary markers designating the entire permitted acreage which shall be composed of material which will last throughout the life of the sanitary landfill.

5. Construction stakes. Stakes marking the individual section(s) or phase(s) specifically designated for the placement of solid waste are to be placed in locations and composed of material that is consistent with the operating life of the section or phase.

(C) Satisfactory Compliance—Operations.

1. All boundary markers, benchmarks, horizontal control stations and construction stakes shall be clearly marked and identified.

2. Missing or displaced benchmarks or horizontal control stations shall be replaced or reestablished by or under the supervision of a land surveyor. The registered surveyor shall prepare a plat showing the replacement or reestablishment and furnish a copy to the department.

3. Missing or displaced construction stakes shall be replaced or reestablished as necessary to ensure the operations proceed in accordance with approved plans.

4. The permanent monuments designating vertical and horizontal control stations and boundary markers designating the entire permitted acreage shall be placed prior to receiving an operating permit as required by 10 CSR 80-2.020(2)(B).

5. Construction stakes marking the active area shall be placed prior to deposition of waste in individual areas, sections or phases of the sanitary landfill as designated by the approved engineering plans.

(8) Water Quality.

(A) Requirement. The location, design, construction and operation of the sanitary landfill shall minimize environmental hazards and shall conform to applicable ground and surface water quality standards and requirements. Applicable standards are federal, state or local standards and requirements that are legally enforceable.

(B) Satisfactory Compliance—Design.

1. Plans shall include:

A. A report on the detailed geologic and hydrologic investigation of the site as required by 10 CSR 80-2.015.

B. Current and projected use of water resources in the potential zone of influence of the sanitary landfill;

C. Groundwater elevation and proposed separation between the lowest point of

the lowest cell and the predicted maximum water table elevation;

D. Potential interrelationship of the sanitary landfill, local aquifers and surface waters based on historical records or other sources of information;

E. Proposed location and design of observation wells, sampling stations and testing program planned; and

F. Provisions for surface water runoff control to minimize infiltration and erosion of cover. All applicable permits and approvals necessary to comply with requirements of the Missouri Clean Water Law and corresponding rules shall be obtained from the department.

(I) The area of the watershed which will be affected by the sanitary landfill shall be specified.

(II) On-site drainage structures and channels shall be designed to prevent flow onto the active portion of the sanitary landfill during peak discharge from at least a twenty-five (25)-year storm. The engineering calculations and assumptions shall be included and explained in the engineering report.

(III) On-site drainage structures and channels shall be designed to collect and control at least the water volume resulting from a twenty-four (24)-hour, twenty-five (25)-year storm.

(IV) On-site drainage and channels shall be designed to empty expeditiously after storms to maintain the design capacity of the system.

(V) Contingency plans for on-site management of surface water which comes in contact with solid waste shall be specified.

(C) Satisfactory Compliance—Operations.

1. Surface water courses and runoff shall be diverted from the sanitary landfill (especially from the working face) by devices such as ditches, berms, and proper grading. The sanitary landfill shall be constructed and graded so as to promote rapid surface water runoff without excessive erosion. Regrading shall be done as required during construction and after completion to avoid ponding of precipitation and to maintain cover integrity.

2. The quantity of water coming in contact with solid waste shall be minimized by the daily operational practices. Water which comes in contact with solid waste shall be managed as leachate in accordance with the approved plans.

(9) Leachate Collection System.

(A) Requirement. A leachate collection system shall be designed, constructed, maintained and operated to collect and remove leachate from the sanitary landfill.

(B) Satisfactory Compliance—Design. The potential for leachate generation shall be evaluated in determining the design of the system. Leachate flow quantities shall be estimated and the method(s) of leachate treatment and disposal shall be outlined. Leachate storage and treatment facilities shall comply with all currently applicable requirements of the Missouri Clean Water Law and corresponding rules. Construction quality assurance/quality control (qa/qc) procedures shall be included. Where a leachate treatment system is designed to have a discharge to the waters of the state, any required discharge permit(s) shall be obtained from the department in accordance with requirements of the Missouri Clean Water Law and corresponding rules.

1. 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. Construction material chemically resistant to the waste managed in the sanitary landfill and the leachate expected to be generated;

C. Construction materials of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying solid wastes, cover, leachate, and by any equipment used at the sanitary landfill;

D. Design and operate systems to function without clogging through the scheduled operating life, closure and post-closure of the sanitary landfill;

E. Design and operate systems to maintain less than one foot (1') depth of leachate over the disposal area liner; and

F. Design and operate systems so that any leachate formed will flow by gravity into collection areas from which the leachate can be removed, treated, and disposed.

2. Leachate management by recirculation within the permitted fill area shall be conducted in accordance with an approved engineering method.

3. Any leachate collection system open to the atmosphere must be designed to prevent discharge during a twenty-five (25)-year, twenty-four (24)-hour storm event. Plans shall include the calculations detailing the design.

4. The applicant shall provide a method of leachate management in the application. A secondary or "backup" method of leachate disposal will be required unless the applicant can demonstrate that a secondary method will not be necessary.

(C) Satisfactory Compliance—Operations.

1. The leachate collection systems specified by subsection (9)(B) shall be properly installed and operated in accordance with the permit and the approved design and plans and maintained for the thirty (30)-year post-closure care period, or as long as the department determines necessary.

2. Leachate generated by the sanitary landfill shall be controlled on-site and not be allowed to discharge off the sanitary landfill property or discharge into the waters of the state, except in accordance with the approved plans and the Missouri Clean Water Law and corresponding rules.

(10) Liner System.

(A) Requirement. A liner shall be placed on all surfaces to minimize the migration of leachate from the sanitary landfill.

(B) Satisfactory Compliance—Design. A composite liner shall be installed at all landfills permitted after October 9, 1993, and existing landfills with uncovered surfaces, as determined by the department on a site-by-site basis, that consists of two (2) components—

1. An upper component that shall consist of a minimum thirty (30) mil thick geomembrane. Geomembrane components consisting of high density polyethylene (HDPE) shall be at least sixty (60) mil thick;

2. A lower component that shall consist of a least a two foot (2')-layer of compacted soil with a hydraulic conductivity of no more than  $1 \times 10^{-7}$  cm/sec. A compacted soil liner at a minimum shall be constructed of six to eight-inch (6–8") lifts, compacted to ninety-five percent (95%) of standard Proctor density with the moisture content between optimum moisture content and four percent (4%) above the optimum moisture content, or within other ranges of density and moisture that are shown to provide for the liner to have a hydraulic conductivity no more than  $1 \times 10^{-7}$  cm/sec. The design shall include a detailed explanation of the construction techniques and equipment necessary to achieve ninety-five percent (95%) of the standard Proctor density under field conditions. The design also shall include qa/qc procedures to be followed during construction of the liner. The composite liner shall be protected from the adverse effects of desiccation or freeze/thaw cycles after construction, but prior to placement of waste. Traffic shall be routed so as to minimize the detrimental impact on the constructed liner prior to placement of waste. The soils used for this purpose shall meet the following minimum specifications:

A. Be classified under the Unified Soil Classification Systems as CL, CH, or SC (ASTM Test D2487-85);

B. Allow more than thirty percent (30%) passage through a No. 200 sieve (ASTM Test D1140);

C. Have a liquid limit equal to or greater than twenty (20) (ASTM Test D4318-84);

D. Have a plasticity index equal to or greater than ten (10) (ASTM Test D4318-84); and

E. Have a coefficient of permeability equal to or less than  $1 \times 10^{-7}$  cm/sec when compacted to ninety-five percent (95%) of standard Proctor density with the moisture content between optimum moisture content and four percent (4%) above the optimum moisture content, when tested by using (ASTM D-5084) a flexible wall permeameter or other procedures approved by the department;

3. The geomembrane component shall be installed in direct and uniform contact with the compacted soil component so as to minimize the migration of leachate through the geomembrane should a break occur; and

4. All solid waste disposal areas shall have a minimum bottom slope in any direction of flow of at least one percent (1%).

(C) Satisfactory Compliance—Operations.

1. A test pad shall be constructed at the site and tested to verify that the proposed construction and quality control (qc) procedures are adequate to ensure that the soil component of the composite liner system will meet the requirements of (10)(B)2. of this rule.

A. Construction and qc procedures 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 laboratory hydraulic conductivity tests shall be performed on undisturbed samples of the completed test pad;

(II) At least one (1) *in situ* hydraulic conductivity test 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 interlift bonding.

B. If test pad construction and testing shows that the proposed methods are not sufficient to meet the requirements of paragraph (10)(B)2. of this rule, a new test pad shall be constructed using revised procedures approved by the department.

2. For phased construction, only one test pad will be required.

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

A. The report must be approved by the department prior to beginning construction of any portion of the composite liner system in the disposal area.

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

4. The requirement for a test pad may be waived provided—

A. The applicant can demonstrate to the department's satisfaction that construction and qc procedures identical to those described in the approved engineering report have resulted in construction of a liner which meets the requirements of paragraph (10)(B)2. of this rule; and

B. 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 D4318-84);

(II) Allow more than fifty percent (50%) passage through a number 200 sieve (ASTM D1140); and

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

5. The liner specified by subsection (10)(B) of this rule shall be constructed in accordance with the approved design specifications.

(11) Groundwater Monitoring.

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

(B) Satisfactory Compliance—Design.

1. All sanitary landfills permitted after October 9, 1993, shall be in compliance with all of the groundwater monitoring requirements of this section before an operating permit is issued. Existing sanitary landfills shall be in compliance with section (11)—

A. By October 9, 1994, if located less than one (1) mile from a drinking water intake (surface or subsurface);

B. By October 9, 1995, if located between one (1) mile and two (2) miles from a drinking water intake (surface or subsurface); or

C. By October 9, 1996, if located greater than two (2) miles from a drinking water intake (surface or subsurface).

2. The owner/operator of a sanitary landfill shall establish the potential for migration of fluid generated by the sanitary 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 sanitary 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 sanitary landfill.

3. A groundwater monitoring system shall be capable of yielding groundwater samples for analysis and shall consist of—

A. Monitoring wells (at least one (1) installed hydraulically upgradient; that is, in the direction of increasing static head from the sanitary landfill. The numbers, locations and depths shall be sufficient to yield groundwater samples that are—

(I) Representative of background water quality in the groundwater near the sanitary landfill; and

(II) Not affected by the sanitary landfill; and

B. Monitoring wells (at least three (3) installed hydraulically downgradient; that is, in the direction of decreasing hydraulic head from the sanitary landfill. The number, locations and depths shall ensure that they detect any significant amounts of fluids generated by the sanitary landfill that migrate from the sanitary landfill to the groundwater. 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.

4. All monitoring wells shall be constructed as per 10 CSR 23-4.

(C) Satisfactory Compliance—Operations.

1. Groundwater monitoring wells.

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

(I) Aquifer thickness, groundwater flow rate, groundwater flow direction includ-

ing seasonal and temporal fluctuations in groundwater flow; and

(II) 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.

B. 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.

C. All groundwater monitoring wells shall be operational prior to the acceptance of wastes, unless other arrangements are approved by the department.

D. The design, installation, development, and decommissioning of monitoring wells and piezometers must be performed in accordance with 10 CSR 23-4.

2. Sampling and reporting.

A. Each groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells installed in compliance with subsection (11)(B). The owner/operator must submit the sampling and analysis program to the department for approval. The program must include procedures and techniques for—

(I) Monitoring well maintenance;

(II) Monitoring well redevelopment;

(III) Monitoring well depth measurement and hydraulic levels;

(IV) Monitoring well purging and sampling utilizing dedicated equipment;

(V) Equipment calibration;

(VI) Decontamination and field blanks;

(VII) Sample and duplicate sample collection;

(VIII) Sample preservation;

(IX) Sample labeling;

(X) Sample handling;

(XI) Field measurements;

(XII) Field documentation;

(XIII) Chain of custody control;

(XIV) Sample shipment;

(XV) Analytical procedures;

(XVI) Qa/qc control—field and laboratory; and

(XVII) Statistical testing strategy per paragraph (11)(C)5. for each parameter's concentrations.

B. Each groundwater monitoring program shall include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. Analysis shall be performed on unfiltered samples.

C. The sampling procedures and frequency shall be protective of human health and the environment.

D. Groundwater elevations shall be measured in each well immediately prior to purging, each time groundwater is sampled. The owner/operator shall determine the 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.

3. Baseline/background monitoring.

A. The owner/operator shall establish background groundwater quality for each of the monitoring parameters or constituents required under paragraphs (11)(C)4. To establish background, a minimum of four (4) quarterly samples of statistically independent sample data shall be obtained and analyzed from all monitoring wells during a minimum of one (1) year following well installation.

B. The number of samples collected to establish background values for groundwater quality data shall satisfy the requirements of subsection (11)(C) and shall be consistent with the appropriate statistical procedures determined pursuant to paragraph (11)(C)5. The sampling procedures shall be those specified under paragraph (11)(C)4. for detection monitoring, paragraph (11)(C)6. for assessment monitoring and section (12) for corrective action.

4. Detection monitoring.

A. The owner/operator shall obtain and analyze water samples from the groundwater monitoring wells during the months of May and November of each calendar year.

B. The following parameters shall be analyzed each time a sample is obtained:

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

Chlorides (Cl, (mg/l));

Iron (Fe, (mg/l));

pH (units);

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



Total Dissolved Solids (TDS, (mg/l)); and All parameters listed in Appendix 1 of this rule.

Additionally, the water level in each well shall be measured at the time the sample is taken.

C. The sample results, and any results of statistical analysis determining statistically significant increases for any parameter per paragraph (11)(C)5., shall be submitted to the department in one (1) report within ninety (90) days of when samples are collected.

D. 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 sanitary landfill (including closure) and the post-closure period. The department may add additional parameters or delete parameters on a site-by-site basis through an evaluation of waste and leachate characteristics of the sanitary landfill.

E. The electronic submission of groundwater data is required. This submission shall be in the format and method as prescribed by the department.

5. The owner/operator shall specify in the operating record one (1) or more of the following statistical methods to be used in evaluating groundwater monitoring data for each monitoring constituent. The statistical test chosen shall be conducted separately for each constituent:

A. A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The procedure shall include estimation and testing of the contrasts between each downgradient well's mean and the upgradient means for each parameter;

B. An ANOVA based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The procedure shall include estimation and testing of the contrasts between each downgradient well's median and the background medians for each parameter;

C. A confidence interval procedure in which an interval for each parameter in each downgradient well is constructed around the mean/median of the particular well's data or data residuals and compared to the mean/median of pooled background well data;

D. A prediction interval procedure in which an upper prediction limit for an interval for each parameter in each well is compared to subsequently obtained values from the same well;

E. A prediction interval procedure in which an upper prediction limit for an interval for each parameter constructed on the pooled background well data or data residuals is compared to subsequently obtained values from each downgradient well;

F. A tolerance interval procedure in which an upper tolerance limit for an interval for each parameter's pooled background well data is compared to each downgradient well's concentration values;

G. A multicomparison procedure utilizing any recommended U.S. Environmental Protection Agency combinations of intra-well and inter-well procedures for each parameter;

H. A control chart approach, meeting the performance standards of part (11)(C)5.J.(III), that gives control limits for each parameter;

I. A different statistical test method that meets the performance standards of subparagraph (11)(C)5.J. of this rule. The owner/operator must submit the statistical test method to the department for approval before the use of the alternative test;

J. Any statistical method chosen under subparagraph (11)(C)5.J. of this rule shall comply with the following performance standards, as appropriate:

(I) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of the concentration data for the chemical parameters or hazardous constituents. If the distribution of the concentration data for the chemical parameters or hazardous constituents is shown by the owner/operator to be inappropriate for a normal data distribution theory test, then the data should be transformed or a distribution-free (nonparametric) theory test should be used. If the concentration data distributions for the constituents of each well differ, more than one (1) statistical method will be needed;

(II) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentration or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment-wide error rate for each testing period shall be no less than 0.05, however, the Type I error of no less than 0.01 for individual well comparisons shall be maintained. This performance standard does not apply to tolerance intervals, prediction intervals or control charts;

(III) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its

associated parameter values shall be protective of human health and the environment. The selection of this method shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern;

(IV) If a confidence interval, tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, then the level of confidence for each interval, and the percentage of the population that each interval contains, shall be protective of human health and the environment. Selection of one (1) or more of these methods shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern;

(V) The statistical method shall account for data below the limit of detection with one (1) or more statistical procedures that are protective of human health and the environment. Any practical quantization limit that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility; and

(VI) If necessary, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.

6. Response to statistical analysis.

A. If the comparison for the upgradient wells show a statistically significant increase (or pH change) over background, the owner/operator shall submit this information to the department.

B. If the comparisons for downgradient wells show a statistically significant increase (or pH change) over background, the owner/operator shall immediately obtain two (2) additional groundwater samples from each downgradient well where a statistically significant difference was detected. One shall be analyzed by the owner; the other shall be analyzed by the department to determine whether the statistically significant difference was a result of laboratory error.

C. If the additional samples show 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 sanitary landfill caused the contamination or that the statistically significant increase resulted from an error in sampling, analysis, statistical evaluation or natural variation. If

the owner/operator cannot make this demonstration to the department, the owner/operator shall submit a plan to the department for a groundwater assessment monitoring program and implement the program as described in subparagraphs (11)(C)6.D. through J. of this rule. The plan shall specify the following:

(I) The number, location and depth of wells;

(II) Sampling and analytical methods for the monitoring parameters listed in Appendix II of this rule;

(III) Evaluation procedures, including any use of previously gathered groundwater quality information;

(IV) The rate and extent of migration of a contaminant plume in the groundwater; and

(V) The concentrations of the contaminant plume in the groundwater.

D. Within ninety (90) days of beginning an assessment monitoring program, and semiannually after that, the owner/operator shall sample and analyze the groundwater for all constituents identified in Appendix II of this rule. A minimum of one (1) sample from each downgradient well shall be collected and analyzed during the initial sampling event. A minimum of one (1) sample from each downgradient well at which Appendix II constituents were detected shall be collected and analyzed at each subsequent sampling event. For any new constituent detected during assessment monitoring (that was not detected during detection monitoring) in the downgradient wells, a minimum of four (4) statistically independent samples from each well (upgradient and downgradient) shall be collected and analyzed to establish background for the new constituents. The department may add additional parameters or delete parameters on a site-by-site basis through an evaluation of waste and leachate characteristics of the sanitary landfill.

E. The owner/operator shall establish a groundwater protection standard for each constituent specified in Appendix II of this rule and detected in the groundwater. The groundwater protection standard shall be—

(I) For constituents for which a maximum contaminant level (MCL) has been promulgated under section 1412 of the Federal Safe Drinking Water Act and found at 40 CFR part 141, the MCL for that constituent;

(II) For constituents for which MCLs have not been promulgated, the background concentration for the constituent established from wells in accordance with paragraph (11)(C)3. of this rule;

(III) For constituents for which the background level is higher than the MCL

identified in part (11)(C)6.E.(I) of this rule, the background concentration; or

(IV) A level established by the department based upon a consideration of relevant factors, including: multiple contaminants in the groundwater, exposure threats to sensitive environmental receptors, and other site-specific exposure or potential exposure to groundwater.

F. After obtaining the results from the initial or subsequent sampling events required in subparagraph (11)(C)6.D. the owner/operator shall—

(I) Within fourteen (14) days, notify the department and place a notice in the operating record identifying the constituents that have been detected;

(II) Within ninety (90) days, and on at least a semiannual basis after that, resample all wells and conduct analysis for all constituents listed in Appendix I to this rule and for those constituents listed in Appendix II of this rule that are detected in response to the requirements of subparagraph (11)(C)6.D. of this rule. Record the concentrations of each constituent in the facility operating record and notify the department of the constituent concentrations. A minimum of one (1) sample from each well sampled (background and downgradient) shall be collected and analyzed during these sampling events;

(III) Establish background concentrations for any new constituents detected during subsequent monitoring events; and

(IV) Establish groundwater protection standards for all new constituents detected during subsequent monitoring events.

G. If the concentrations of all constituents listed in Appendix II to this rule are shown to be at or below background levels as established in paragraph (11)(C)3. of this rule for two (2) consecutive sampling periods, the owner/operator may reinstate detection monitoring at the sanitary landfill as specified under subparagraph (11)(C)3.C. of this rule.

H. If the concentrations of any constituents listed in Appendix II of this rule are above background values, but all concentrations are below the groundwater protection standard established under subparagraph (11)(C)6.E. of this rule using the statistical procedures in paragraph (11)(C)5. of this rule, 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 measures assessment, or both.

I. If one (1) or more constituents listed in Appendix II of this rule are detected at levels above the groundwater protection stan-

dard as established under subparagraph (11)(C)6.E., the owner/operator shall—

(I) Provide the department with a report assessing potential corrective measures as required under subsection (11)(A);

(II) Characterize the nature and extent of the release by installing additional monitoring wells as necessary; install at least one (1) additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with paragraph (11)(C)6. of this rule 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 as per the implementation of the corrective action program specified in section (12) of this rule.

J. 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.

#### (12) Corrective Action.

##### (A) Assessment of Corrective Measures.

1. Within ninety (90) days of finding that any of the constituents listed in Appendix II of this rule have been detected at a statistically significant level exceeding the groundwater protection standards defined under subparagraph (11)(C)6.E. of this rule, the owner/operator shall initiate an assessment of corrective measures. This assessment shall be completed within a reasonable period of time, and a report describing the assessment of corrective measures shall be submitted to the department.

2. The owner/operator shall continue to monitor in accordance with the assessment monitoring program as specified in subparagraph (11)(C)6.F. of this rule.

3. The assessment shall include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under subsection (12)(B) of this rule, addressing at least the following:

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

B. The time required to begin and complete the remedy;

C. The costs of remedy implementation; and

D. The institutional requirements such as state or local permit requirements or other environmental or public health requirements that may substantially affect implementation of the remedy(ies).

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

(B) Selection of Remedy.

1. Based on the results of the corrective measures assessment conducted under subsection (12)(A) of this rule the owner/operator shall propose a remedy that, at a minimum, meets the standards listed in paragraph (12)(B)2. of this rule. The owner/operator shall submit to the department, within fourteen (14) days of selecting a proposed remedy, a report describing the proposed remedy and shall place a copy of the report in the operating record that describes how the proposed remedy meets the standards in paragraph (12)(B)2. of this rule.

2. Remedies shall—

A. Be protective of the public health and the environment;

B. Attain the groundwater protection standard as specified pursuant to subparagraph (11)(C)6.E. of this rule;

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 II of this rule into the environment that may pose a threat to human health or the environment; and

D. Comply with standards for management of wastes as specified in paragraph (12)(C)4.

3. In proposing a remedy that meets the standards of paragraph (12)(B)2. of this rule, the owner/operator, and, in approving a remedy, the department shall consider the following evaluation factors:

A. The long- and short-term effectiveness and protectiveness of the potential remedy, 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 required, including monitoring, operation and maintenance;

(IV) Short-term risks that might be posed to the community, workers or the environment during implementation of the remedy, including potential threats to human health and the environment associated with

excavation, transportation and redisposal or containment;

(V) Time until full protection is achieved;

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

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

(VIII) Potential need for replacement of the remedy;

B. The effectiveness of the remedy 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 remedy(ies) based on consideration of the following types of factors:

(I) Degree of difficulty associated with constructing the remedy 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 remedy(ies).

4. The owner/operator shall specify as part of the proposed remedy a schedule(s) for initiating and completing remedial activities. This schedule shall require the initiation of remedial activities within a reasonable period of time taking into consideration the factors set forth in subparagraphs (12)(D)4.A. through H. of this rule. The owner/operator shall consider the following factors in determining, and the department will consider the following factors in approving, the schedule of remedial activities:

A. Extent and nature of contamination;

B. Practical capabilities of remedial technologies in achieving compliance with groundwater protection standards established under subparagraph (11)(C)6.E. of this rule and other objectives of the remedy;

C. Availability of treatment or disposal capacity for wastes managed during implementation of the remedy;

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 remedy;

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 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 II of this rule from a sanitary 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 a sanitary landfill and those substances are present in concentrations such that cleanup of the release from the sanitary 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 (12)(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 Program.

1. Based on the schedule established under paragraph (12)(B)4. of this rule for initiation and completion of remedial activities the owner/operator shall—

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

(I) At a minimum, meets the requirements of an assessment monitoring program under paragraph (11)(C)6. of this rule;

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

(III) Demonstrates compliance with groundwater protection standard pursuant to subparagraph (11)(C)6.E. of this rule.

B. Implement the corrective action remedy selected under subsection (12)(B) of this rule; and

C. Take any interim measures necessary, any measures determined to be necessary by the department, or both, to ensure the protection of human health and the environment. Interim measures shall, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to subsection (12)(B) of this rule. The following factors shall be considered by an owner/operator, and will be considered by the department, in determining whether interim measures are necessary:

(I) Time required 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 remedial action is not initiated expeditiously;

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

(VI) Risks of fire or 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 remedy has begun or other information, that compliance with requirements of paragraph (12)(B)2. of this rule are not being achieved through the remedy 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 (12)(C)3. of this rule.

3. If the department determines that compliance with requirements under paragraph (12)(B)2. of this rule 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 with the requirements under paragraph (12)(B)2. cannot be practically achieved with any currently available methods;

B. Implement alternative measures to control exposure of humans or the environment to residual contamination, as necessary to protect human health and the environment;

C. Implement alternative measures 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 remedy; and

D. Submit a report to the department justifying the alternative measures. The alternative measures must be approved by the department prior to implementation.

4. All solid wastes that are managed pursuant to a remedy required under subsection (12)(C) or an interim measure required under subparagraph (12)(C)1.C. of this rule, shall be managed in a manner—

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

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

5. Remedies selected pursuant to subsection (12)(B) of this rule shall be considered complete when—

A. The owner/operator complies with the groundwater protection standards established under subparagraph (11)(C)6.E. of this rule at all points within the plume of contamination;

B. Compliance with the groundwater protection standards established under subparagraph (11)(C)6.E. of this rule has been achieved by demonstrating that concentra-

tions of all constituents listed in Appendix II of this rule have not exceeded the groundwater protection standard(s) for a period of three (3) consecutive years using the statistical procedures and performance standards in subsection (11)(C). The department may specify an alternative length of time during which the owner/operator shall demonstrate that concentrations of all constituents listed in Appendix II 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 remedy have been completed.

6. Upon completion of the remedy, the owner/operator shall submit a certification to the department within fourteen (14) days after the remedy has been completed in compliance with the requirements of paragraph (12)(C)5. 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 determines that the corrective action remedy has been completed in accordance with the requirements under paragraph (12)(C)5. of this rule, the owner/operator shall be released from the requirements for financial assurance for corrective action under 10 CSR 80-2.030(4)(C).

(13) Air Quality.

(A) Requirement. The design, construction and operation of the sanitary landfill shall minimize environmental hazards and shall conform to applicable ambient air quality and source control regulations.

(B) Satisfactory Compliance—Design. Plans shall include an effective dust control program.

(C) Satisfactory Compliance—Operations. Burning of solid waste shall be prohibited. A burning permit or exemption may be obtained from the department permitting the burning of tree trunks, tree limbs, vegetation and untreated waste lumber. In areas operating under exemption certificates authorized by Chapter 643, RSMo approval shall be

obtained from the local pollution control agency. The operating procedures and location for burning practices shall be submitted to the department for review and written approval. Burning at the sanitary landfill shall be conducted in accordance with Chapter 643, RSMo, the corresponding rules, the terms conditions, or both, of the plans, permit, or both, and all local requirements.

(14) Gas Control.

(A) Requirement. Decomposition gases generated within the sanitary landfill shall be controlled on-site, as necessary, to avoid posing a hazard to the environment or to public health and the safety of occupants of adjacent property.

(B) Satisfactory Compliance—Design.

1. Plans shall contain a monitoring program capable of detecting decomposition gas migration.

A. The monitoring program must specify the type of monitoring and be based on—

- (I) Soil conditions;
- (II) The hydrogeologic and topographic conditions surrounding the facility; and
- (III) The location of facility structures, property boundaries, and off-site features.

B. The monitoring program described in the plans must include:

- (I) A written description of the monitoring system, including spacing of monitoring locations and frequency of monitoring;
- (II) The results of any gas assessment that has been performed;
- (III) The location of all gas monitoring wells shown on a plan sheet;
- (IV) A drawing detailing the typical gas monitoring well design;
- (V) The design depths and bottom elevations of the gas monitoring wells; and
- (VI) Boring logs that support the design gas monitoring well depths.

C. The gas monitoring specified in the plans shall be performed at gas monitoring wells. The monitoring program shall specify how buildings on the landfill property are to be monitored. Gas monitoring wells shall be designed to monitor the unsaturated soil and rock down to an elevation equal to the bottom elevation of the landfill. Gas monitoring wells shall be placed between the landfill and off-site buildings and other features that may be harmed by landfill gas or may easily transmit gas from the landfill. Gas monitoring well locations at the property boundary shall not be more than five hundred feet (500') apart unless the permittee can

show that the potential for gas migration is low.

2. Plans shall assess the need for gas control and indicate the location and design of any vents, barriers or other control measure to be provided.

A. The gas control system shall be constructed of materials that are chemically resistant to the solid wastes managed in the sanitary landfill and the gas expected to be generated. These materials shall be specified in the engineering report and the choice of materials justified.

B. The gas control system shall be constructed of materials that are of sufficient strength and thickness to prevent collapse under the pressures exerted by overlying solid wastes, cover and by any equipment used at the sanitary landfill. Overburden pressure calculations, material specifications and system installation procedures shall be included in the engineering report.

C. Maintenance and repair options shall be considered in the design and specified in the engineering report.

D. All applicable permits and approvals necessary to comply with the requirements of the Air Conservation Law and rules promulgated shall be obtained from the department.

E. The plan shall estimate the maximum anticipated rate of gas generation at the disposal area and the length of time over which it is anticipated to be generated. The method by which these calculations are arrived at shall also be included.

(C) Satisfactory Compliance—Operations.

1. Decomposition gases shall not be allowed to migrate laterally from the sanitary landfill to endanger public health and safety or to pose a hazard to the environment. They shall be controlled on-site, flared or vented to the atmosphere directly through the cover, cut-off trenches or ventilation systems in a way that they do not accumulate in explosive or toxic concentrations, especially within structures. (Information on the limits of flammability of gases is available in such references as the *Handbook of Chemistry and Physics*, 68th ed. Cleveland, Chemical Rubber Publishing Co., 1987.)

2. Decomposition gases shall not be allowed to concentrate above the following levels:

A. Twenty-five percent (25%) of the lower explosive limit (LEL) or one and one-quarter percent (1.25%) by volume for methane in buildings on the sanitary landfill property; and

B. Fifty percent (50%) of the LEL or two and one-half percent (2.5%) by volume

for methane in the soil at the property boundary of the sanitary landfill.

3. For purposes of this section, lower explosive limit (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.

4. Owners/operators of all sanitary landfills shall implement a methane monitoring program capable of detecting decomposition gas migration in the most likely zone(s) of migration, to ensure that the standards of paragraph (14)(C)2. of this rule are met. Methane monitoring shall be conducted at least quarterly with equipment warranted by the manufacturer to detect explosive gases under the conditions the equipment is to be used. Facilities shall submit the results of this methane monitoring to the department at least quarterly. The electronic submission of methane monitoring data is required. This submission shall be in a format and manner as prescribed by the department.

5. If methane gas levels exceeding the limits specified in paragraph (14)(C)2. of this rule are detected, the owner/operator shall—

A. Notify the department and immediately take all necessary steps to ensure protection of public health and safety which include:

(I) When results of monitoring in on-site or off-site structures indicate levels in excess of those specified, the operator shall take appropriate action to mitigate the effects of landfill gas accumulation in those structures until a permanent remediation is completed. Actions which must be undertaken include:

(a) Notification of the fire department or other appropriate local public safety authorities;

(b) Notification of adjacent property owners and/or occupants;

(c) Ventilation of any confined spaces that may trap decomposition gases or the installation of alarm systems in any confined spaces that may trap decomposition gases; and

(d) Establishment of a temporary methane monitoring program in affected structures.

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

C. Within sixty (60) days of detection, submit to the department for approval a remediation plan designed by a professional engineer for the methane gas releases. A gas control system shall be designed to—

(I) Prevent methane accumulation in on-site and off-site buildings;

(II) Reduce methane concentrations at monitored property boundaries to below compliance levels; and

(III) Reduce methane concentrations off-site to below compliance levels;

D. Landfill gas corrective action plans shall describe the nature and extent of the problem and the proposed remedy. The plan shall be implemented upon departmental approval; and

E. The department may establish alternative schedules for demonstrating compliance with subparagraphs (14)(C)5.B. and C. of this rule.

6. The sanitary landfill shall operate in compliance with all applicable requirements of Chapter 643, RSMo and corresponding rules.

(15) Vectors.

(A) Requirements. Conditions shall be maintained that are unfavorable for the harboring, feeding and breeding of vectors.

(B) Satisfactory Compliance—Design. Plans shall include contingency programs for vector control and the operator shall be prepared at all times to implement those procedures.

(C) Satisfactory Compliance—Operations. Vector control contingency programs shall be implemented when necessary to prevent or rectify vector problems.

(16) Aesthetics.

(A) Requirement. The sanitary landfill shall be designed and operated at all times in an aesthetically acceptable manner.

(B) Satisfactory Compliance—Design. Plans shall include an effective litter control facility and operating program.

(C) Satisfactory Compliance—Operations.

1. Portable litter fences or other devices shall be used in the immediate vicinity of the working face and at other appropriate locations to control blowing litter. At the end of each operating day, or more often as required, litter shall be removed from the fences and the ground and incorporated into the cell being used. Alternatively, the litter may be containerized for disposal on the next operating day.

2. Solid wastes that are easily moved by wind shall be covered, as necessary, to prevent becoming airborne and scattered.

3. On-site vegetation should be cleared only as necessary. Natural windbreaks, such as green belts, should be maintained where they will improve the appearance and operation of the sanitary landfill.

4. Salvage operations shall be conducted in such a manner as to not detract from the appearance of the sanitary landfill. Salvaged materials shall be removed from the sanitary landfill daily or stored in aesthetically acceptable containers or enclosures.

(17) Cover.

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

(B) Satisfactory Compliance—Design. The owner/operator shall prepare a written closure plan that describes the steps necessary to close all sanitary landfill phases at any point during the active life of the sanitary landfill in accordance with the requirements of 10 CSR 80-2.030(4)(A). In addition, the final cover requirements specified in the closure and post-closure plans shall specify—

1. Cover sources, quantities and soil classification (Unified Soil Classification System or United States Department of Agriculture classification system);

2. The capability of the cover to perform the functions listed in subsection (17)(A) of this rule;

3. Surface grades and side slopes needed to promote maximum runoff, without excessive erosion, to minimize infiltration. Final side slopes shall not 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.

4. Procedures to establish and maintain vegetative growth to combat erosion and improve appearance of idle and completed areas. Procedures shall include seeding rate, fertilizer rate, soil conditioning rate and provisions for mulching;

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

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

7. The final slope of the top of the sanitary landfill shall have a minimum slope of five percent (5%); and

8. Shear failure analyses shall be included 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.

(C) Satisfactory Compliance—Operations.

1. Cover shall be applied by the end of each operating day regardless of weather; sources of cover, therefore, shall be accessible on all operating days. The thickness of the compacted cover shall not be less than six inches (6"). Sanitary landfills operating twenty-four (24) hours per day shall incorporate all solid waste into one (1) or more cells at least every twenty-four (24) hours. Where a liner and leachate collection system are in place, an alternative daily cover may be approved by the department on a site-specific basis, if the owner/operator demonstrates that the alternative material controls run-on, runoff, disease vectors, fires, odors, blowing litter and scavenging without presenting a threat to human health and the environment.

2. Cover shall be increased to a total thickness of at least one foot (1') of compacted cover on filled areas of the sanitary landfill which are idle for more than sixty (60) days.

3. No active, intermediate or final slope shall exceed thirty-three and one-third percent (33 1/3%).

4. As each phase of the sanitary landfill is completed, a final cover system shall be installed at portions of—

A. Existing sanitary landfills without composite liners. This final cover shall consist of at least two feet (2') of compacted clay 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;

B. Sanitary landfills with composite liners. This final cover shall consist of component layers, in order from top to bottom, as follows:

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

(II) A drainage layer;

(III) A geomembrane liner at least as thick as the geomembrane liner described in subparagraph (10)(B)1.G.;

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

C. The geomembrane liner shall be in intimate contact with the underlying compacted clay.

5. The installation of the final cover systems shall include provisions for slope stability.

6. 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 paragraph (17)(C)3. of this rule.

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

8. Vegetation shall be established within one hundred eighty (180) days of application of the cover required by paragraphs (17)(C)2. and 3. of this rule. Vegetation shall be established and maintained to minimize erosion and surface water infiltration.

9. Regrading and recovering shall be performed as necessary to maintain cover slope and integrity.

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

11. The compacted clay portion of the final cover shall consist of soils classified under the Unified Soil Classification System as CH, CL, ML, SC or MH.

(18) Compaction.

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

(B) Satisfactory Compliance—Design.

1. Arrangements shall be made and indicated in the plans where substitute equipment will be available to provide uninterrupted service during routine maintenance periods or equipment breakdowns.

2. The plans shall specify the equipment that should be available to conduct the sanitary landfill operation at the projected solid waste loading.

(C) Satisfactory Compliance—Operations.

1. Solid waste handling equipment, on any operating day shall be capable of performing and shall perform the following functions:

A. Spread the solid wastes to be compacted in layers no more than two feet (2') thick, while confining it to the smallest practicable area;

B. Compact the spread solid wastes to the smallest practicable volume; and

C. Place, spread and compact the cover as much as practicable.

2. A preventive maintenance program should be employed to maintain equipment in operating order.

3. No solid waste shall be disposed of in water where the presence of the water will prohibit the proper spreading and compaction of the solid waste or where a mosquito breeding problem would be created.

(19) Safety.

(A) Requirement. The sanitary landfill shall be designed, constructed and operated in a manner so as to protect the health and

safety of personnel and others associated with and affected by the operation.

(B) Satisfactory Compliance—Design.

1. Provisions shall be included in the plans to control and limit access to the sanitary landfill in a manner that is compatible with the surrounding land use.

2. Provisions shall be included in the plans to control dust for safety purposes and to prevent a nuisance to the surrounding area.

3. The plans shall specify the facilities and methods to be provided for extinguishing fires.

(C) Satisfactory Compliance—Operation.

1. A fire extinguisher shall be provided on all solid waste handling equipment.

2. Any fires in wastes being delivered to the sanitary landfill or which occur at the working face or within equipment or personnel facilities shall be extinguished.

3. Adequate communications equipment shall be available at the sanitary landfill for emergency situations.

4. Scavenging shall be prohibited at all times to avoid injury and to prevent interference with sanitary landfill operations.

5. Access to the sanitary landfill shall be controlled and shall be by established roadways only. The sanitary landfill shall be accessible only when operating personnel are on duty. Large containers may be placed at the sanitary landfill entrance so that users can conveniently deposit solid waste after hours. The containers and the areas around them shall be maintained in a sanitary and litter-free condition.

6. Traffic signs or markers should be provided to promote an orderly traffic pattern to and from the discharge area and, if necessary, to restrict access to hazardous areas or to maintain efficient operating conditions. Drivers of manually discharging vehicles should not hinder operation of mechanically discharging vehicles. Vehicles should not be left unattended at the working face or along traffic routes. If a regular user persistently poses a safety hazard, s/he should be barred from the sanitary landfill.

7. Dust control provisions shall be utilized as necessary for safety purposes and to prevent a nuisance to the surrounding area.

(20) Records.

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

(B) Satisfactory Compliance—Design. Plans shall prescribe methods to be used in maintaining records and monitoring the environmental impact of the sanitary landfill.

Information on recording and monitoring requirements may be obtained from the department.

(C) Satisfactory Compliance—Operations.

1. Records shall be maintained at the landfill office. Records five (5) years old or older may be stored at an alternate site if approved by the department; such stored records must be made available at the landfill upon request of department personnel. Records must cover at least the following:

A. Major operational problems, complaints or difficulties;

B. Gas monitoring results from monitoring and any remediation plans required under section (14) of this rule;

C. Any demonstration, certification, finding, monitoring, testing or analytical data required under sections (4) and (11) of this rule;

D. Vector control efforts;

E. Dust and litter control efforts;

F. Quantitative measurements of the solid waste handled and an estimate of the air space left at the facility. Every two (2) years after the date of the permit issuance and within sixty (60) days of the anniversary date of the permit issuance, the owner/operator shall submit to the department two (2) copies of a topographic map, prepared under the direction of a land surveyor or by aerial photography, showing the current horizontal and vertical boundaries of solid waste in the sanitary landfill and the boundaries of the sanitary landfill. Maps prepared by aerial photography shall meet the current National Map Accuracy Standards for Photogrammetry as indicated in United States Bureau of the Budget "Circular A-16 Exhibit C," dated October 10, 1958;

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

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

I. Closure and post-closure care plans and any monitoring, testing or analytical data as required under 10 CSR 80-2.030(4)(A);

J. Any cost estimates and financial assurance documentation required under 10 CSR 80-2.030(4)(B) and (C);

K. Inspection records and training procedures as required under 10 CSR 80-2.060 and subsection (3)(B) of this rule;

L. Records associated with fees as required under 10 CSR 80-2.080(2);

M. Records associated with corrective measures as required under section (10) of this rule; and

N. Effective January 1, 1998, 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. The landfill operator shall keep a detailed report of the origin of all waste received.

2. Upon closing of the sanitary landfill, the existence of the sanitary landfill shall be recorded with the recorder(s) of deeds in the county(ies) where the sanitary landfill is located. The owner/operator may request permission from the department to remove the notation from the deed if all wastes are removed from the facility.

A. A survey and plat meeting the requirements of the current Minimum Standards of Property Boundary Survey 10 CSR 30-2.010 and detailed description of the sanitary landfill shall be prepared by a land surveyor. The survey plat and detailed description, at a minimum, shall contain the following information:

(I) The name of the property owner as it appears on the property deed;

(II) The detailed description of the property;

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

(IV) The location of any leachate control, gas control or water monitoring systems which shall be maintained after closure and the length of time that these systems are to be maintained.

B. The owner/operator shall obtain approval from the department of the survey plat and detailed description prior to filing with the county recorder of deeds. After receiving approval from the department and before filing with the county recorder of deeds, the detailed description shall be notarized by a lawful notary public. Filing the notarized plat or detailed description shall be accomplished within thirty (30) days of departmental approval. Two (2) copies of the notarized and properly recorded plat or detailed description showing the recorder of deeds' seal or stamp, the book and page numbers and the date of filing shall be submitted to the department within thirty (30) days of the date of filing.

C. Owners of solid waste disposal areas permitted prior to January 1, 1987, and which close after January 1, 1989, as a part of closure of the solid waste disposal area shall—

(I) Execute an easement with the department, which allows the department, its agents or its contractors to enter the premises to complete work specified in the closure plan, to monitor or maintain the solid waste disposal area or take remedial action during post-closure period; and

(II) Submit evidence to the department that a notice and covenant running with the land has been recorded with the recorder of deeds in the county where the sanitary landfill is located. The notice and covenant shall specify the following:

(a) That the property has been permitted as a sanitary landfill; and

(b) That use of the land in any manner which interferes with closure plans, and post-closure plans filed with the department, is prohibited.

*AUTHORITY: section 260.225, RSMo Supp. 1997.\* 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. 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.*

*\*Original authority 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 rev-*

*enue sharing funds may also be expended for such purposes.*

#### Appendix I—Constituents for Detection Monitoring

##### Inorganic Constituents

Ammonia (NH<sub>3</sub> as N, mg/l)  
Antimony (Sb, µg/l)  
Arsenic (As, µg/l)  
Barium (Ba, µg/l)  
Beryllium (Be, µg/l)  
Boron (B, µg/l)  
Cadmium (Cd, µg/l)  
Calcium (Ca, mg/l)  
Chromium (Cr, µg/l)  
Cobalt (Co, µg/l)  
Copper (Cu, µg/l)  
Fluoride (F, mg/l)  
Hardness (calculated, mg/l)  
Lead (Pb, µg/l)  
Magnesium (Mg, mg/l)  
Manganese (Mn, µg/l)  
Mercury (Hg, µg/l)  
Nickel (Ni, mg/l)  
Nitrate/Nitrite (NO<sub>3</sub>/NO<sub>2</sub>, mg/l)  
Phosphorus (total P, mg/l)  
Selenium (Se, µg/l)  
Silver (Ag, µg/l)  
Sodium (Na, mg/l)  
Sulfate (SO<sub>4</sub>, mg/l)  
Thallium (Tl, µg/l)  
Total Organic Carbon (TOC, 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	gamma-BHC; Lindane	58-89-9	Dichlorodifluoromethane; CFC 12;	75-71-8
trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene	Bis(2-chloroethoxy)methane	111-91-1	1,1-Dichloroethane; Ethylidene chloride	75-34-3
1,2-Dichloropropane; Propylene dichloride	Bis(2-chloroethyl) ether; Dichloroethyl ether	111-44-4	1,2-Dichloroethane; Ethylene dichloride	107-06-2
cis-1,3-Dichloropropene	Bis(2-chloro-1-methylethyl) ether; 2,2'-Dichlorodiisopropyl ether; DCIP	108-60-1	1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	75-35-4
trans-1,3-Dichloropropene	Bis(2-ethylhexyl) phthalate	See Note 3	cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2
Ethylbenzene	Bromochloromethane; Chlorobromomethane	117-81-7	trans-1,2-Dichloroethylene	156-60-5
2-Hexanone; Methyl butyl ketone	Bromodichloromethane; Dibromochloromethane	74-97-5	trans-1,2-Dichloroethene	120-83-2
Methyl bromide; Bromomethane	Bromoform; Tribromomethane	75-27-4	2,4-Dichlorophenol	87-65-0
Methyl chloride; Chloromethane	4-Bromophenylphenyl ether	75-25-2	2,6-Dichlorophenol	78-87-5
Methylene bromide; Dibromomethane	Butyl benzyl phthalate; Benzyl butyl phthalate	101-55-3	1,2-Dichloropropane; Propylene dichloride	142-28-9
Methylene chloride; Dichloromethane	Butyl benzyl phthalate	85-68-7	1,3-Dichloropropane; Trimethylene dichloride	594-20-7
Methyl ethyl ketone; MEK; 2-Butanone	Cadmium (Total)		2,2-Dichloropropane; Isopropylidene chloride	563-58-6
Methyl iodide; Iodomethane	Cadmium	75-15-0	1,1-Dichloropropene	10061-01-5
4-Methyl-2-pentanone; Methyl isobutyl ketone	Carbon disulfide	56-23-5	cis-1,3-Dichloropropene	10061-02-6
Styrene	Carbon tetrachloride	See Note 4.	trans-1,3-Dichloropropene	60-57-1
1,1,1,2-Tetrachloroethane	Chlordane	106-47-8	Dieldrin	84-66-2
1,1,2,2-Tetrachloroethane	p-Chloroaniline	108-90-7	Diethyl phthalate	297-97-2
Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	Chlorobenzene	510-15-6	O,O-Diethyl O-2-pyrazinyl phosphorothioate; Thionazin	60-51-5
Toluene	Chlorobenzilate	59-50-7	Dimethoate	60-11-7
1,1,1-Trichloroethane; Methylchloroform	p-Chloro-m-cresol; 4-Chloro-3-methylphenol	75-00-3	p-(Dimethylamino)azobenzen	57-97-6
1,1,2-Trichloroethane	Chloroethane; Ethyl chloride	67-66-3	7,12-Dimethylbenz[a]anthracene	119-93-7
Trichloroethylene; Trichloroethene	Chloroform; Trichloromethane	91-58-7	3,3'-Dimethylbenzidine	105-67-9
Tichlorofluoromethane; CFC-11	2-Chloronaphthalene	95-57-8	2,4-Dimethylphenol; m-Xylenol	131-11-3
1,2,3-Trichloropropane	2-Chlorophenol	7005-72-3	Dimethyl phthalate	99-65-0
Vinyl acetate	4-Chlorophenyl phenyl ether	126-99-8	m-Dinitrobenzene	4,6-Dinitro-o-cresol
Vinyl chloride	Chloroprene	(Total)	4,6-Dinitro-2-methylphenol	534-52-1
Xylenes	Chromium (Total)		2,4-Dinitrophenol;	51-28-5

**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	m-Cresol; 3-methylphenol	108-39-4	2,4-Dinitrotoluene
Acenaphthylene	208-96-8	o-Cresol; 2-methylphenol	95-48-7	2,6-Dinitrotoluene
Acetone	67-64-1	p-Cresol; 4-methylphenol	106-44-5	Dinoseb; DNBP;
Acetonitrile; Methyl cyanide	75-05-8	Cyanide	57-12-5	2-sec-Butyl-4,6-dinitrophenol
Acetophenone	98-86-2	2,4-D; 2,4-Dichlorophenoxyacetic acid	94-75-7	Di-n-octyl phthalate
2-Acetylaminofluorene; 2-AAF	53-96-3	4,4'-DDD	72-54-8	Diphenylamine
Acrolein	107-02-8	4,4'-DDE	72-55-9	Disulfoton
Acrylonitrile	107-13-1	4,4'-DDT	50-29-3	Endosulfan I
Aldrin	309-00-2	Diallate	2303-16-4	Endosulfan II
Allyl chloride	107-05-1	Dibenz[a,h]anthracene	53-70-3	Endosulfan sulfate
4-Aminobiphenyl	192-67-1	Dibenzofuran	132-64-9	Endrin
Anthracene	120-12-7	Dibromochloromethane; Chlorodibromomethane	124-48-1	Endrin aldehyde
Antimony	(Total)	1,2-Dibromo-3-chloropropane; DBCP	96-12-8	Ethylbenzene
Arsenic	(Total)	1,2-Dibromoethane; Ethylene dibromide; EDB	106-93-4	Ethyl methacrylate
Barium	(Total)	Di-n-butyl phthalate	84-74-2	Ethyl methanesulfonate
Benzene	71-43-2	o-Dichlorobenzene;		Famphur
Benzo[a]anthracene; Benzanthracene	56-55-3	1,3-Dichlorobenzene	95-50-1	Fluoranthene
Benzo[b]fluoranthene	205-99-2	m-Dichlorobenzene;		Fluorene
Benzo[k]fluoranthene	207-08-9	1,3-Dichlorobenzene	541-73-1	Heptachlor
Benzo[ghi]perylene	191-24-2	p-Dichlorobenzene;		Heptachlor epoxide
Benzo[a]pyrene	50-32-8	1,4-Dichlorobenzene	106-46-7	Hexachlorobenzene
Benzyl alcohol	100-51-6	3,3'-Dichlorobenzidine	91-94-1	Hexachlorobutadiene
Beryllium	(Total)	trans-1,4-Dichloro-2-butene	110-57-6	Hexachlorocyclopentadiene
alpha-BHC	319-84-6			Hexachloroethane
beta-BHC	319-85-7			Hexachloropropene
delta-BHC	319-86-8			

2-Hexanone; Methyl butyl ketone	591-78-6	Propionitrile; Ethyl cyanide	107-12-0	(CAS RN 12674-11-2), Aroclor 1221 (CAS
Indeno(1,2,3-cd)pyrene	193-39-5	Pyrene	129-00-0	RN 11104-28-2), Aroclor 1232 (CAS RN
Isobutyl alcohol	78-83-1	Safrole	94-59-7	11141-16-5), Aroclor 1242 (CAS RN 53469-
Isodrin	465-73-6	Selenium	(Total)	21-9), Aroclor 1248 (CAS RN 12672-29-6),
Isophorone	78-59-1	Silver	(Total)	Aroclor 1254 (CAS RN 11097-69-1), and
Isosafrole	120-58-1	Silvex; 2,4,5-TP	93-72-1	Aroclor 1260 (CAS RN 11096-82-5).
Kepone	143-50-0	Styrene	100-42-5	
Lead	(Total)	Sulfide	18496-25-8	6. Toxaphene: This entry includes congener
Mercury	(Total)	2,4,5-T;		chemicals contained in technical toxaphene
Methacrylonitrile	126-98-7	2,4,5-Trichlorophenoxyacetic acid	93-76-5	(CAS RN 8001-35-2), i.e., chlorinated cam-
Methapyrilene	91-80-5	1,2,4,5-Tetrachlorobenzene	95-94-3	phene.
Methoxychlor	72-43-5	1,1,1,2-Tetrachloroethane	630-20-6	7. Xylene (total): This entry includes o-
Methyl bromide; Bromomethane	74-83-9	1,1,2,2-Tetrachloroethane	79-34-5	xylene (CAS RN 96-47-6), m-xylene (CAS
Methyl chloride; Chloromethane	74-87-3	Tetrachloroethylene; Tetra-		RN 108-38-3), p-xylene (CAS RN 106-42-3),
3-Methylcholanthrene	56-49-5	chloroethene; Perchloroethylene	127-18-4	and unspecified xylenes (dimethylbenzenes)
Methyl ethyl ketone; MEK;		2,3,4,6-Tetrachlorophenol	58-90-2	(CAS RN 1330-20-7).
2-Butanone	78-93-3	Thallium	(Total)	
Methyl iodide; Iodomethane	74-88-4	Tin	(Total)	
Methyl methacrylate	80-62-6	Toluene	108-88-3	
Methyl methanesulfonate	66-27-3	o-Toluidine	95-53-4	
2-Methylnaphthalene	91-57-6	Toxaphene	See Note 6.	<b>10 CSR 80-3.011 Design and Operation</b>
Methyl parathion; Parathion		1,2,4-Trichlorobenzene	120-82-1	<i>Emergency rule filed Sept. 29, 1993, effective</i>
methyl	298-00-0	1,1,1-Trichloroethane;		<i>Oct. 9, 1993, expired Feb. 5, 1994. Emer-</i>
4-Methyl-2-pentanone;		Methylchloroform	71-55-6	<i>gency rule filed Jan. 28, 1994, effective Feb.</i>
Methyl isobutyl ketone	108-10-1	1,1,2-Trichloroethane	79-00-5	<i>7, 1994, expired June 6, 1994.</i>
Methylene bromide; Dibromomethane	74-95-3	Trichloroethylene; Trichloroethene	79-01-6	
Methylene chloride;		Trichlorofluoromethane; CFC-11	75-69-4	
Dichloromethane	75-09-2	2,4,5-Trichlorophenol	95-95-4	
Naphthalene	91-20-3	2,4,6-Trichlorophenol	88-06-2	
1,4-Naphthoquinone	130-15-4	1,2,3-Trichloropropane	96-18-4	
1-Naphthylamine	134-32-7	0,0,0-Triethyl phosphorothioate	126-68-1	
2-Naphthylamine	91-59-8	sym-Trinitrobenzene	99-35-4	
Nickel	(Total)	Vanadium	(Total)	
o-Nitroaniline; 2-Nitroaniline	88-74-4	Vinyl acetate	108-05-4	
m-Nitroaniline; 3-Nitroaniline	99-09-2	Vinyl chloride; Chloroethene	75-01-4	
p-Nitroaniline; 4-Nitroaniline	100-01-6	Xylene (total)	See Note 7.	
Nitrobenzene	98-95-3	Zinc	(Total)	
o-Nitrophenol; 2-Nitrophenol	88-75-5			
p-Nitrophenol; 4-Nitrophenol	100-02-7			
N-Nitrosodi-n-butylamine	924-16-3			
N-Nitrosodiethylamine	55-18-5			
N-Nitrosodimethylamine	62-75-9			
N-Nitrosodiphenylamine	86-30-6			
N-Nitrosodipropylamine;				
N-nitroso-N-dipropylamine				
Di-n-propylnitrosamine	621-64-7			
N-Nitrosomethylethylamine	10595-95-6			
N-Nitrosopiperidine	100-75-4			
N-Nitrosopyrrolidine	930-55-2			
5-Nitro-o-toluidine	99-55-8			
Parathion	56-38-2			
Pentachlorobenzene	608-93-5			
Pentachloronitrobenzene	82-68-8			
Pentachlorophenol	87-86-5			
Phenacetin	62-44-2			
Phenanthrene	85-01-8			
Phenol	108-95-2			
p-Phenylenediamine	106-50-3			
Phorate	298-02-2			
Polychlorinated biphenyls; PCBs;	See Note 5.			
Aroclors				
Pronamide	23950-58-5			

#### 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; synonym sexist 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