7035.2815 MIXED MUNICIPAL SOLID WASTE LAND DISPOSAL FACILITIES.

Subpart 1. **Scope.** The requirements of subparts 2 to 16 apply to landowners and owners and operators of facilities that dispose of mixed municipal solid waste in or on the land, except as provided in part 7035.2525, subpart 2.

Subp. 2. **Location.** Land disposal facilities must be located in accordance with items A to C and part 7035.2555:

A. A facility must be located only in an area where:

(1) the topography, geology, and ground water conditions allow the facility to be designed, operated, constructed, and maintained in a manner that minimizes environmental impacts;

(2) ground water flow paths and variations in soil or bedrock conditions are known in sufficient detail to enable reliable tracking of pollutant movement in the event of a release from the facility;

(3) it is feasible to construct a monitoring system with sufficient monitoring points to assure that pollutants can be detected and tracked in the event of a release from the facility; and

(4) in the event of a release from a facility, pollutants can be contained and corrective actions taken to prevent adverse impacts on water supplies and to return the facility to compliance with ground water and surface water quality standards.

B. Unless the owner or operator provides an engineered secondary containment system, a facility cannot be located in an area where the hydrologic or topographic conditions would allow rapid or unpredictable pollutant migration, impair the long-term integrity of the facility, or preclude reliable monitoring. The additional engineering must be approved by the commissioner and must consist of at least:

(1) a second liner with a collection system between the two liners;

(2) an in-place, operational ground water containment and treatment or disposal system that can be activated immediately if ground water pollution is detected; or

(3) another method of secondary containment backing up the liner providing additional protection equivalent to subitem (1) or (2) and backing up the cover system.

C. A land disposal facility must not be located on a site where:

(1) there are karst features, such as sinkholes, solution channels, disappearing streams, and caves, which may cause failures of the leachate management system or prevent effective monitoring or containment of a release of leachate;

(2) there are other unstable soil or bedrock conditions that may cause failures of the leachate management system; or

(3) an airport runway used or scheduled for use by turbojet aircraft is located within 10,000 feet of the waste boundary, or an airport runway used or scheduled for use by piston type aircraft only is located within 5,000 feet of the waste boundary, unless approval is obtained from the Federal Aviation Administration.

Subp. 3. **Hydrogeologic evaluation.** The owner or operator must complete a hydrogeologic evaluation in accordance with items A to I.

A. The owner or operator of a mixed municipal solid waste land disposal facility must investigate and define the hydrogeologic conditions at the facility. The hydrogeologic evaluation is required to obtain or retain a facility permit, and must be included in the application for a permit under parts 7001.3275, 7001.3300, and 7001.3475. The owner or operator must provide updates and revisions to the hydrogeologic evaluation as needed to clarify and define changes in the hydrogeologic conditions.

The owner or operator may use previous data and field installations to help fulfill the hydrogeologic evaluation requirements. If the commissioner determines that portions of this previous work are reliable, well-documented, and comparable in information content, they may be substituted for the corresponding type and number of work items required in this subpart.

B. The hydrogeologic evaluation must be conducted in phases, in which the work done under each of the items E to I makes use of the results of the work required under the preceding items.

(1) Before conducting each phase, the owner or operator shall submit for the commissioner's approval a detailed description of the work proposed for that phase and a report of the findings from the previous phase, accompanied by documentation of information sources and methods and procedures used, boring and monitoring point logs, test data, and sample calculations. The commissioner may require additional work plans, if necessary, to enable review between successive stages of field and laboratory investigations.

(2) Soil and rock samples must be retained for at least 90 days after submittal of the report containing the boring logs.

C. The owner or operator must define the hydrogeologic conditions within at least the following areas:

(1) beneath the waste fill area and leachate management system;

(2) sufficient distances beyond the waste fill area and leachate management system, based on the directions and rates of ground water flow, to define the soil and ground water conditions that would control pollutant migration from the facility;

(3) within areas in which corrective actions would be implemented to contain, recover, or treat leachate or polluted ground water; and

(4) within the following vertical zones:

(a) the unsaturated zone;

(b) any perched saturated zone;

(c) the zone of continuous saturation, from the water table, through the uppermost aquifer, the next aquifer below it, and any intervening units;

(d) for facilities that have affected ground water quality to a depth greater than that given in unit (c), the zone of continuous saturation, from the water table to and including both the lowest affected aquifer and the next aquifer below it. As used in this item, the lowest affected aquifer means the lowest aquifer in which one or more pollutants originating from the facility exceed the intervention limits or alternative intervention limits under subpart 4; and

(e) any additional aquifers used locally as major sources of water supply.

The commissioner may approve a minimum depth shallower than required in subitem (4) if there is little likelihood that ground water pollutants originating from the facility will migrate below this designated level.

D. Where drilling methods, testing methods, minimum quantities or depths, and reporting requirements are specified in items E to I, the owner or operator may propose alternative procedures if subsurface conditions indicate a need for these procedures. The commissioner may approve or require changes from the requirements in items E to I for good cause, including cases where:

(1) subsurface conditions are shown to be uniform, or the requirements are otherwise unnecessary or excessive for site conditions;

(2) a requirement is infeasible for a particular site or hydrogeologic condition;

(3) an alternative procedure would produce more or better information or would reduce the chance of pollutant migration between connecting aquifers; or

(4) the required procedures are insufficient to produce the information required in item G.

In all cases, alternative procedures are acceptable only if the subsurface conditions are thoroughly defined and the uncertainty of monitoring and corrective action is not increased.

E. In the first phase of the hydrogeologic evaluation, the available published and unpublished information about the facility site and surrounding area must be evaluated. The

report for this phase must include at least the following information wherever it is available or can be developed from available sources:

(1) A description of previous investigations of the site and surrounding area, and a discussion of the reliability and completeness of this information.

(2) Descriptions, maps, and aerial photographs depicting the site and surrounding area's geologic history, stratigraphic sequence, soils, topography, vegetation, climate, surface water hydrology, area water usage, regional hydrogeologic setting, ground water occurrence at the site, aquifers and aquitards, hydrogeologic parameters such as transmissivity and storage coefficient, recharge and discharge areas, rates and directions of ground water movement, and water quality.

(3) One or more geologic columns or sections.

(4) Cross-sections, oriented along and perpendicular to the directions of ground water flow.

(5) An inventory and a plan map of all active, unused, and abandoned wells within one mile of the facility, and of high-capacity wells and community water supply wells within three miles of the facility. The inventory must include well logs and all other available information on well construction, water levels, and well usage, and it must be based on thorough reviews of state and local collections of water well logs and, if required by the commissioner, interviews or surveys of well owners. The commissioner may require interviews and surveys of well owners if needed well logs are not available through other sources.

(6) For existing facilities, preliminary evaluations of the adequacy of the water monitoring system; the monitoring points' compliance with chapter 4725, Department of Health Water Well Construction Code; and the water quality monitoring data.

F. In the second phase of the hydrogeologic evaluation, the owner or operator must evaluate in detail the distribution and properties of the earth materials underlying the site and the ground water conditions beneath the site.

(1) The investigation must be sufficient to identify the soil and bedrock units beneath the site, delineate their areal and vertical extent, determine their water transmitting properties, identify perched saturated zones, define vertical and horizontal components of ground water flow, predict pollutant movement in the event of releases from the facility, and provide the information needed for the report under item G.

(2) The work plan required for this phase must describe the methods and quality control measures to be used in drilling, logging, piezometer installation, boring and piezometer abandonment, and soils, bedrock, and ground water testing; and the hydrogeologic basis for the investigation, including specific subsurface conditions the investigations are likely to encounter and will seek to define. The work plan must describe

the planned numbers, locations, depths and sequence of borings, test pits, geophysical or other measurements, sampling sites, and testing sites.

(3) Sufficient soil borings must be done to define the soil and bedrock conditions within the areas required in item C. The initial drilling must include borings positioned throughout the site; within each geomorphic feature including ridges, knolls, depressions, and drainage swales; and within any geophysical anomalies already identified. The minimum required number of borings for this initial drilling is as follows:

Size of Site	**Number of Borings**
0-10 acres	15
10-20	Add one boring per additional acre
20	25
20-40	Add one boring per additional two acres
40	35
more than 40	Add one boring per additional four acres

Additional borings, geophysical investigations, or both must be done, where needed, to delineate the thickness, extent, and properties of the soil and bedrock units identified in the initial drilling. The commissioner may require test pits for examination of the near-surface soils. In bedrock, the commissioner shall require core samples if necessary to identify the stratigraphic position of the uppermost bedrock or to determine the water-bearing and water-transmitting properties of the bedrock.

(4) Soil borings must comply with chapter 4725 and must not create pathways for pollutant migration. They must be permanently sealed using the procedures given in parts 4725.2700 to 4725.3100. Except where the soil boring is converted to an active piezometer or monitoring point or where the Minnesota Department of Health approves alternative methods, soil and bedrock borings must be sealed with grout, bentonite, or other impermeable material in a manner that minimizes the potential for future pollutant movement along the borehole.

(5) Soil samples must be collected using procedures conforming to American Society for Testing and Materials (ASTM) standards D1586 (split-barrel), D1587 (thin-walled tube), D3550 (ring-lined barrel), or equivalent methods approved by the commissioner. Within each boring, soil samples must be collected at maximum five-foot intervals and at changes in soil type distinguishable through changes in drilling characteristics, examination of cuttings, or other means. At least one boring per ten acres of proposed waste fill must be continuously sampled below the elevation of the base of the fill. Wherever necessary to determine detailed stratigraphy, the commissioner shall require smaller intervals between samples, additional continuously-sampled borings, borehole

geophysical logging, or other procedures. Samples must be preserved and transported in accordance with ASTM standard D4220.

(6) The soils and bedrock must be described and classified using information from field drilling observations, any geophysical logs, and laboratory examination and testing. Soil descriptions must include textural classification, primary and secondary structures, voids, and other properties that may affect soils correlations and influence pollutant movement. Rock cores or samples must be described and classified using accepted geologic classification systems and nomenclature.

(7) Based on the descriptions and testing required in subitems (6), (8), and (9), the soils and bedrock must be classified and, to the extent feasible, correlated over the site.

(8) For each soil unit identified on the site, a series of soil samples from different borings and elevations within the unit must be laboratory-tested. The owner or operator must develop a procedure and supporting rationale to select samples for this testing that are representative of the unit or are critically located within the unit. Together with the in-field testing required in subitem (9), the laboratory testing must determine the water-bearing and water-transmitting properties including, as appropriate, particle size distribution, porosity, vertical permeability, and clay mineral content or cation exchange capacity. Samples must not be combined into composites for classification or testing. Samples used to test permeability must not be compacted, and disturbance of samples must be minimized. Testing and quality assurance must conform with methods approved by the American Society for Testing and Materials or other standard methods.

(9) A program to determine in-place permeabilities must be developed including criteria for the placement of test wells or piezometers. Test locations must be at or adjacent to logged borings and must be suitably distributed to characterize the variation in the permeabilities of soil or bedrock units.

(10) Ground water flow conditions must be defined in detail within the zone specified in item C. A series of piezometers complying with subpart 10, item R, must be installed to map hydraulic head within this zone. The range of fluctuation in hydraulic head must be determined through historical records and a series of on-site measurements over time, unless the commissioner approves alternative methods to estimate the importance of fluctuations. The effects of pumping from high-capacity wells must be evaluated.

(11) Logs of all soil and bedrock borings must be submitted to the commissioner. The soil and bedrock logs must contain the information generated under subitems (3) to (8) and a scale drawing of the soil types encountered. At a minimum, the logs must contain the following: date of the boring; name and address of the driller and testing firm; drilling and sampling methods; surveyed elevation of the ground surface above mean sea level; surveyed location referenced to permanent benchmarks; soil and

rock classifications and narrative descriptions, contacts between strata or units, sample depths, blow counts, and test data; observations during drilling; water level measurements; any geophysical logs; and sealing procedures.

(12) The well inventory, plan map, and supporting information required under item E, subitem (5), must be field-checked and updated to include all wells within the prescribed distances. Owners of structures or facilities that may have wells must be contacted directly to supplement the information previously obtained.

G. The report for the second phase of the hydrogeologic evaluation must contain at least the following information generated under item F:

(1) logs developed under item F, subitem (11), for borings and under subpart 10, items O to R, for piezometers and monitoring wells;

(2) descriptions of the soil and bedrock units and of the properties that may influence water movement including:

(a) texture and classification;

(b) particle size distributions;

(c) mineral composition, cementation, and soil structure;

(d) geologic structure, including strike, dip, folding, faulting, and jointing;

(e) permeabilities, including vertical permeabilities, and porosity; and

(f) lenses and other discontinuous units, voids, solution openings, layering, fractures, other heterogeneity, and the scale or frequency of this heterogeneity;

(3) one or more detailed geologic columns;

(4) descriptions of the hydrologic units within the saturated zone, including their thicknesses; hydraulic properties; the role and effect of each as an aquifer, aquitard, or perched saturated zone; and the actual or potential use of the aquifers as water supplies;

(5) plan-view maps and a series of cross-sections, spaced no more than 500 feet apart, oriented at a minimum in directions parallel to and perpendicular to the predominant directions of ground water flow, and showing the areal and vertical extent of the soil and bedrock units, the position of the water table, measured values of hydraulic head, equipotential lines and inferred ground water streamlines, soil or bedrock borings, locations and construction of piezometers and monitoring points, and locations of any geophysical measurements used to prepare the cross-sections;

(6) description and evaluation of the ground water flow system, specifically addressing the following components and discussing their significance with respect to ground water and pollutant movement:

(a) local, intermediate, and regional flow systems;

(b) ground water recharge and discharge areas, interactions of ground water with perennial or intermittent surface waters, and how the facility affects recharge rates;

(c) existing or proposed ground water and surface water withdrawals;

(d) the effect of heterogeneity, fractures, or directional differences in permeability on ground water movement;

(e) directions of ground water movement including vertical components of flow, specific discharge rates, and average linear velocities within the hydrologic units described in subitem (4); and

(f) seasonal or other temporal fluctuations in hydraulic head;

(7) an analysis of potential impacts on ground water quality, surface water quality, and water users in the event of a release from the facility including projected paths and rates of movement of both water-soluble and low-solubility components of leachate; and

(8) if mathematical or analog models are used to simulate ground water flow or contaminant migration, the report must thoroughly describe the model and its capabilities and limitations, state all assumptions or approximations made in using the model, identify quantities or values derived from the model that are not confirmed by direct measurement, and evaluate the reliability and accuracy of the results.

H. In the third phase of the hydrogeologic evaluation, the water monitoring system must be designed and installed based on the information obtained under items E to G. The monitoring system must comply with the requirements of subpart 10.

(1) The work plan for this phase must include:

(a) a description of the proposed monitoring system; monitoring point locations, design, and installation procedures; and a thorough evaluation of the suitability of any existing monitoring points proposed for inclusion in the monitoring system, including any deficiencies with respect to the requirements of subpart 10;

(b) an explanation of how the proposed monitoring system addresses the hydrogeologic conditions identified under items E to G; and

(c) a preliminary version of the monitoring protocol required under subpart 14.

(2) The report for this phase must include:

(a) the monitoring point construction and installation records required under subpart 10, items O to S;

(b) a description of any changes from the locations, design, and installation procedures identified in the work plan; and

(c) an evaluation of any differences from previously reported soils and bedrock conditions, water levels, or ground water flow conditions.

I. In the fourth phase of the hydrogeologic evaluation, water quality information must be collected from the monitoring system and interpreted. Water quality monitoring must comply with the requirements of subpart 14.

(1) The work plan for this phase must include the proposed monitoring protocol required in subpart 14; schedule of background or initial sampling dates; proposed analytical constituents and measurements; and methods of data analysis and interpretation.

(2) The report for this phase must contain the monitoring and quality assurance data, analysis of water quality trends, and identification of constituents that exceed ground water performance standards of subpart 4 or surface water quality standards of chapter 7050.

Subp. 4. **Ground water performance standards.** The owner or operator must design, construct, operate, and maintain the facility to achieve compliance with items A to J.

A. A compliance boundary must be established at each facility in accordance with items B and C. If the conditions in item D or E apply, a lower compliance boundary and surface water compliance boundary may also be established. Ground water quality must comply with items E, F, and H at the locations given in item F. If an intervention limit established under items E, F, and H is exceeded in ground water at any location, the owner or operator must take the actions specified in item G.

B. The owner or operator must propose the locations of the compliance boundary. The owner or operator shall submit the proposed locations to the commissioner for review and approval, together with the rationale for the selected locations, supporting information, and any additional information the commissioner may require to describe the locations of the boundaries in the facility permit.

C. The compliance boundary must be established in accordance with subitems (1) and (2).

(1) The compliance boundary must surround the waste fill area and leachate management system. It must be located on the facility property, with a sufficient setback from the property boundary to enable the installation of monitoring points and, if necessary,

ground water control features. The following factors shall also be considered in establishing the location of the compliance boundary:

(a) hydrogeologic factors, including attenuation and dilution characteristics; ground water quantity, quality, flow rates, and flow directions; and anticipated rates and directions of pollutant movement;

(b) the feasibility of ground water monitoring at the compliance boundary;

(c) the feasibility of corrective actions to maintain compliance with ground water quality standards at the compliance boundary;

(d) the volume, composition, and physical and chemical characteristics of the leachate;

(e) the proximity and withdrawal rates of ground water users, and the availability of alternative water supplies; and

(f) any other public health, safety, and welfare effects.

(2) The distance between the compliance boundary and the permitted waste boundary must be no greater than 200 feet. The commissioner may require a smaller separation distance if ground water flow rates are very slow or where necessary to provide additional protection to ground water, including sites with downward ground water flow. At existing facilities, including expansion areas, the commissioner may allow a separation distance greater than 200 feet if the following conditions are met:

(a) the commissioner determines that the owner or operator has provided sufficient monitoring to assure reliable detection and tracking of pollutant migration within the area enclosed by the compliance boundary, and that the larger separation presents no greater risk to water quality and water use than a separation distance of 200 feet or less;

(b) the hydrogeologic evaluation under subpart 3 is complete or will be completed according to a compliance schedule; and

(c) the owner or operator revises the cost estimate for contingency action under part 7035.2615 to reflect any greater costs for additional monitoring; ground water containment, removal, and treatment; and other contingency actions, and provides evidence of financial assurance to pay for the increased costs.

D. In addition to the compliance boundary required of all facilities under item C, the commissioner shall designate a lower compliance boundary at any facility where there is a potential for substantial pollutant migration downward to a deeper aquifer used locally as a source of water supply. The lower compliance boundary shall be designated at a contact

between soil or hydrogeologic units, or other definable surface within the saturated zone, and shall be located to prevent adverse effects on water supplies.

E. The commissioner may designate a surface water compliance boundary if it is determined, by the analysis under subpart 3, item G, subitem (7) or otherwise, that pollutants entering the ground water from the facility may migrate to surface water at concentrations that could adversely affect the quality of surface water.

(1) The surface water compliance boundary must be designated as a vertical plane extending downward from the land surface or as some other readily definable plane located between the land disposal facility and the surface water.

(2) The surface water compliance boundary may either replace a portion of the compliance boundary or be designated in addition to the compliance boundary. The surface water compliance boundary may be substituted entirely for a portion of the compliance boundary only if the facility is within 500 feet of the surface water and the commissioner determines that all pollutants entering the ground water from the facility will discharge into that surface water.

(3) The commissioner shall establish standards and intervention limits for the surface water compliance boundary in the facility permit based on the applicable provisions of chapter 7050. If the surface water in turn recharges an aquifer used as a water supply, the commissioner shall establish standards and intervention limits protective of both surface water and drinking water.

(4) The commissioner shall require submission of any facility and site information needed to establish standards and intervention limits for the surface water compliance boundary, including low-flow stream discharge rates, mixing characteristics and rates, biological communities, and chemical composition of the surface water and leachate.

F. Except as provided in items E and H and this item, pollutant concentrations in ground water must not exceed the standards listed in this item at or beyond the compliance boundary and at or below the lower compliance boundary. The standards and intervention limits for these two boundaries are as follows:

	Substance	**Standard or intervention limit (in micrograms per liter unless otherwise noted)**
(1)	Acrylamide	0.025
(2)	Acrylonitrile	0.17
(3)	Alachlor	2.5
(4)	Aldicarb	2.3

(5)	Aldrin	0.0075
(6)	Allyl chloride	7.35
(7)	Arsenic	12.5
(8)	Asbestos	1800000 medium and long (greater than 10 microns) fibers per liter
(9)	Barium	375
(10)	Benzene	3
(11)	Bis(2-chloroethyl)ether	0.078
(12)	Cadmium	1.25
(13)	Carbofuran	9
(14)	Carbon tetrachloride	0.67
(15)	Chlordane	0.055
(16)	Chlorobenzene (monochlorobenzene)	15
(17)	Chloroform	1.3
(18)	Chromium	30
(19)	Copper	325
(20)	DDT	0.25
(21)	Dibromochloropropane (DBCP)	0.063
(22)	1,2-Dibromoethane (Ethylene dibromide, EDB)	0.002
(23)	1,2-Dichlorobenzene (orth-)	155
(24)	1,3-Dichlorobenzene (meta-)	155
(25)	1,4-Dichlorobenzene (para-)	18.8
(26)	3,3'-Dichlorobenzidine	0.052
(27)	1,2-Dichloroethane	0.95
(28)	1,1-Dichloroethylene	1.8
(29)	1,2-Dichloroethylene (cis-)	17
(30)	1,2-Dichloroethylene (trans-)	17
(31)	Dichloromethane (methylene chloride)	12
(32)	2,4-Dichlorophenoxyacetic acid (2,4-D)	17
(33)	1,2-Dichloropropane	1.5

(34)	Dieldrin	0.0025
(35)	2,4-Dinitrotoluene	0.27
(36)	1,2-Diphenylhydrazine	0.11
(37)	Epichlorohydrin	8.9
(38)	Ethylbenzene	170
(39)	Heptachlor	0.025
(40)	Heptachlor epoxide	0.0015
(41)	Hexachlorobenzene	0.053
(42)	Hexachlorobutadiene	1.1
(43)	Hexachlorocyclohexane (alpha-)	0.0075
(44)	Hexachlorocyclohexane (beta-)	0.047
(45)	Hexachlorocyclohexane (gamma-)(Lindane)	0.05
(46)	Hexachlorodibenzodioxin	0.000015
(47)	Hexachloroethane	6.2
(48)	Lead	5.0
(49)	Mercury	0.75
(50)	Methyl ethyl ketone	43
(51)	Methoxychlor	85
(52)	Nickel	38
(53)	Nitrate (as Nitrogen)	2500
(54)	Nitrite (as Nitrogen)	250
(55)	N-Nitrosodimethylamine	0.0035
(56)	N-Nitrosodiphenylamine	17.8
(57)	Total carcinogenic polynuclear aromatic hydrocarbons (PAH)	0.007
(58)	Polychlorinated biphenyls (PCB's)	0.02
(59)	Pentachlorophenol	55
(60)	Selenium	11
(61)	Styrene	35
(62)	2,3,7,8-Tetrachlorodibenzo-p-dioxin (-TCDD)	0.0000005
(63)	1,1,2,2-Tetrachloroethane	0.44

(64)	Tetrachloroethylene	1.7
(65)	Toluene	500
(66)	Toxaphene	0.075
(67)	1,1,1-Trichloroethane	50
(68)	1,1,2-Trichloroethane	1.5
(69)	Trichloroethylene	7.8
(70)	2,4,6-Trichlorophenol	4.4
(71)	2,4,5-TP (Silvex)	13
(72)	Vinyl chloride	0.037
(73)	Xylene	110

G. If an intervention limit established under items E, F, and H is exceeded in ground water at any location where the facility's impacts are monitored, the owner or operator must take the following actions:

(1) immediately notify the commissioner in writing;

(2) immediately resample if previous samples at the facility did not exceed the intervention limits;

(3) evaluate the need to resample if previous samples exceeded the intervention limits;

(4) evaluate the significance of the exceedance and the source or cause of the constituents exceeding the intervention limits;

(5) evaluate the need for immediate corrective action to prevent pollutant concentrations from approaching or exceeding standards at the compliance boundary, surface water compliance boundary, or lower compliance boundary;

(6) evaluate the need for changes in water monitoring, including sampling frequencies, constituents analyzed, and installation of additional monitoring points;

(7) within 30 days after obtaining the sample results in which an intervention limit was exceeded, submit a written report to the commissioner describing the evaluations and conclusions under subitems (2) to (6) and the actions taken or planned under subitem (8); and

(8) take other actions described in the facility's contingency action plan and as required in subpart 15 and part 7035.2615.

H. In lieu of the intervention limits and standards under items E and F, the commissioner may establish alternative standards and intervention limits in the facility permit as follows:

(1) If the concentration of any constituent in the background ground water at a facility is greater than a standard or intervention limit established in this subpart, the background concentration of the constituent must be used as the standard or intervention limit. For purposes of this subitem, background refers to the condition of ground water that has experienced no change in quality due to migration of constituents from the facility. If the background water quality is inadequately defined, the commissioner may require additional evaluation including sampling, statistical analysis of sampling data, and installation of additional monitoring points. The commissioner may alter the alternative standards or intervention limits if background water quality is changing due to actions or events occurring outside the facility property and beyond the owner's or operator's control.

(2) Upon request by the owner or operator, the commissioner may establish alternative limits for some or all substances for portions of a facility filled before November 15, 1988. Unless approved by the agency, or by the commissioner as provided in subitem (1), the alternative limits must not exceed four times the concentrations given in item F. The owner or operator must have completed a remedial investigation study evaluating the extent and severity of ground water pollution at the facility and a feasibility study evaluating the feasibility and the environmental and economic costs, risks, and benefits of the possible alternative corrective actions. The alternative approaches must include corrective actions intended to achieve compliance with the standards under items E and F and at least one additional approach intended to maintain ground water concentrations lower than four times the concentrations under item F. The feasibility study also must evaluate the pollutant concentrations that would remain in ground water after corrective action and the extent to which the use of these alternative limits may adversely affect the immediate and future use of ground water downgradient from the facility.

(3) If the quality of a public water supply is potentially affected by migration of leachate from a facility, and if the maximum contaminant level for a substance as defined and established under either chapter 4720 or under the National Primary Drinking Water Regulations, Code of Federal Regulations, title 40, part 141, is a lower concentration than the standard under items E and F, the commissioner may use the maximum contaminant level as the alternative standard and alternative intervention limit for that substance.

(4) If a substance is present in ground water at a facility, and if that substance is known to impart undesirable taste or odor to drinking water, the commissioner may upon the recommendation of the Minnesota commissioner of health establish alternative limits to avoid these taste and odor effects.

(5) If a substance not listed in item F is present in ground water at a facility and is determined by the Minnesota commissioner of health to be potentially harmful to health, the commissioner may establish alternative limits for that substance. Except as provided elsewhere in this subpart, the alternative limits shall be 25 percent of the concentration given in unit (a) or (b):

(a) For a substance not classified by the United States Environmental Protection Agency as Group A (human carcinogen) or Group B (probable human carcinogen), the recommended allowable limit, as determined by the Minnesota commissioner of health; or

(b) For a substance classified by the United States Environmental Protection Agency as a Group A or Group B carcinogen, either the concentration corresponding to a risk of one additional case of cancer per 100,000 adults consuming the water over a lifetime, as estimated by the United States Environmental Protection Agency and the Minnesota commissioner of health, or the recommended allowable limit under unit (a), whichever is lower.

(6) If a substance which has a standard or an alternative standard under subitems (2) to (5) is present in ground water at a facility, and if the recommended allowable limit or the concentration corresponding to the one-in-100,000 cancer risk under subitem (5) is changed, the commissioner may establish alternative limits for that substance. The alternative limits shall be 25 percent of the concentration given in subitem (5), unit (a) or (b), whichever is applicable.

I. If a substance is not detected in a sample and the limit of detection is higher than the intervention limit or standard for that substance, the intervention limit or standard will not be assumed to have been attained or exceeded.

J. The commissioner, after investigation and evaluation, may require the owner or operator to implement the facility contingency action plan and to take corrective action under the following circumstances, even if a standard or intervention limit established under this subpart is not being exceeded:

(1) in the event of a substantial release of leachate that the commissioner may reasonably expect to result in a violation of water quality standards; or

(2) based on the additive carcinogenicity or toxicity of a combination of pollutants in the ground water, in lieu of the limits for individual substances under items E, F, and H. The additive carcinogenicity or toxicity must be computed using the approach given in "Guidelines for the Health Risk Assessment of Chemical Mixtures," Federal Register, Volume 51, pages 34014-34025, September 24, 1986. Where quantification using this approach is feasible, the commissioner may require response actions if the sum total risk of consuming the water over a lifetime would exceed either 2.5 additional cases of cancer

in a population of 1,000,000 persons or for noncarcinogens, 25 percent of the acceptable concentration for long-term consumption.

Subp. 5. **Design requirements.** The design requirements for a mixed municipal solid waste land disposal facility are as follows:

A. The owner or operator must develop an engineering report for the site. The report must include specifications for site preparation. The report shall be submitted with the final permit application required under part 7001.3300. These specifications as they relate to phase development of the facility must be established in the engineering report. Site preparations include clearing and grubbing for disposal areas and building locations, topsoil stripping and storage, cover material excavation, other excavations, berm construction, drainage control structures, leachate collection and treatment system, ground water monitoring system, gas monitoring and collection system, entrance and access roads, screening, fencing, and other special design features.

B. The owner or operator must develop the site in phases. Each phase must contain individual cells that will provide for filling in a manner to achieve final waste elevations as rapidly as possible. The phases must be designed and constructed to minimize moisture infiltration into the fill areas while maintaining stable slopes and appropriate operating conditions. The owner or operator must consider seasonal phases in order to accommodate the differences between wet and dry and warm and cold weather operations. The owner or operator must bring each phase to the final waste contours, as shown on the ultimate site development plan, and close the phase according to the approved facility closure plan.

C. Any new fill area at a land disposal facility must be located at least 200 feet from the nearest property line, unless otherwise approved by the commissioner based on existing filling procedures, existing site structures, the facility design, compliance boundaries, and existing land restrictions.

D. The owner or operator must divert surface water drainage around and away from the site operating area. A drainage control system, including changes in the site topography, ditches, berms, sedimentation ponds, culverts, energy breaks, and erosion control measures, must take into consideration at least the following features:

(1) the expected final contours for the site and the planned drainage pattern;

(2) the drainage pattern of the surrounding area and the possible effects on and by the regional watershed;

(3) the need for temporary structures as filling progresses at the site;

(4) the base of each fill area and the top of each lift graded at a minimum two percent slope; and

(5) the area's ten-year, 24-hour rainfall.

E. The owner or operator must design and maintain slopes and drainageways to prevent erosion, particularly of liner and final cover materials. Slopes greater than 200 feet long must include diversion drainageways unless the commissioner approves a greater distance based on sedimentation run-off calculations, proposed design features and sedimentation control devices. Where water runs off top slopes onto steeper side slopes, the owner or operator must evaluate the need for drainageways around the perimeter of the top slope and flumes or drop structures to prevent erosion of the cover. Drainageways must include energy breaks and concrete or rip rap reinforcement necessary to prevent erosion.

F. The owner or operator must provide a sediment settling pond if run-off would otherwise carry excessive sediment off the facility property. The commissioner may require monitoring of water quality within or beneath a sedimentation pond and corrective actions if adverse water quality effects are detected.

G. The final contours for the fill area must be a minimum three percent and a maximum 20 percent slope unless the commissioner approves other contours based on existing site topography, design plans, and operating conditions.

H. The facility design must include:

(1) a cover system in accordance with subpart 6;

(2) a liner system in accordance with subpart 7;

(3) a leachate collection and treatment system in accordance with subpart 9;

(4) a water monitoring system in accordance with subpart 10; and

(5) a gas monitoring and collection system in accordance with subpart 11 unless determined to be unnecessary by the commissioner based on the location, waste characteristics, and site characteristics.

Subp. 6. **Intermittent, intermediate, and final cover system.** The owner or operator of a mixed municipal solid waste land disposal facility must design and maintain a cover system capable of minimizing infiltration of precipitation into the fill areas, preventing surface water ponding on fill areas, controlling gas movement, preventing erosion of surface and side slopes, reducing wind erosion and wind blown litter, minimizing the creation and movement of dust, retaining slope stability, reducing effects of freeze-thaw and other weather conditions, maintaining vegetative growth while minimizing root penetration of the low permeability cover layer, and discouraging vector and burrowing animal intrusion into the site. A complete cover system must consist of intermittent, intermediate, and final covers as outlined in items A to E.

A. The owner or operator must place an intermittent cover upon all exposed solid waste in accordance with the approved operation and maintenance manual for the site. The

owner or operator shall submit to the commissioner for approval a proposed cover system that addresses the frequency and depth of placement and the material to be used as cover. The frequency of placement may be no less than once per week. The cover depth must be sufficient to cover the waste completely and must be at least six inches if soil or similar material is used. The commissioner, in approving the proposed cover system, must consider the characteristics of the proposed cover material, the characteristics of the solid waste, the leaching potential of the solid waste, the design and operation of the facility, and the potential for nuisance conditions if other than daily cover is proposed.

B. The owner or operator must place intermediate cover on all filled surfaces of the facility where no additional solid waste will be deposited within 30 days. The intermediate cover must consist of compacted material of sufficient depth, at least 12 inches if soil or similar material is used, to cover the waste completely, and graded to prevent surface water ponding.

C. The owner or operator of an existing mixed municipal solid waste land disposal facility must comply with the final cover requirements of subitems (1) to (4) if, within 18 months after November 15, 1988, waste will no longer be received and the facility will be closed.

(1) The final cover system must be compatible with the end use for the site.

(2) The final cover system must be graded to prevent surface water ponding and must have a minimum slope of two percent and a maximum slope no greater than 25 percent.

(3) The final cover system must consist of a barrier layer at least 24 inches thick of materials having a permeability not greater than 2×10^{-6} centimeters per second overlain by 12 inches of material of which at least six inches is topsoil capable of sustaining a vegetative cover. A barrier consisting of synthetic materials at least 30/1000 of an inch thick may be used in place of the barrier layer described above.

(4) The vegetative cover must consist of shallow rooted perennial grasses or other suitable vegetation that will not penetrate the barrier layer.

D. The owner or operator of a new mixed municipal solid waste land disposal facility or an existing facility or portions thereof that will close or reach final permitted waste elevations more than 18 months after November 15, 1988, must comply with the requirements of subitems (1) to (9).

(1) The final cover system must be compatible with the end use for the site.

(2) The final cover system must be designed and constructed to contain or reject at least 90 percent of the precipitation falling on the system.

(3) A final cover system comprised of soils or amended soils must consist of at least three layers; a barrier layer, a drainage layer, and a top layer. The barrier layer must be at least 24 inches thick if it consists of soils or amended soils. The drainage layer must be at least six inches thick. The top layer must be at least 18 inches thick, of which at least six inches is topsoil, and of sufficient depth to contain the vegetative roots and have an available water-holding capacity to promote vegetative growth.

(4) The barrier layer must have a maximum permeability no greater than 2 x 10^{-6} centimeters per second.

(5) A synthetic membrane may be used as the barrier layer. The membrane must be at least 30/1000 of an inch thick and meet the physical property standards for the material type developed by the National Sanitation Foundation and reproduced in the United States Environmental Protection Agency Manual, "Lining of Waste Impoundment and Disposal Facilities", SW-870, March 1983, Office of Research and Development, Cincinnati, Ohio.

(6) The layer of topsoil must be capable of sustaining vegetative cover consisting of shallow-rooted perennial grasses or other suitable vegetation that will not penetrate the barrier layer.

(7) In designing the drainage for the final cover system, the owner or operator must consider the need for drainage ditches, pipes, and collection areas to prevent erosion and excessive sediment movement off site. The owner or operator must also consider design and construction techniques needed to maintain the drainage layer in place on the barrier layer.

(8) The barrier layer must be placed upon a buffer material covering the waste to protect the barrier layer from damage.

(9) The owner or operator must grade the final cover system to achieve a minimum three percent and a maximum 20 percent slope, unless the commissioner approves otherwise. The commissioner's approval must consider the ability of the proposal to minimize infiltration and prevent erosion, the design and operational specifications, and the ultimate use for the site. The final cover system must maximize surface water run-off and prevent ponding of surface water.

E. The owner or operator must place all cover material for the barrier, buffer, and drainage layers in lifts of no more than six inches and compact the lifts within zero to five percent of optimum moisture content to achieve 95 percent Standard Proctor of maximum density according to the compaction test of subpart 8. The owner or operator must not compact the uppermost six inches to this specification.

Subp. 7. **Liner requirements.** Any previously unfilled portion of an existing mixed municipal solid waste land disposal facility or any portion of a new mixed municipal solid

waste land disposal facility must be lined. An extension of 18 months from November 15, 1988, may be granted by the commissioner to the owner or operator of an existing mixed municipal solid waste land disposal facility provided the owner or operator shows that the liner is unnecessary for that time based on: subsurface geologic conditions; ground water and surface water flow patterns; ground water and surface water quality; depth to ground water; distance to surface water; remaining site capacity; design and construction techniques to be used to mitigate leachate generation; and other site conditions that exist and will minimize impacts on the environment.

A liner is not required for existing disposal areas at existing mixed municipal solid waste land disposal facilities that will be expanded vertically. However, a permit for a vertical expansion may be granted by the commissioner only if the owner or operator shows that the expansion will not increase the potential for harm to human health or the environment. The owner or operator shall submit to the commissioner an engineering and hydrogeologic report containing a detailed analysis of the impact the expansion would have on the environment and human health. The report must also contain the design and construction modifications to be used at the facility to minimize impacts on the environment. The report must include a hydrogeologic evaluation as outlined in subpart 3; a feasibility study on minimizing leachate generation, controlling leachate movement, and on treating ground water and surface water pollution; an evaluation of long-term monitoring; and an appropriate adjustment to the financial instruments in place for the facility.

The liner installed at a mixed municipal solid waste land disposal facility must comply with the requirements of items A to N. The lined portion of the disposal area must be separated from any existing fill area by low permeability material to the extent practicable, be designed to collect the additional water movement from the old fill area to the new fill area, and prevent movement of water from the new fill area to the old fill area.

A. The liner system in combination with the cover system must achieve an overall site efficiency of 98.5 percent collection or rejection of the precipitation that falls on the disposal area and minimize the amount of leachate leaving the fill site to the soil and ground water system below the site.

B. The liner system must be compatible with the waste and leachate.

C. The liner must maintain its integrity for the operating life of the facility and the postclosure care period.

D. The liner system must consist of at least the following:

(1) a smooth, stable subgrade for placement of the barrier liner by means of the placement of protective material over the existing subgrade, the removal of abrasive objects, organic matter, and vegetation in the subgrade, and regrading;

(2) a barrier liner capable of containing leachate generated at the facility and surface water that has come in contact with waste; and

(3) a drainage layer above the barrier liner to rapidly convey surface water and leachate from the fill area, and to protect the barrier layer from puncture or other disturbances that might disrupt the integrity of the barrier liner.

E. A natural soil barrier liner must be at least four feet thick. A synthetic membrane must be at least 60/1000 of an inch thick for an unreinforced membrane or 30/1000 of an inch thick for a reinforced membrane. A synthetic membrane must meet the specifications of the National Sanitation Foundation, Standard Number 4, Flexible Membrane Liners, November 1983, Ann Arbor, Michigan. The synthetic membrane must be placed over a natural soil barrier liner at least two feet thick. The drainage layer must consist of at least 12 inches of suitable soil material or an equivalent synthetic material.

F. The barrier liner must have a permeability no greater than 1×10^{-7} centimeters per second. The drainage layer must have a permeability of 1×10^{-3} centimeters per second or greater throughout.

G. The base of the liner must be graded to a minimum two percent and a maximum ten percent slope and the side slopes must be no steeper than 50 percent.

H. The barrier layer must be compacted in lifts no greater than eight inches.

I. The drainage layer must cover the base liner and the side slopes.

J. The liner must be designed to have a leachate collection efficiency of at least 95 percent of the precipitation falling on the fill area. The efficiency calculation must consider the liner thickness, the liner slope, the saturated hydraulic conductivity of the liner and drainage layer, the drainage layer thickness, the permeability of the drainage layer and liner, the porosity of the drainage layer, the flow distance to collection pipes, and the amount of leachate to be generated and collected based on annual infiltration and ground water inflow.

K. An alternative liner system design may be used when approved by the commissioner. The commissioner's approval shall be based on the ability of the proposed liner system to control leachate migration, meet performance standards, and protect human health and the environment.

L. The owner or operator of a mixed municipal solid waste land disposal facility must discuss the design of the liner system in the engineering report required in part 7001.3475, item D and must address at least the following:

(1) the source and quantity of natural soils capable of meeting the requirements of this subpart;

(2) the likelihood and consequences of failures caused by puncture, tear, creep, freeze-thaw, thermal stress, abrasion, swelling, extraction, oxidative degradation,

exposure to ultraviolet radiation, acidic conditions, concentration of ions, organic constituents, pressure, and the presence of gases, rodents, microbes, and root penetration;

(3) the composition of the drainage layer and liner including the soil gradations, percent fines, mineral composition, and solubility under acidic conditions and when in contact with solvents; and

(4) the calculations and assumptions used in choosing the particular design proposed for the facility.

M. The liner system must be protected from damage during operation of the facility by a method approved by the commissioner.

N. The installation of the liner must comply with the construction specifications developed under subpart 12.

Subp. 8. **Cover and liner evaluation.** Soils intended for use as cover or liner material must be evaluated for the following properties as appropriate:

A. particle size distribution according to ASTM D421, ASTM D422, and ASTM D2217;

B. percent fines according to ASTM D1140;

C. Atterberg limits according to ASTM D423, ASTM D424, and ASTM D427;

D. specific gravity according to ASTM D854;

E. soil description according to ASTM D2488;

F. soil classification according to ASTM D2487;

G. water content according to ASTM D2216 and ASTM D3017;

H. compaction according to ASTM D698 or ASTM DM1557;

I. consolidation according to ASTM D2435;

J. permeability according to ASTM D2434;

K. mineralogy according to the American Society of Agronomy and American Society for Testing and Materials;

L. unconfined compression according to ASTM D2166;

M. triaxial compression according to ASTM D2850;

N. cation exchange capacity according to Methods of Soil Analysis, Agronomy Monograph No. 9, C.A. Black, editor, American Society of Agronomy, Madison, Wisconsin, 1965; and

O. the nutrient content, pH, and percent organic matter for topsoils used to grow vegetation.

Alternative test methods may be used upon written approval by the commissioner.

Subp. 9. **Leachate detection, collection, and treatment system.** The facility design must include a leachate detection, collection, and on-site or off-site treatment system. The detection system must monitor the level of leachate build-up in the fill area and the effectiveness of the liner system. The collection and treatment system must collect the leachate for proper treatment. If leachate treatment will take place off-site, the owner or operator must provide pretreatment of the leachate, if necessary. The system must comply with items A to K.

A. The owner or operator must install the detection system at the lowest elevation of the fill area and throughout the fill area, as necessary, to monitor leachate build-up and for use as a part of the collection system. The detection system must be capable of monitoring leachate build-up in the fill area and consist of collection lysimeters and standpipes capable of monitoring, detecting, and collecting leachate movement through the liner. The detection system must consist of materials compatible with the leachate. The commissioner may approve a detection system without collection lysimeters or standpipes provided the owner or operator shows either to be unnecessary based on the liner system, subsurface soil conditions, ground and surface water flow patterns, depth to ground water, and the amount of leachate generated. The detection system must be designed and constructed to monitor the effectiveness of the leachate storage area.

B. The owner or operator must construct a clean-out system capable of cleaning the entire collection system. Clean-out structures must be spaced no more than 500 feet apart.

C. The owner or operator must design the size of the collection system in accordance with subitems (1) to (4).

(1) The owner or operator must complete a water balance calculation based upon the amount of precipitation, evapotranspiration, surface run-off, soil and waste moisture storage capacity, root zone depth, surface slope, subsurface lateral drainage, and average monthly temperature. The owner or operator must derive the leachate generation rate by calculating the amount of water that percolates through the cover each month using actual data from an average weather year and a year when the precipitation exceeds the average precipitation by at least 20 percent. The engineering design report must contain all calculations and assumptions made during the water balance calculation.

(2) The size of the fill area the collection system will serve must be considered in determining pipe and storage area sizing.

(3) The amount of leachate to be collected must relate to the water balance calculated in subitem (1) and the site efficiency as calculated in subpart 7.

(4) In sizing sump pumps to remove leachate from the fill area, the owner or operator must use the storage capacity anticipated in the waste and leachate collection system, the anticipated amount of leachate to be generated, and the amount of leachate moving to the holding area by gravity drains. The pumps must be compatible with the leachate.

(5) The storage area must be designed and constructed to drain the system back into the overall leachate collection system to minimize the potential for overfilling of the storage area. The storage design must be capable of detecting leaks, containing the leaks, and minimizing the need for corrective actions.

D. The height of free standing liquid over the liner in the fill area must not exceed one foot.

E. The unintercepted leachate flow distance along the drainage layer must not exceed 100 feet.

F. The design of the collection system must include collection pipes of sufficient diameter to handle the flow and allow cleaning. The pipes must be capable of handling loads experienced during construction and disposal of solid waste. The engineering design report must contain the buckling capacity and compressive strength of the pipe. The pipes must be placed in lined trenches and covered with a suitable filter material or geotextile membrane designed and constructed to encourage flow to the pipe and prevent infiltration of fine-grained soils. The geotextile membrane must not be placed in contact with the collection pipe.

G. The collection pipes must be trenched into the barrier liner with the same thickness of liner beneath the pipes as exists elsewhere or be constructed under a positive projection condition.

H. The collection system must consist of pipes resistant to chemical and biological breakdown as a result of contact with the leachate.

I. The design and construction of the collection system must be coordinated with the planned phase development for the site and the amount and timing of leachate generation.

J. The collection system must be designed to allow the collection of leachate samples for chemical analysis.

K. The owner or operator must design and construct the collection system to transport leachate into a holding area for testing and treatment prior to disposal, if the holding area is necessary. The owner or operator must design any holding area or treatment system compatible with the leachate and capable of preventing releases of leachate to the environment. The treatment and disposal of leachate must comply with parts 7001.0010 to 7001.0210, and 7001.1000 to 7001.1100. The design and construction of a leachate

treatment and disposal system must be completed in accordance with a feasibility study conducted by the owner or operator and approved by the commissioner.

Subp. 10. **Water monitoring systems.** The owner or operator must design, install, and maintain a water monitoring system in compliance with items A to T.

A. A water monitoring system must be installed at a mixed municipal solid waste land disposal facility and must be designed, constructed, and operated:

(1) to yield samples that are representative of the water quality in the portions of the ground water, surface water, or unsaturated zone the individual monitoring points are intended to sample;

(2) to allow ground water or surface water quality potentially affected by the facility to be distinguished from background water quality;

(3) to allow early detection of the release of pollutants from a facility;

(4) to allow determination of the composition, areal and vertical extent, concentration distribution, and highest concentrations of pollutants in the ground water or surface water; and

(5) to allow determination of whether the facility complies with the ground water performance standards of subpart 4.

B. The owner or operator must demonstrate the adequacy of the water monitoring system to reliably detect pollution and to comply with the requirements of this subpart. The numbers, types, locations, and depths of monitoring points, and the separation distances between them, must be designed based on:

(1) an evaluation of potential sources of leachate releases, including the leachate collection system, critical or higher-risk areas of the liner, areas of greatest potential buildup of leachate on the liner, leachate tanks, and leachate treatment and holding areas;

(2) an evaluation of the hydrogeologic conditions at the facility, including the variability of water quality and the projected paths and rates of migration of leachate from the potential sources identified under subitem (1). This analysis must include both water-soluble and low-solubility components of leachate; and

(3) a consideration of the location of any potentially impacted water supply wells, other points of water use, and surface waters.

C. Water monitoring systems must include monitoring points situated as follows:

(1) Monitoring points must be installed upgradient and downgradient from the facility, with upgradient monitoring points in each aquifer that has a downgradient monitoring point.

(2) All monitoring systems must be sufficient at a minimum to allow early detection of the release of leachate from each of the potential sources identified under item B, subitem (1).

(3) If pollutants originating from the facility are detected in ground water, the owner or operator shall provide additional monitoring points as necessary to delineate the polluted zone and to measure the facility's compliance with the ground water performance standards of subpart 4.

(4) Monitoring points must be installed within aquitards, confining units, and aquifers, as needed, to meet the requirements of this subpart.

(5) The commissioner shall require water quality monitoring beneath an aquifer or aquitard that is already affected by leachate unless there is little or no risk to the deeper ground water.

(6) Where changes in land use, water use, or other factors have altered ground water flow, the commissioner shall require necessary changes in the monitoring system.

D. The owner or operator shall provide monitoring points or instrumentation other than conventional monitoring wells if these installations are needed to fulfill the requirements of this subpart. The commissioner shall require separate monitoring points whenever necessary to monitor conditions other than ground water quality, including hydraulic head, ground water or surface water flow, and leachate quality and movement in the unsaturated zone.

E. Before any monitoring point is constructed, sealed, rebuilt, or redeveloped, the owner or operator must submit the design and description of the proposed actions to the commissioner for review and approval. Approval must first be obtained from the Minnesota Department of Health, as required in part 4725.1860, before constructing a monitoring well that extends into any aquifer below the aquifer nearest the ground surface.

F. Monitoring wells and piezometers must be designed, constructed, maintained, and sealed in compliance with this subpart and with chapter 4725, Department of Health Water Well Construction Code.

G. Monitoring wells must be designed and constructed to function properly over the intended operating life of the well, to prevent vertical movement of ground water and pollutants within and along the well and drill hole, and to be pressure tight without leakage at casing joints.

(1) Materials used in well casings, screens, and annular seals must comply with chapter 4725 and must be resistant to corrosion, chemical attack, and other deterioration and must not be subject to penetration by pollutants.

(2) The casing and screen must be centered in the drill hole to ensure a continuous seal around the casing.

(3) When granular filter packs are used around well screens, they must be of insoluble, nonreactive mineral composition and they must be sized, graded, and washed specifically for use in filter packs. Silica sand must be used for filter packs except where this is infeasible and the commissioner approves other materials.

H. The owner or operator must ensure that in all phases of monitoring well construction, drilling, installation, and completion, the methods and materials used do not introduce substances that may interfere with water quality analysis.

(1) Drilling fluids, muds, foams, dispersants, disinfectants, other additives, and water from outside the well may be used only if approved by the commissioner. The commissioner may approve their use if they do not interfere with water quality analyses, or if there are no reasonable alternative methods and all feasible methods are used to remove them from the drill hole.

(2) Drilling tools and cables and well construction materials must be clean and free of oils, greases, and other contaminants.

(3) Equipment contaminated by contact with pollutants in the soil or ground water must be thoroughly cleaned before drilling to greater depths or in other locations.

I. Where well construction materials are unsuitable for sampling some substances, the commissioner may allow the owner or operator to install two or more adjacent monitoring points constructed of different materials to allow testing of all required substances.

J. Monitoring wells and filter packs must be designed based on the site hydrogeologic characteristics including the permeability and particle size distribution of the formation material at the screen or intake interval.

(1) An owner or operator proposing a screen or intake area longer than five feet, or ten feet if the water table intersects the screen or intake, must provide a written justification for the additional length.

(2) Monitoring wells must be designed, constructed, and developed to minimize the time needed for water levels to recover after the well is evacuated, to allow water to flow readily into the screen or intake area with low flow velocities through the screen, and to minimize the entry of soil particles into the well.

K. Monitoring wells must be clearly and permanently marked with a Minnesota Unique Well Number and, if different from the unique number, the identifying well name or number used in the facility plans, permit, and water quality data records.

L. Monitoring wells must be protected from damage and unauthorized access as required under part 4725.1860, subpart 5, except that a locked metal cap must be used. Caps must be kept locked when the well is not being monitored.

M. A monitoring well must be developed after installation and, if necessary to minimize the entry of soil particles into the well or to restore well yield, during its operating life. After development, the owner or operator must analyze unfiltered water samples from the monitoring well for suspended solids, and must measure the depth of the well to verify that the well is free of accumulated sediment. The commissioner may require additional measures including additional development or installation of a new monitoring well, where necessary to reduce the entry of sediment into the monitoring well.

N. After development, the owner or operator must conduct a stabilization test, recovery rate test, or other appropriate procedure to estimate the rate and length of time the well must be pumped and the volume of water that must be removed before each sampling to ensure that water samples are representative of actual ground water quality.

O. Accurate records must be kept of the soil or rock types encountered while installing a monitoring point. The soils logging procedures must meet the requirements for soil borings contained in subpart 3, item F, except that the commissioner may approve alternative procedures upon written request by the owner or operator if these soil logging requirements are unnecessary or infeasible for a particular monitoring point. Where conditions during drilling result in an unanticipated change to a drilling method that does not provide the required soils information, the owner or operator must notify the commissioner and request approval of a change as soon as possible and must submit an explanation of the reason for the change with the construction and installation record required under item P.

P. Within 30 days after installing or sealing a monitoring point, the owner or operator shall submit to the commissioner a record of the monitoring point construction or sealing. The record must state the dates when the work was done.

(1) For monitoring wells, the construction record must include the soils and well construction log required under item Q; the Minnesota Unique Well Number; a copy of any water well record submitted to the commissioner of health as required by part 4725.6700; logs from any geophysical testing done on the well; well development data; stabilization or recovery rate testing data; suspended solids analyses; any other measurements or testing done on the well including pumping, drawdown, yield, or flow direction tests; and a dated, signed, revised landfill plan sheet showing the surveyed location coordinates of the monitoring well to the nearest foot.

(2) The well sealing record must contain the well name, surveyed location, casing diameter and material type, and a Minnesota Unique Well Number; the depth of the well measured immediately before sealing the well; the type and quantity of well seal

material used; and how the well seal was installed. If all this information is contained in the report required in part 4725.2700, a copy of this report will suffice.

(3) The accuracy and completeness of the records submitted must be verified by a water well contractor licensed under parts 4725.0500 to 4725.1800, or an engineer registered under part 4725.1850. This statement must be accompanied by the individual's name, signature, company, and license or registration number.

Q. Unless the commissioner has approved alternative methods under item O, the soils and well construction log must contain the soils information required in subpart 3, item F. The soils and well construction logs may be combined onto one log if the required information can be clearly shown. The well construction log must include a drawing of the well in vertical cross-section, the identification and location of the well, and the following information regarding the well's construction:

(1) well casing material type, inside diameter, and casing schedule number, standard dimension ratio, or wall thickness;

(2) well screen material type, product name, and description; type and direction of alignment of openings (horizontal or vertical); opening or slot width; and type of screen bottom;

(3) the methods and materials used to join sections of casing and screen, casing to screen, and well bottom to screen;

(4) granular filter pack manufacturer and, if applicable, product name or number; mineral composition including carbonates or other soluble or reactive minerals; gradations; and quantity of filter pack material used;

(5) type of grout or other approved annular seal material, manufacturer and product name, proportions of water and solids in the grout mix, and quantity used;

(6) elevation of the top of each casing, surveyed to the nearest 0.01 foot;

(7) elevations of the ground surface, protective concrete slab, bottom of the drill hole, top and bottom of any dedicated pump or sampling or measuring device, top and bottom of the screen or intake interval and of each different size or type of casing, each change in the diameter of the drilled hole, and each change in filter pack, annular seal, or other backfill material, as verified by depth measurement of the top of each backfill material;

(8) methods of drilling and installation, including type of drilling rig; how the well, filter packs, and grout were installed; description of drilling fluids used; and procedures for cleaning materials or equipment;

(9) observations during drilling and installation, including any problems encountered and conditions that may affect the performance of the monitoring well; and

(10) type of dedicated pump, sampling device or measuring device including manufacturer and model number, pumping capacity, dimensions, location of intake area, how secured at the desired elevation, type of material used for connecting lines or hoses, and type and location of power source.

R. Piezometers that will not be used to measure water quality must comply with items E to G, J to M, O to R, and T. They must be designed and constructed to accurately measure hydraulic head in the portion of the aquifer or formation immediately surrounding the screen or intake area and to minimize the time lag between fluctuations in head outside the piezometer and the inside water level. If the time lag is too large, the commissioner may require pressure transducers or other alternative designs to be used.

S. Surface water monitoring points must comply with the following requirements:

(1) A permanent marker must be installed on land adjacent to the sampling location. The marker must clearly identify the monitoring station. The commissioner may approve an alternate procedure if a sampling location is outside the permitted property and permission cannot be obtained to install a marker.

(2) Monitoring stations in a river or stream must be located upstream of the area of ground water discharge, downstream where the discharge has mixed with the stream flow, and within the area of maximum projected pollutant concentrations in the discharging ground water.

(3) Within 30 days after establishing a surface water monitoring station, the owner or operator shall submit to the commissioner a revised landfill plan sheet showing the location and identification of the sampling station and marker.

T. Sampling personnel must inspect monitoring points and markers each time the monitoring point is measured or sampled. The owner or operator must inspect monitoring points and markers at least annually. The owner or operator must correct damaged or obstructed monitoring points, or other conditions that interfere with the proper functioning of the monitoring point within the time periods required for monitoring wells in part 4725.1860, subpart 5, item E. The owner or operator must resurvey the elevation of the top of the casing immediately after any change or repair that may have altered its elevation. The owner or operator must revise the well construction log, the monitoring protocol under subpart 14, item H, and the facility plans to show the new elevations, previous elevations, and the date of each change in elevation and submit the revised log and plans to the commissioner within 30 days after the change or repair.

Subp. 11. **Gas monitoring, collection, and treatment system.** The concentration of any explosive gas must not exceed its lower explosion limit at the property boundary or 25 percent of its lower explosion limit in and around facility structures or any other on-site

monitoring point. A gas monitoring, collection, and treatment system must be designed to meet the requirements of items A to G.

A. The gas monitoring system, at a minimum, must be capable of monitoring gas build-up in a facility structure and at the property boundary. The commissioner shall establish monitoring requirements (including water quality parameters that indicate gas migration) in the permit, closure document, order, or stipulation agreement. Field inspection to detect odors and signs of vegetative stress, and portable or in-place probes to monitor explosive gases must be included in the monitoring system.

B. Gas monitoring probes must be placed between the disposal site and on-site structures or property lines. The probes must be placed no closer to the property line than the compliance boundary defined in subpart 4, item C, to allow for installation of control measures. If the owner or operator believes that monitoring probes are unnecessary or infeasible, the owner or operator shall submit reasons to the commissioner to support this belief. The commissioner will decide on the need for monitoring probes based on the waste characteristics, fill size, surrounding soils, the water table, and the proximity to occupied buildings.

C. Probe depths and locations must be based on the soils, site geology, depth of fill, water table, and depth of frost.

D. At a minimum, each mixed municipal solid waste land disposal facility must be designed and constructed with gas vents. The number and placement of the gas vents must release gas pressure in the fill area to prevent ruptures of the cover system and to encourage vertical gas migration.

E. The gas control systems must extend below the facility to the water table or to a subsurface soil capable of impeding the movement of gas. The gas control system must be located adjacent to the fill area.

F. The size of the gas collection system must be based on the volume and type of waste to be received at the site. The owner or operator must determine the need for a gas collection system and discuss in the engineering report how the need was determined. The commissioner shall review the determination during the permit review process and again at closure. Approval of a gas monitoring system without collection at the time of permitting shall not limit future requirements determined necessary by the commissioner based on the volume of gas generated at the facility, the proximity to residential or business property, or problems experienced at the facility in maintaining vegetative growth or accumulation of gas in site structures.

G. A gas monitoring program must include sampling and analysis for the amount and type of gas generated. The monitoring program must be included in the operations manual for the facility. The program must account for variation in gas generation and

migration due to climatic conditions, variation in the amount of waste in place at the facility, and the length of time the waste has been in place. The operations manual must include the techniques to be used to monitor gas at the site.

Subp. 12. **Construction requirements.** The construction requirements in items A to M must be incorporated into the project specifications for all major design features, at a minimum.

A. The owner or operator must notify the commissioner at least seven days before the day construction is expected to begin on the major design features, including phase excavation, phase construction, liner installation, monitoring well installation, and the placement of final cover.

B. The construction firm's inspector must record all procedures completed during construction at a mixed municipal solid waste land disposal facility. The record must document that design features were constructed in accordance with parts 7035.2525 to 7035.2815 and 7035.2855. This record must include pictures, field notes, and all test results.

C. The owner or operator must install a permanent benchmark on-site and show its location on the facility as-built plan.

D. The owner or operator must complete tests for compaction, Atterberg limits, grain size distribution, lab and field permeability, and field moisture density, at a minimum, on liners and final covers constructed at the facility to ensure the requirements of subparts 5 to 9 are met. The owner or operator must retain a portion of the field-molded and field-compacted samples of liners and the final cover layers until the construction certification is complete.

E. Unless otherwise noted in subparts 5 to 9, the minimum permissible cover slope is three percent and the maximum permissible cover slope is 20 percent.

F. As horizontal phases are installed, the liner must be joined to existing liners.

G. Flexible membranes must be installed during dry conditions. The seams joining membrane panels must be inspected as construction proceeds. Seams must be air tested and field seams must be tested for tensile strength. All flexible membranes must be protected after placement. The natural layer above and below the barrier layer must be free of roots, sharp objects, rocks, or other items that might puncture the liner.

H. Barrier liners constructed of in situ soils must be formed by scarifying and recompacting these soils.

I. All pipe used in constructing the leachate collection system must be tested for deformations. The allowable pipe deflection is five percent.

J. All pipes exiting the lined area must be fitted with antiseep collars.

K. Vegetative growth on liners must be prevented.

L. The liner and cover slopes must be surveyed and staked during placement.

M. A quality control/quality assurance program must be established for all construction projects. The program must include the tests to be completed during construction. The program also must establish the frequency of inspection and testing, the accuracy and precision standards for the tests, procedures to be followed during inspections and sample collection, and the method of documentation for all field notes including testing, pictures, and observations.

Subp. 13. **Operation and maintenance requirements.** A mixed municipal solid waste land disposal facility must be operated by a certified operator, as defined in parts 7048.0100 to 7048.1300. A certified operator must be present during the time that the facility is open to accept waste. The facility operations must meet the requirements of items A to W, at a minimum.

A. Solid waste must be spread and compacted in layers two feet or less in depth.

B. All mixed municipal solid waste must be sloped to promote drainage off the fill area.

C. The waste must be covered in accordance with the approved intermittent cover system required in subpart 6.

D. When no solid waste will be placed on a fill area for 30 days or more, intermediate cover, as defined in subpart 6, item B, must be spread and compacted over the waste.

E. Each fill phase, upon reaching final permitted waste elevations, must be covered in accordance with subpart 6, item C or D, as appropriate.

F. Each fill phase must be outlined with grade stakes and approved by the commissioner in accordance with subpart 12 before the deposition of any waste.

G. Resource recovery operations must be confined to the designated areas approved in the facility permit. Storage areas must be kept as small as practical, must be marked with signs, and must not interfere with normal mixed municipal solid waste disposal operations.

H. A mixed municipal solid waste land disposal facility must not be used to store more than 10,000 waste tires above ground or to process more than 500 waste tires unless a waste tire facility permit is obtained by the owner or operator as required under Minnesota Statutes, sections 115A.90 to 115A.914.

I. The facility must be inspected in accordance with the schedule approved by the commissioner for at least the following items: uncontrolled vegetative growth, soil

erosion on slopes and completed areas, vandalism on the monitoring systems, rodents and burrowing animals, malfunctions in the leachate and gas detection and collection systems, and settlement in completed areas.

J. All leachate must be sampled and analyzed in accordance with subparts 9 and 14.

K. The leachate collection system must be cleaned annually.

L. The amount of leachate collected must be monitored and recorded.

M. Corrective actions must be implemented to repair any conditions not in compliance with parts 7035.2525 to 7035.2815.

N. Dead animals must be disposed of under chapter 35.

O. Demolition debris and construction waste may be deposited in an area separate from the mixed municipal solid waste.

P. Sampling and analysis of ground water must be completed in accordance with subparts 10 and 14.

Q. Gas monitoring must be completed in accordance with subpart 11.

R. Procedures for operating the facility during wet weather conditions must provide protection for liners, covers, and other design features that might be disrupted by additional loads in a saturated condition.

S. The fill area must be surveyed annually before November 1 by a land surveyor registered in Minnesota. An updated existing conditions plan must be submitted with the annual report required in part 7035.2585. The plan must show the elevations of completed fill areas, areas partially filled, and all design features that changed in elevation due to facility operations or settlement. The remaining fill capacity must be calculated and shown on the plan.

T. All trenches or area fills must be staked with permanent markers.

U. All lined areas must have at least six feet of solid waste in-place on the liner by December 31 of each year. No disposal may take place on uncovered areas after December 31 without testing the liner integrity and approval granted by the commissioner.

V. All closure costs expended under part 7035.2625, all postclosure care cost expenditures made under part 7035.2645, and all corrective action expenditures made under part 7035.2615 must be recorded and maintained in the operating record.

W. The sequence and direction of below-grade operations must be conducted to prevent surface water from entering the fill area.

Subp. 14. **Sampling and analysis.** The owner or operator must ensure that sampling and analyses for pollutants are conducted in compliance with items A to Q.

A. The owner or operator must monitor ground water quality and, where required in permits, orders, and stipulation agreements, surface water quality and leachate quality. This monitoring must comply with parts 7035.2525 to 7035.2875, 7050.0150, and 7060.0800, and the agency issued facility permit.

B. The commissioner shall establish the requirements for monitoring water quality and leachate quality for each facility, including sampling locations, sampling schedule, constituents to be analyzed, and other necessary sampling procedures. The owner or operator must provide information needed to establish the requirements and to support any conditions proposed by the owner or operator. In establishing the monitoring requirements, the commissioner must consider at least the following factors:

(1) the presence of pollutants in previous samples, the extent and severity of ground water and surface water effects from the facility, the facility's compliance with water quality standards, including the ground water performance standards of subpart 4, and the evaluation under subpart 4, item F, subitem (5), if applicable; and

(2) facility location, design, operation, composition of the waste stream and leachate, ground water flow directions and rates, aquifer thickness, depth, and degree of natural protection, seasonal variations in water quality, surface water flow conditions, and downgradient or downstream water resources and water users.

C. Until the commissioner has established facility-specific monitoring requirements under item B, the owner or operator must comply with the monitoring requirements of this item. Water quality monitoring points at the facility must be sampled at least three times per year at the times specified in the facility permit. For one of the three sampling events, the owner or operator must provide the field measurements, laboratory analyses, and field and laboratory observations listed in subitems (1) and (2) for all ground water monitoring points. For the other two sampling events, the owner or operator must provide only the measurements and observations listed in subitem (2) for all ground water monitoring points. Where existing monitoring points may be unsuitable for sampling some or all of the listed substances, the commissioner may make appropriate changes in the monitoring requirements.

(1) Table 1:

(a) Alkalinity, total as calcium carbonate;

(b) Ammonia Nitrogen;

(c) Arsenic, dissolved;

(d) Cadmium, dissolved;

(e) Calcium, dissolved;

(f) Chloride;

(g) Chromium, total dissolved;

(h) Copper, dissolved;

(i) Dissolved Solids, total;

(j) Eh (oxidation potential) (a);

(k) Iron, dissolved;

(l) Lead, dissolved;

(m) Magnesium, dissolved;

(n) Manganese, dissolved;

(o) Mercury, dissolved;

(p) Nitrate + Nitrite, as N;

(q) Potassium, dissolved;

(r) Sodium, dissolved;

(s) Sulfate;

(t) Suspended Solids, total;

(u) Zinc, dissolved; and

(v) Cation-anion balance.

(2) Table 2:

(a) Appearance (b);

(b) pH (a);

(c) specific conductance (a);

(d) Temperature (a);

(e) Water elevation (c); and

(f) Volatile organic chemicals, halogenated and nonhalogenated (d):

Halogenated

Allyl chloride

Bromodichloromethane

Bromoform

Bromomethane

Carbon tetrachloride

Chlorobenzene (monochlorobenzene)

Chloroethane

Chloroform

Chloromethane

1,2-Dichlorobenzene

1,3-Dichlorobenzene

1,4-Dichlorobenzene

Dichlorodifluoromethane

1,1-Dichloroethane

1,2-Dichloroethane

1,1-Dichloroethylene

cis-1,2-Dichloroethylene

trans-1,2-Dichloroethylene

Dichlorofluoromethane

Dichloromethane (methylene chloride)

1,2-Dichloropropane

1,1,2,2-Tetrachloroethane

Tetrachloroethylene

1,1,1-Trichloroethane

1,1,2-Trichloroethane

Trichloroethylene

Trichlorofluoromethane

1,1,2-Trichlorotrifluoroethane

Vinyl Chloride

Nonhalogenated

Acetone

Benzene

Cumene

Ethylbenzene

Ethyl ether

Methyl ethyl ketone

Methyl isobutyl ketone

Tetrahydrofuran

Toluene

m-Xylene

o-Xylene

p-Xylene

Footnotes:

(a) Two measurements: in field, immediately after obtaining sample, and in laboratory.

(b) Visual observation, in field and laboratory, noting conditions such as the following, if present: color, cloudiness, floating films, other liquid or gas phases, odor.

(c) As measured in field before pumping or bailing.

(d) Purge and trap method.

D. In addition to the constituents listed in item C, the commissioner may require monitoring of:

(1) substances with standards or alternative standards under subpart 4 or other constituents that can, if consumed or contacted, adversely affect public health, public safety, or the environment;

(2) constituents that can adversely affect the taste, odor, or appearance of water or otherwise adversely affect the public welfare;

(3) major dissolved ions;

(4) constituents or properties of water that may be indicators of water pollution;

(5) substances that may cause analytical interference or otherwise affect water quality determinations;

(6) properties related to the movement of pollutants, including hydraulic head in the saturated or unsaturated zones;

(7) in surface waters, bed sediments, aquatic organisms, and other media, and stream discharge rates; and

(8) leachate composition and leachate release rates in the unsaturated zone beneath a land disposal facility.

E. The owner or operator must determine the initial water quality in new monitoring points and monitoring systems, including the range of seasonal variation in water quality. The commissioner shall establish sampling frequencies, analytical constituents, and other conditions for the initial water quality monitoring based on the site's ground water flow conditions and known water quality. For new facilities and expansions, background monitoring must be continued at least quarterly until waste disposal activity begins.

F. The owner or operator shall submit only samples collected by persons who have received training in ground water sampling and, if applicable, surface water sampling. This training must cover the procedures established under items G to L for the required classes of analytical constituents, such as volatile organics or dissolved metals.

G. The owner or operator of a mixed municipal solid waste land disposal facility must develop and keep current a written monitoring protocol for the facility and must ensure the protocol is followed during sampling and sample analysis.

(1) The monitoring protocol must describe in detail the sampling and sample transportation procedures under items H to L and the analytical procedures under items M to O.

(2) The monitoring protocol must be submitted for the commissioner's approval and must be included in a section of the operations manual required under part 7001.3475.

(3) The protocol must be revised immediately to reflect any changes in the monitoring system, field or analytical procedures, sampling personnel, or analytical laboratory. The monitoring protocol must be reviewed at least annually by the owner or operator, sampling personnel, and analytical laboratory and revised as needed. Revisions of the monitoring protocol must be submitted to the commissioner upon written request or as specified in the facility permit, order, or stipulation agreement. Dated records of past protocol language must be retained throughout the operating life of the facility and the postclosure period.

(4) If necessary to assure confidence in the monitoring results, the commissioner shall establish specific procedures and quality control requirements to be used at the facility and incorporated into the monitoring protocol, including as appropriate:

(a) acceptable limits for precision, accuracy, and other measures of the reliability of the field procedures and analytical results;

(b) conditions for and frequencies of use of quality control samples, measurements, or procedures in the field or analytical laboratory; and

(c) the use of gas chromatograph/mass spectrometer or other analytical procedures to achieve positive identification and quantification of analytical constituents.

H. At a minimum, the field portions of the monitoring protocol must include the following:

(1) monitoring point locations and elevations, and the order in which monitoring points are to be sampled;

(2) all tests, measurements, and procedures needed at each monitoring point, and the order in which these procedures will be carried out;

(3) equipment and containers to be used, procedures and precautions for their use; precautions to avoid introducing contaminants from outside sources into monitoring wells or samples; and when and how equipment must be cleaned between uses;

(4) procedures for evacuating each monitoring well before each sampling;

(5) if required, procedures for sampling surface water monitoring points, including exact sampling locations and depths, and for sampling leachate;

(6) quality control procedures to identify outside sources of contamination and sampling error, including types and numbers of quality control samples to be used in the field and during transport and handling procedures for these samples;

(7) procedures and criteria for field filtration of samples;

(8) sample preservation, including preservatives and temperature control requirements;

(9) procedures for sample labeling, sample handling and storage at the facility, and transport to the laboratory;

(10) chain of custody procedures; and

(11) procedures, measurements, and observations to be recorded as required under item L.

I. The equipment, materials, and procedures used in well evacuation, sampling, and subsequent sample handling must minimize contamination, turbulence, water contact with air, gas exchange, depressurization, adsorption, desorption, chemical reaction, or other alteration of the composition of the water sample.

J. Before evacuating and sampling a monitoring well, the elevation of the water surface or potentiometric surface must be measured to the nearest 0.01 foot. Before sampling, the well must be evacuated using a stabilization or recovery rate test or other procedure developed based on the initial testing done under subpart 10, item N.

K. The commissioner shall require filtration of samples wherever necessary to obtain sediment-free samples representative of actual ground water conditions. Filtration must be done at the monitoring point location using in-line methods or other procedures that minimize the loss of dissolved constituents from solution.

L. At the time of sampling, the persons conducting the sampling must record their procedures, measurements, and the condition of the monitoring point. The field records must be sufficient to document whether the procedures under items G to K have been followed. The records must contain the names of the persons conducting the sampling, the time and date each monitoring point was sampled, water elevations and other required field measurements, and the evacuation procedures and test results before sampling. The owner or operator must retain the field records throughout the operating life of the facility and the postclosure period.

M. Water quality analyses must be performed using methods acceptable to the commissioner based on their performance record, reliability, sensitivity, precision, and accuracy. Analytical methods and quality control procedures must be chosen to yield accurate results within the range of concentration and composition of the samples analyzed. All appropriate actions must be taken to minimize error and to assure the reliability, precision, and accuracy of the analytical results. Where the limit of detection or the limit of quantitation for a substance is higher than the concentration of concern, including the standard or alternative standard established under subpart 4, the commissioner may investigate the feasibility of attaining lower analytical limits and must require lower limits if necessary and feasible.

N. The monitoring protocol must contain the analytical and quality assurance procedures that will be followed for all samples originating from the facility. The protocol must include written procedures covering the following areas:

(1) responsibilities of laboratory personnel;

(2) sample containers and preservatives, cleaning of sample containers and sampling equipment, shipment and storage of samples, and sample holding times;

(3) analytical methods and laboratory equipment used;

(4) for each analytical constituent, the laboratory's measurements of precision and accuracy over a range of concentrations, limit of detection, limit of quantitation, and an explanation of how these quantities were measured;

(5) methods used to identify and prevent contamination of samples in the laboratory and during transport;

(6) analytical quality control procedures, as required in item O;

(7) methods of reviewing and assessing all data for completeness and accuracy;

(8) sample retention times after analyses are completed;

(9) inspection, testing, and preventive maintenance programs for all laboratory equipment;

(10) chain-of-custody procedures;

(11) procedures for documentation and retention of quality control results; and

(12) continuing education requirements for analytical personnel.

O. The quality assurance program under item N must include quality control procedures to assess the reliability, precision and accuracy of the analytical results. The monitoring protocol must describe and state the conditions for and frequencies of use of field and trip blanks, laboratory blanks, calibration standards, internal and external laboratory control samples, laboratory spikes, laboratory duplicates, laboratory replicates, and other quality control procedures.

P. The owner or operator shall submit monitoring results to the commissioner by the dates specified by permit, order, or stipulation agreement. The monitoring results must be accompanied by information sufficient to establish the reliability, precision, and accuracy of the reported values, including the following:

(1) a certification signed by the sampling personnel, analytical laboratory, and owner or operator stating whether all procedures, from obtaining the samples through completion of the analyses, were performed as described in the approved monitoring protocol; describing any departures from these procedures; and explaining why these departures were necessary;

(2) water elevations and other required field measurements and observations, dates and times when each sample was collected and received by the analytical laboratory, and the date each sample was analyzed;

(3) analytical results from all blanks;

(4) retention times and peak sizes for unidentified substances; and

(5) if required by the commissioner, additional information needed to establish the validity of the analytical results, including precision and accuracy data from the batch of samples in which each sample was analyzed, limits of quantitation, limits of detection, and results from other quality control procedures; chain-of-custody records; and field records under item L.

Q. Once a year, in accordance with part 7035.2585, the owner or operator shall submit to the commissioner a summary and discussion of the monitoring results. This annual summary must identify recent and long-term trends in the concentrations of monitored constituents and in water elevations, tabulate the analytical results to date and highlight those that exceeded the ground water performance standards of subpart 4 or surface water quality standards, evaluate the effect the facility is having on ground water and surface water quality, and suggest any additions, changes, or maintenance needed in the monitoring system.

Subp. 15. **Contingency action.** The owner or operator must implement the actions necessary to repair site features or to control, recover, or treat polluted ground or surface waters and explosive or toxic gases. The actions must include the measures dictated by the situation and outlined in the contingency action plan developed under part 7035.2615. The contingency action plan developed under part 7035.2615 must include the repair of clogged collection systems, repair of monitoring wells or probes, repair of cover systems, and the repair of liners or holding areas. If the contingency action plan did not anticipate the level of effort required to protect human health and the environment, actions to bring the facility into compliance with parts 7035.2525 to 7035.2805 must include any necessary work beyond that identified in the contingency action plan.

Subp. 16. **Closure and postclosure care.** Closure and postclosure care requirements are as follows:

A. Closure of each fill phase must be started within 30 days after reaching final permitted waste elevations. After closure of each fill phase, the owner or operator shall submit a closure certification that complies with part 7035.2635, subpart 3, indicating that closure has been completed in accordance with parts 7035.2625 and 7035.2635.

B. After final closure, the owner or operator must comply with all postclosure requirements contained in parts 7035.2645 and 7035.2655, including maintenance and monitoring throughout the postclosure care period specified in part 7035.2655 and the closure document. The owner or operator must:

(1) restrict access to the facility by use of gates, fencing, or other means to prevent further disposal at the site, unless the site's final use allows access;

(2) maintain the integrity and effectiveness of the final cover, including making repairs to the final cover system as necessary to correct the effects of settling, subsidence, gas and leachate migration, erosion, root penetration, burrowing animals, or other events;

(3) maintain and monitor the gas and ground water monitoring systems and comply with all other applicable requirements of subparts 11 and 14;

(4) continue to operate the leachate collection and removal system;

(5) prevent run-on and runoff from eroding or otherwise damaging the final cover;

(6) protect and maintain surveyed benchmarks used in complying with subpart 12;

(7) survey the facility at least annually to determine the extent of settling, subsidence, erosion, or other events;

(8) submit an annual report to the commissioner as required in part 7035.2585 describing the present conditions and corrective actions taken or needed for subitems (1) to (7); and

(9) complete repair work within 30 days of discovery.

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