

**567—113.10(455B) Environmental monitoring and corrective action requirements for groundwater and surface water.** All MSWLFs shall comply with the following environmental monitoring and corrective action requirements for groundwater and surface water.

**113.10(1) General requirements for environmental monitoring and corrective action for groundwater and surface water.** The following general requirements apply to all provisions of this rule.

*a.* Surface water requirements. MSWLF units shall not:

(1) Cause a discharge of pollutants into waters of the United States, including wetlands, that violates any requirements of the Clean Water Act, including, but not limited to, the National Pollutant Discharge Elimination System (NPDES) requirements, pursuant to Section 402 of the Clean Water Act.

(2) Cause the discharge of a nonpoint source of pollution into waters of the United States, including wetlands, that violates any requirement of an areawide or statewide water quality management plan that has been approved under Section 208 or 319 of the Clean Water Act.

*b.* A new MSWLF unit must be in compliance with the groundwater monitoring requirements specified in subrules 113.10(2), 113.10(4), 113.10(5) and 113.10(6) before waste can be placed in the unit.

*c.* Once established at an MSWLF unit, groundwater monitoring shall be conducted throughout the active life and postclosure care period of that MSWLF unit as specified in rule 567—113.13(455B).

*d.* For the purposes of this rule, a “qualified groundwater scientist” means a scientist or an engineer who has received a baccalaureate or postgraduate degree in the natural sciences or engineering and has sufficient training and experience in groundwater hydrology and related fields demonstrated by state registration, professional certifications, or completion of accredited university programs that enable that individual to make sound professional judgments regarding groundwater monitoring, contaminant fate and transport, and corrective action.

*e.* The department may establish alternative schedules for demonstrating compliance with:

(1) Subparagraph 113.10(2)“*e*”(3), pertaining to notification of placement of certification in operating record;

(2) Subparagraph 113.10(5)“*c*”(1), pertaining to notification that statistically significant increase (SSI) notice is in operating record;

(3) Subparagraphs 113.10(5)“*c*”(2) and (3), pertaining to an assessment monitoring program;

(4) Paragraph 113.10(6)“*b*,” pertaining to sampling and analyzing Appendix II constituents;

(5) Subparagraph 113.10(6)“*d*”(1), pertaining to placement of notice (Appendix II constituents detected) in record and notification of placement of notice in record;

(6) Subparagraph 113.10(6)“*d*”(2), pertaining to sampling for Appendices I and II;

(7) Paragraph 113.10(6)“*g*,” pertaining to notification (and placement of notice in record) of SSI above groundwater protection standard;

(8) Numbered paragraph 113.10(6)“*g*”(1)“4” and paragraph 113.10(7)“*a*,” pertaining to assessment of corrective measures;

(9) Paragraph 113.10(8)“*a*,” pertaining to selection of remedy and notification of placement in record;

(10) Paragraph 113.10(9)“*f*,” pertaining to notification of placement in record (certification of remedy completed).

**113.10(2) Groundwater monitoring systems.** All MSWLFs shall have a groundwater monitoring system that complies with the following requirements:

*a.* A groundwater monitoring system must be installed that meets the following objectives:

(1) Yields groundwater samples from the uppermost aquifer that represent the quality of background groundwater that has not been affected by leakage from a unit. A determination of background quality may include sampling of wells that are not hydraulically upgradient of the waste management area where either:

1. Hydrogeologic conditions do not allow the owner or operator to determine which wells are hydraulically upgradient; or

2. Sampling at other wells will provide an indication of background groundwater quality that is as representative as or more representative than that provided by the upgradient wells.

(2) Yields groundwater samples from the uppermost aquifer that represent the quality of groundwater passing the relevant point of compliance specified by the department under numbered paragraph 113.7(5)“*a*”(2)“2.” The downgradient monitoring system must be installed at the relevant point of compliance

specified by the department under numbered paragraph 113.7(5)“a”(2)“2” that ensures detection of groundwater contamination in the uppermost aquifer. When physical obstacles preclude installation of groundwater monitoring wells at the relevant point of compliance at existing units, the downgradient monitoring system may be installed at the closest practicable distance, hydraulically downgradient from the relevant point of compliance specified by the department under numbered paragraph 113.7(5)“a”(2)“2,” that ensures detection of groundwater contamination in the uppermost aquifer.

(3) Provides a high level of certainty that releases of contaminants from the site can be promptly detected. Downgradient monitoring wells shall be placed along the site perimeter, within 50 feet of the planned liner or waste boundary unless site conditions dictate otherwise, downgradient of the facility with respect to the hydrologic unit being monitored. Each groundwater underdrain system shall be included in the groundwater detection monitoring program under subrule 113.10(5). The maximum drainage area routed through each outfall shall not exceed 10 acres unless it can be demonstrated that site-specific factors such as drain flow capacity or site development sequencing require an alternative drainage area. If contamination is identified in the groundwater underdrain system pursuant to subrule 113.10(5), the owner or operator shall manage the underdrain discharge as leachate in lieu of assessment monitoring and corrective action.

(4) Be designed and constructed with the theoretical release evaluation pursuant to subparagraph 113.6(3)“e”(6) taken into consideration.

*b.* For those facilities which are long-term, multiphase operations, the department may establish temporary waste boundaries in order to define locations for monitoring wells. The convergence of groundwater paths to minimize the overall length of the downgradient dimension may be taken into consideration in the placement of downgradient monitoring wells provided that the multiphase unit groundwater monitoring system meets the requirements of paragraphs 113.10(2)“a,” 113.10(2)“c,” 113.10(2)“d” and 113.10(2)“e” and will be as protective of human health and the environment as the individual monitoring systems for each MSWLF unit, based on the following factors:

- (1) Number, spacing, and orientation of the MSWLF units;
- (2) Hydrogeologic setting;
- (3) Site history;
- (4) Engineering design of the MSWLF units; and
- (5) Type of waste accepted at the MSWLF units.

*c.* Monitoring wells must be constructed and cased by a well contractor certified pursuant to 567—Chapter 82 in a manner that maintains the integrity of the monitoring well borehole. This casing must be screened or perforated and packed with gravel or sand, where necessary, to enable collection of groundwater samples. The annular space (i.e., the space between the borehole and well casing) above the sampling depth must be sealed to prevent contamination of samples and the groundwater. Monitoring wells constructed in accordance with the rules in effect at the time of construction shall not be required to be abandoned and reconstructed as a result of subsequent amendments to these rules unless the department finds that the well is no longer providing representative groundwater samples. See Figure 1 for a general diagram of a properly constructed monitoring well.

(1) The owner or operator must notify the department that the design, installation, development, and decommission of any monitoring wells, piezometers and other measurement, sampling, and analytical devices documentation has been placed in the operating record.

(2) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices must be operated and maintained so that they perform to design specifications throughout the life of the monitoring program.

(3) Each groundwater monitoring point must have a unique and permanent number, and that number must never change or be used again at the MSWLF. The types of groundwater monitoring points shall be identified as follows:

1. Monitoring wells by “MW# (Insert unique and permanent number)”.
2. Piezometers by “PZ# (Insert unique and permanent number)”.
3. Groundwater underdrain systems by “GU# (Insert unique and permanent number)”.

(4) Monitoring well construction shall be performed by a certified well contractor (pursuant to 567—Chapter 82) and shall comply with the following requirements:

1. In all phases of drilling, well installation and completion, the methods and materials used shall not introduce substances or contaminants that may alter the results of water quality analyses.

2. Drilling equipment that comes into contact with contaminants in the borehole or aboveground shall be thoroughly cleaned to avoid spreading contamination to other depths or locations. Contaminated materials or leachate from wells must not be discharged onto the ground surface or into waters of the state so as to cause harm in the process of drilling or well development.

3. The owner or operator must ensure that, at a minimum, the well design and construction log information is maintained in the facility's permanent record using DNR Form 542-1277 and that a copy is sent to the department.

(5) Monitoring well casings shall comply with the following requirements:

1. The diameter of the inner well casing (see Figure 1) of a monitoring well shall be at least 2 inches.

2. Plastic-cased wells shall be constructed of materials with threaded and nonglued joints that do not allow water infiltration under the local subsurface pressure conditions and when the well is evacuated for sampling.

3. Well casing shall provide sufficient structural stability so that a borehole or well collapse does not occur. Flush joint casing is required for small diameter wells installed through hollow stem augers.

(6) Monitoring well screens shall comply with the following requirements:

1. Slot size shall be based on sieve analysis of the sand and gravel stratum or filter pack. The slot size must keep out at least 90 percent of the filter pack.

2. Slot configuration and open area must permit effective development of the well.

3. The screen shall be no longer than 10 feet in length, except for water table wells, in which case the screen shall be of sufficient length to accommodate normal seasonal fluctuations of the water table. The screen shall be placed 5 feet above and below the observed water table, unless local conditions are known to produce greater fluctuations. Screen length for piezometers shall be 2 feet or less. Multiple-screened, single-cased wells are prohibited.

(7) Monitoring well filter packs shall comply with the following requirements:

1. The filter pack shall extend at least 18 inches above and 12 inches below the well screen.

2. The size of the filter pack material shall be based on sieve analysis when sand and gravel are screened. The filter pack material must be 2.5 to 3 times larger than the 50 percent grain size of the zone being monitored.

3. In stratum that is neither sand nor gravel, the size of the filter pack material shall be selected based on the particle size of the zone being monitored.

(8) Monitoring well annular space shall comply with the following requirements:

1. Grouting materials must be installed from the top of the filter pack up in one continuous operation with a tremie tube.

2. The annular space between the filter pack and the frostline must be backfilled with bentonite grout.

3. The remaining annular space between the protective casing and the monitoring well casing must be sealed with bentonite grout from the frostline to the ground surface.

(9) Monitoring well heads shall be protected as follows:

1. Monitoring wells shall have a protective metal casing installed around the upper portion of the monitoring well casing as follows:

- The inside diameter of the protective metal casing shall be at least 2 inches larger than the outer diameter of the monitoring well casing.

- The protective metal casing shall extend from a minimum of 1 foot below the frostline to slightly above the well casing top; however, the protective casing shall be shortened if such a depth would cover a portion of the well screen.

- The protective casing shall be sealed and immobilized with a concrete plug around the outside. The bottom of the concrete plug must extend at least 1 foot below the frostline; however, the concrete plug shall be shortened if such a depth would cover a portion of the well screen. The top of the concrete plug shall

extend at least 3 inches above the ground surface and slope away from the well. Soil may be placed above the plug and shall be at least 6 inches below the cap to improve runoff.

- The inside of the protective casing shall be sealed with bentonite grout from the frostline to the ground surface.

- A vented cap shall be placed on the monitoring well casing.

- A vented, locking cap shall be placed on the protective metal casing. The cap must be kept locked when the well is not being sampled.

2. All monitoring wells shall have a ring of brightly colored protective posts or other protective barriers to help prevent accidental damage.

3. All monitoring wells shall have a sign or permanent marking clearly identifying the permanent monitoring well number (MW#).

4. Run-on shall be directed away from all monitoring wells.

(10) Well development is required prior to the use of the monitoring well for water quality monitoring purposes. Well development must loosen and remove fines from the well screen and gravel pack. Any water utilized to stimulate well development must be of sufficient quality that future samples are not contaminated. Any gases utilized in well development must be inert gases that will not contaminate future samples. Following development, the well shall be pumped until the water does not contain significant amounts of suspended solids.

*d.* Groundwater monitoring points that are no longer functional must be sealed. Groundwater monitoring points that are to be sealed and are in a future waste disposal area shall be reviewed to determine if the method utilized to seal the monitoring point needs to be more protective than the following requirements. All abandoned groundwater-monitoring points (e.g., boreholes, monitoring wells, and piezometers) shall be sealed by a well contractor certified pursuant to 567—Chapter 82 and in accordance with the following requirements.

(1) The following information shall be placed in the operating record and a copy sent to the department:

1. The unique, permanent monitoring point number.

2. The reasons for abandoning the monitoring point.

3. The date and time the monitoring point was sealed.

4. The method utilized to remove monitoring point materials.

5. The method utilized to seal the monitoring point.

6. Department Form 542-1226 for Water Well Abandonment Plugging Record.

(2) The monitoring point materials (e.g., protective casing, casing, screen) shall be removed. If drilling is utilized to remove the materials, then the drilling shall be to the maximum depth of the previously drilled monitoring point. All drilling debris shall be cleaned from the interior of the borehole.

(3) The cleared borehole shall be sealed with impermeable bentonite grout via a tremie tube. The end of the tremie tube shall be submerged in the grout while filling from the bottom of the borehole to the top of the ground surface. Uncontaminated water shall be added from the surface as needed to aid grout expansion.

(4) After 24 hours, the bentonite grout shall be retopped if it has settled below the ground surface.

*e.* Hydrologic monitoring system plan (HMSP). Unless otherwise approved by the department in writing, the number, spacing, and depth of groundwater monitoring points shall be:

(1) Determined based upon site-specific technical information, including but not limited to the soil and hydrogeologic investigation pursuant to subrule 113.6(3) and the site exploration and characterization report pursuant to subrule 113.6(4), that must include thorough characterization of:

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

2. Saturated and unsaturated geologic units and fill materials overlying the uppermost aquifer, materials comprising the uppermost aquifer, and materials comprising the confining unit defining the lower boundary of the uppermost aquifer, including, but not limited to: thicknesses, stratigraphy, lithology, hydraulic conductivities, porosities and effective porosities; and

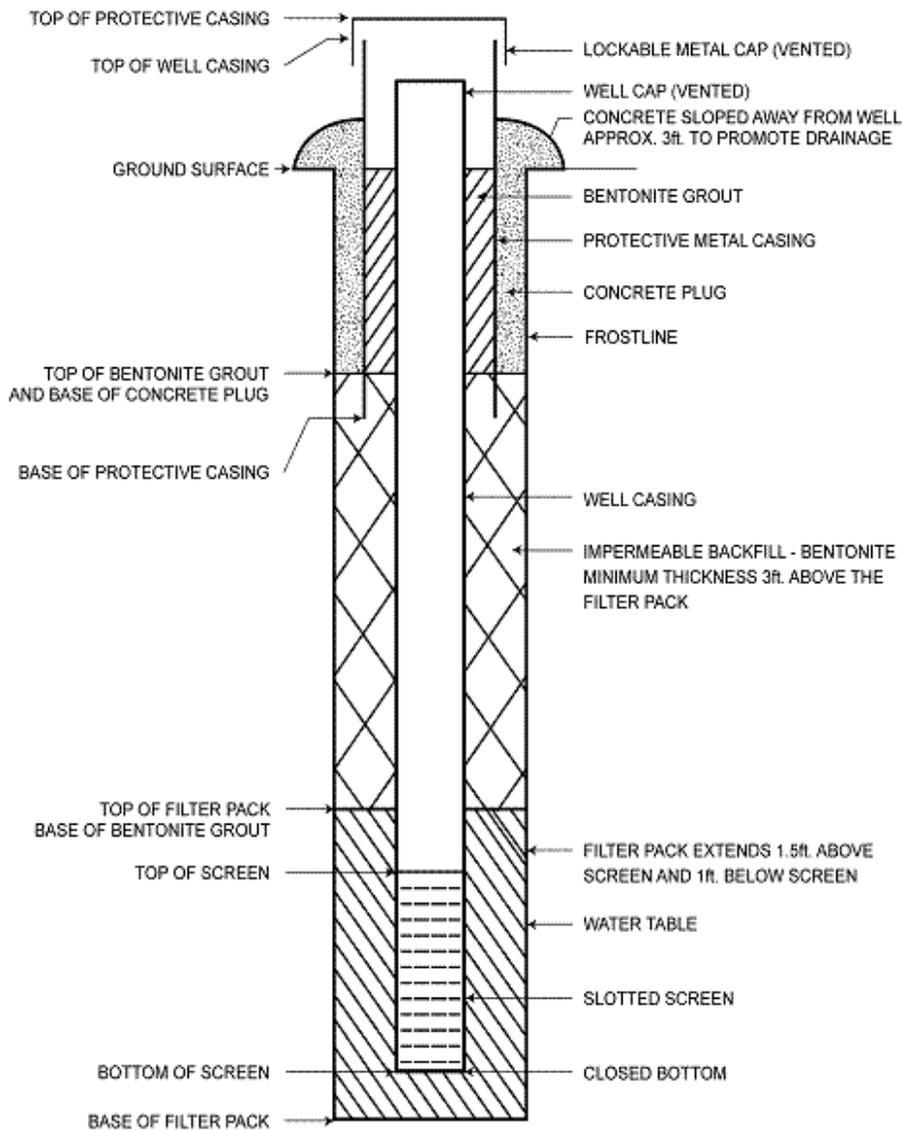
3. Projected paths and rates of movement of contaminants found in leachate pursuant to subparagraph 113.6(3)“e”(6).

(2) Designed and constructed with a maximum of 300 feet between downgradient groundwater monitoring wells, unless it is demonstrated by site-specific analysis or modeling that an alternative well spacing is justified. The convergence of groundwater paths to minimize the overall length of the downgradient dimension may be taken into consideration in the placement of downgradient monitoring wells provided that the groundwater monitoring system meets the requirements of paragraphs 113.10(2)“a,” 113.10(2)“c,” 113.10(2)“d,” and 113.10(2)“e.”

(3) Certified by a qualified groundwater scientist, as defined in paragraph 113.10(1)“d,” and approved by the department. Within 14 days of this certification and approval by the department, the owner or operator must notify the department that the certification has been placed in the operating record.

Figure 1

Typical Monitoring Well Cross Section



-- NOT TO SCALE --

f. Monitoring well maintenance and performance reevaluation plan. A monitoring well maintenance and performance reevaluation plan shall be included as part of the hydrologic monitoring system plan. The plan shall ensure that all monitoring points remain reliable. The plan shall provide for the following:

(1) A biennial examination of high and low water levels accompanied by a discussion of the acceptability of well location (vertically and horizontally) and exposure of the screened interval to the atmosphere.

(2) A biennial evaluation of water level conditions in the monitoring wells to ensure that the effects of waste disposal or well operation have not resulted in changes in the hydrologic setting and resultant flow paths.

(3) Measurements of well depths to ensure that wells are physically intact and not filling with sediment. Measurements shall be taken annually in wells which do not contain dedicated sampling pumps and every five years in wells containing dedicated sampling pumps.

(4) A biennial evaluation of well recharge rates and chemistry to determine if well deterioration is occurring.

**113.10(3) Surface water monitoring systems.** The department may require an MSWLF facility to implement a surface water monitoring program if there is reason to believe that a surface water of the state has been impacted as a result of facility operations (i.e., leachate seeps, sediment pond discharge) or a groundwater SSI over background has occurred.

a. A surface water monitoring program must be developed that consists of a sufficient number of monitoring points, designated at appropriate locations, to yield surface water samples that:

(1) Provide a representative sample of the upstream quality of a surface water of the state if the surface water being monitored is a flowing body of water.

(2) Provide a representative sample of the downstream quality of a surface water of the state if the surface water being monitored is a flowing body of water.

b. Surface water levels must be measured at a frequency specified in the facility's permit, within 1/10 of a foot at each surface water monitoring point immediately prior to sampling, each time surface water is sampled. The owner or operator must determine the rate and direction of surface water flow, if any, each time surface water is sampled. Surface water level and flow measurements for the same surface water of the state must be measured on the same day to avoid temporal variations that could preclude accurate determination of surface water flow and direction.

c. The owner or operator must notify and receive approval from the department for the designation or decommission of any surface water monitoring point, and must place that approval in the operating record.

d. The surface water monitoring points shall be designated to maintain sampling at that monitoring point throughout the life of the surface water monitoring program.

e. Each surface water monitoring point must have a unique and permanent number, and that number must never change or be used again at the MSWLF. Surface water monitoring points shall be identified by "SW# (Insert unique and permanent number)".

f. The number, spacing, and location of the surface water monitoring points shall be determined based upon site-specific technical information, including:

(1) Water level, including seasonal and temporal fluctuations in water level; and

(2) Flow rate and flow direction, including seasonal and temporal fluctuations in flow.

g. The MSWLF may discontinue the surface water monitoring program if monitoring data indicates that facility operations are not impacting surface water.

**113.10(4) Groundwater sampling and analysis requirements.**

a. The groundwater monitoring program must include consistent sampling and analysis procedures that are designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells installed in compliance with subrule 113.10(2). The groundwater monitoring program shall utilize a laboratory certified by the department. The owner or operator must notify the department that the sampling and analysis program documentation has been placed in the operating record, and the program must include procedures and techniques for:

(1) Sample collection;

(2) Sample preservation and shipment;

- (3) Analytical procedures;
- (4) Chain of custody control; and
- (5) Quality assurance and quality control.

*b.* The groundwater monitoring programs must include sampling and analytical methods that are appropriate for groundwater sampling and that accurately measure hazardous constituents and other monitoring parameters in groundwater samples. Groundwater samples shall not be field-filtered prior to laboratory analysis.

*c.* The sampling procedures and frequency must be protective of human health and the environment, and consistent with subrule 113.10(5).

*d.* Groundwater elevations must be measured at a frequency specified in the facility's permit, within 1/100 of a foot in each well immediately prior to purging, each time groundwater is sampled. The owner or operator must determine the rate and direction of groundwater flow each time groundwater is sampled. Groundwater elevations in wells which monitor the same waste management area must be measured within a period of time short enough to avoid temporal variations in groundwater flow which could preclude accurate determination of groundwater flow rate and direction.

*e.* The owner or operator must establish background groundwater quality in a hydraulically upgradient or background well(s) for each of the monitoring parameters or constituents required in the particular groundwater monitoring program that applies to the MSWLF unit, as determined under paragraph 113.10(5) "a" or 113.10(6) "a." Background groundwater quality may be established at wells that are not located hydraulically upgradient from the MSWLF unit if the wells meet the requirements of subparagraph 113.10(2) "a"(1).

*f.* The number of samples collected to establish groundwater quality data must be consistent with the appropriate statistical procedures determined pursuant to paragraph 113.10(4) "g." The sampling procedures shall be those specified under paragraphs 113.10(5) "b" for detection monitoring, 113.10(6) "b" and 113.10(6) "d" for assessment monitoring, and 113.10(7) "b" for corrective action.

*g.* The owner or operator must specify in the operating record which of the following statistical methods will be used in evaluating groundwater monitoring data for each hazardous constituent. The statistical test chosen shall be conducted separately for each hazardous constituent in each well.

(1) A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.

(2) An analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method must include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.

(3) A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.

(4) A control chart approach that gives control limits for each constituent.

(5) Another statistical test method that meets the performance standards of paragraph 113.10(4) "h." The owner or operator must place a justification for this alternative in the operating record and notify the department of the use of this alternative test. The justification must demonstrate that the alternative method meets the performance standards of paragraph 113.10(4) "h."

*h.* The statistical method required pursuant to paragraph 113.10(4) "g" shall comply with the following performance standards:

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

(2) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level not less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experimentwise error rate for each testing period shall be not less than 0.05; however, the Type I error level of not less than 0.01 for individual well comparisons must be maintained.

(3) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. The parameters shall be determined after the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern have been considered.

(4) If a tolerance interval or a predictional interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval must contain, shall be protective of human health and the environment. These parameters shall be determined after the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern have been considered.

(5) The statistical method shall account for data below the limit of detection (LD) by recording such data at one-half the limit of detection (i.e., LD/2) or as prescribed by the statistical method. Any practical quantitation limit (pql) that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.

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

*i.* The owner or operator must determine whether or not there is an SSI over background values for each parameter or constituent required in the particular groundwater monitoring program that applies to the MSWLF unit, as determined under paragraph 113.10(5) "a" or 113.10(6) "a."

(1) In determining whether an SSI has occurred, the owner or operator must compare the groundwater quality of each parameter or constituent at each monitoring well designated pursuant to subrule 113.10(2) to the background value of that constituent, according to the statistical procedures and performance standards specified under paragraphs 113.10(4) "g" and 113.10(4) "h."

(2) Within 45 days after completing sampling and analysis, the owner or operator must determine whether there has been an SSI over background at each monitoring well.

**113.10(5) Detection monitoring program.**

*a.* Detection monitoring is required at MSWLF units at all groundwater monitoring wells defined under subrule 113.10(2). At a minimum, a detection monitoring program must include the monitoring for the constituents listed in Appendix I and any additional parameters required by the department on a site-specific basis. An alternative list of constituents may be used if it can be demonstrated that the constituents removed are not reasonably expected to be in or derived from the waste contained in the unit and if the alternative list of constituents is expected to provide a reliable indication of leachate leakage or gas impact from the MSWLF unit.

(1) The department may establish an alternative list of inorganic indicator parameters for an MSWLF unit within Appendix I, in lieu of some or all of the heavy metals (constituents 1 to 15 in Appendix I), if the alternative parameters provide a reliable indication of inorganic releases from the MSWLF unit to the groundwater. In determining alternative parameters, the department shall consider the following factors:

1. The types, quantities and concentrations of constituents in wastes managed at the MSWLF unit;
2. The mobility, stability and persistence of waste constituents or their reaction products in the unsaturated zone beneath the MSWLF unit;
3. The detectability of indicator parameters, waste constituents and reaction products in the groundwater; and
4. The concentration or values and coefficients of variation of monitoring parameters or constituents in the groundwater background.

(2) Reserved.

b. The monitoring frequency for all constituents listed in Appendix I or in the alternative list approved in accordance with subparagraph 113.10(5)“a”(1) shall be at least semiannual (i.e., every six months) during the active life of the facility (including closure) and the postclosure period. Where insufficient background data exist, a minimum of five independent samples from each well, collected at intervals to account for seasonal and temporal variation, must be analyzed for the constituents in Appendix I or in the alternative list approved in accordance with subparagraph 113.10(5)“a”(1) during the first year. At least one sample from each well must be collected and analyzed during subsequent semiannual sampling events. The department may specify an appropriate alternative frequency for repeated sampling and analysis for constituents in Appendix I or in the alternative list approved in accordance with subparagraph 113.10(5)“a”(1) during the active life (including closure) and the postclosure care period. The alternative frequency during the active life (including closure) shall be not less than annually. The alternative frequency shall be based on consideration of the following factors:

- (1) Lithology of the aquifer and unsaturated zone;
- (2) Hydraulic conductivity of the aquifer and unsaturated zone;
- (3) Groundwater flow rates;
- (4) Minimum distance between upgradient edge of the MSWLF unit and downgradient monitoring well screen (minimum distance of travel); and
- (5) Resource value of the aquifer.

c. If the owner or operator determines, pursuant to paragraph 113.10(4)“i,” that there is an SSI over background for one or more of the constituents listed in Appendix I or in the alternative list approved in accordance with subparagraph 113.10(5)“a”(1) at any monitoring well specified under subrule 113.10(2), then the owner or operator:

- (1) Must, within 14 days of this finding, place a notice in the operating record indicating which constituents have shown statistically significant changes from background levels, and notify the department that this notice was placed in the operating record.

- (2) Must establish within 90 days an assessment monitoring program meeting the requirements of subrule 113.10(6) except as provided in subparagraph 113.10(5)“c”(3).

- (3) The owner or operator may demonstrate that a source other than an MSWLF unit caused the contamination or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration must be certified by a qualified groundwater scientist, approved by the department, and placed in the operating record. If resampling is a part of the demonstration, resampling procedures shall be specified prior to initial sampling. If a successful demonstration to the department is made and documented, the owner or operator may continue detection monitoring as specified in subrule 113.10(5). If, after 90 days, a successful demonstration is not made, the owner or operator must initiate an assessment monitoring program as required in subrule 113.10(6).

**113.10(6) Assessment monitoring program.**

a. Assessment monitoring is required whenever an SSI over background has been confirmed pursuant to paragraph 113.10(5)“c” to be the result of a release from the facility.

b. Within 90 days of triggering an assessment monitoring program, and annually thereafter, the owner or operator must sample and analyze the groundwater for all constituents identified in Appendix II. A minimum of one sample from each downgradient well shall be collected and analyzed during each sampling event. For any constituent detected in the downgradient wells as a result of the complete Appendix II analysis, a minimum of four independent samples from each well must be collected and analyzed to establish background for the constituents. The department may specify an appropriate subset of wells to be sampled and analyzed for Appendix II constituents during assessment monitoring. The department may delete any of the Appendix II monitoring parameters for an MSWLF unit if it can be shown that the removed constituents are not reasonably expected to be in or derived from the waste contained in the unit.

c. The department may specify an appropriate alternate frequency for repeated sampling and analysis for the full set of Appendix II constituents required by paragraph 113.10(6)“b” during the active life (including closure) and postclosure care period of the unit. The following factors shall be considered:

- (1) Lithology of the aquifer and unsaturated zone;

- (2) Hydraulic conductivity of the aquifer and unsaturated zone;
- (3) Groundwater flow rates;
- (4) Minimum distance between upgradient edge of the MSWLF unit and downgradient monitoring well screen (minimum distance of travel);
- (5) Resource value of the aquifer; and
- (6) Nature (fate and transport) of any constituents detected in response to this paragraph.

*d.* After obtaining the results from the initial or subsequent sampling events required in paragraph 113.10(6)“*b*,” the owner or operator must:

- (1) Within 14 days, place a notice in the operating record identifying the Appendix II constituents that have been detected and notify the department that this notice has been placed in the operating record;

- (2) Within 90 days, and on at least a semiannual basis thereafter, resample all wells specified by subrule 113.10(2) and conduct analyses for all constituents in Appendix I or in the alternative list approved in accordance with subparagraph 113.10(5)“*a*”(1), and for those constituents in Appendix II that are detected in response to the requirements of paragraph 113.10(6)“*b*.” Concentrations shall be recorded in the facility operating record. At least one sample from each well must be collected and analyzed during these sampling events. The department may specify an alternative monitoring frequency during the active life (including closure) and the postclosure period for the constituents referred to in this subparagraph. The alternative frequency for constituents in Appendix I or in the alternative list approved in accordance with subparagraph 113.10(5)“*a*”(1) during the active life (including closure) shall be no less than annual. The alternative frequency shall be based on consideration of the factors specified in paragraph 113.10(6)“*c*”;

- (3) Establish background concentrations for any constituents detected pursuant to paragraph 113.10(6)“*b*” or subparagraph 113.10(6)“*d*”(2); and

- (4) Establish groundwater protection standards for all constituents detected pursuant to paragraph 113.10(6)“*b*” or 113.10(6)“*d*.” The groundwater protection standards shall be established in accordance with paragraph 113.10(6)“*h*” or 113.10(6)“*i*.”

*e.* If the concentrations of all Appendix II constituents are shown to be at or below background values, using the statistical procedures in paragraph 113.10(4)“*g*” for two consecutive sampling events, the owner or operator must notify the department of this finding and may return to detection monitoring.

*f.* If the concentrations of any Appendix II constituents are above background values, but all concentrations are below the groundwater protection standard established under paragraph 113.10(6)“*h*” or 113.10(6)“*i*,” using the statistical procedures in paragraph 113.10(4)“*g*,” the owner or operator must continue assessment monitoring in accordance with this subrule.

*g.* If one or more Appendix II constituents are detected at statistically significant levels above the groundwater protection standard established under paragraph 113.10(6)“*h*” or 113.10(6)“*i*” in any sampling event, the owner or operator must, within 14 days of this finding, place a notice in the operating record identifying the Appendix II constituents that have exceeded the groundwater protection standard and notify the department and all other appropriate local government officials that the notice has been placed in the operating record. The owner or operator also:

- (1) Must, within 90 days of this finding, comply with the following requirements or the requirements in subparagraph 113.10(6)“*g*”(2):

1. Characterize the nature and extent of the release by installing additional monitoring wells as necessary until the horizontal and vertical dimensions of the plume have been defined to background concentrations;

2. Install at least one additional monitoring well at the facility boundary in the direction of contaminant migration and sample this well in accordance with subparagraph 113.10(6)“*g*”(2);

3. Notify all persons who own the land or reside on the land that directly overlies any part of the plume of contamination if contaminants have migrated off site when indicated by sampling of wells in accordance with subparagraph 113.10(6)“*g*”(1); and

4. Initiate an assessment of corrective measures as required by subrule 113.10(7).

- (2) May demonstrate that a source other than an MSWLF unit caused the contamination, or that the SSI resulted from error in sampling, analysis, statistical evaluation, or natural variation in groundwater quality. A report documenting this demonstration must be certified by a qualified groundwater scientist,

approved by the department, and placed in the operating record. If a successful demonstration is made, the owner or operator must continue monitoring in accordance with the assessment monitoring program pursuant to subrule 113.10(6), and may return to detection monitoring if the Appendix II constituents are at or below background as specified in paragraph 113.10(6)“e.” Until a successful demonstration is made, the owner or operator must comply with paragraph 113.10(6)“g” including initiating an assessment of corrective measures.

*h.* The owner or operator must establish a groundwater protection standard for each Appendix II constituent detected in the groundwater. The groundwater protection standard shall be:

(1) For constituents for which a maximum contaminant level (MCL) has been promulgated under Section 1412 of the Safe Drinking Water Act (codified) under 40 CFR Part 141, the MCL for that constituent;

(2) For constituents for which MCLs have not been promulgated, the background concentration for the constituent established from wells in accordance with subrule 113.10(2); or

(3) For constituents for which the background concentration is higher than the MCL identified under subparagraph 113.10(6)“h”(1) or health-based concentrations identified under paragraph 113.10(6)“i,” the background concentration.

*i.* The department may establish an alternative groundwater protection standard for constituents for which MCLs have not been established. These groundwater protection standards shall be appropriate health-based concentrations that comply with the statewide standards for groundwater established pursuant to 567—Chapter 137.

*j.* In establishing alternative groundwater protection standards under paragraph 113.10(6)“i,” the department may consider the following:

(1) The policies set forth by the Groundwater Protection Act;

(2) Multiple contaminants in the groundwater with the assumption that the effects are additive regarding detrimental effects to human health and the environment;

(3) Exposure threats to sensitive environmental receptors; and

(4) Other site-specific exposure or potential exposure to groundwater.

**113.10(7) Assessment of corrective measures.**

*a.* Within 90 days of finding that any of the constituents listed in Appendix II have been detected at a statistically significant level exceeding the groundwater protection standards defined under paragraph 113.10(6)“h” or 113.10(6)“i,” the owner or operator must initiate an assessment of corrective measures. Such an assessment must be completed and submitted to the department for review and approval within 180 days of the initial finding unless otherwise authorized or required by the department.

*b.* The owner or operator must continue to monitor in accordance with the assessment monitoring program as specified in subrule 113.10(6).

*c.* The assessment shall include an analysis of the effectiveness of potential corrective measures in meeting all of the requirements and objectives of the remedy as described under subrule 113.10(8), addressing at least the following:

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

(2) The time required to begin and complete the remedy;

(3) The costs of remedy implementation; and

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

*d.* Within 60 days of approval from the department of the assessment of corrective measures, the owner or operator must discuss the results of the corrective measures assessment, prior to the selection of a remedy, in a public meeting with interested and affected parties. The department may establish an alternative schedule for completing the public meeting requirement. Notice of public meeting shall be sent to all owners and occupiers of property adjacent to the permitted boundary of the facility, the department, and the department field office with jurisdiction over the facility. A copy of the minutes of this public

meeting and the list of community concerns must be placed in the operating record and submitted to the department.

**113.10(8)** *Selection of remedy.*

*a.* Based on the results of the corrective measures assessment conducted under subrule 113.10(7), the owner or operator must select a remedy within 60 days of holding the public meeting that, at a minimum, meets the standards listed in paragraph 113.10(8)“*b.*” The department may establish an alternative schedule for selecting a remedy after holding the public meeting. The owner or operator must submit a report to the department, within 14 days of selecting a remedy, describing the selected remedy, stating that the report has been placed in the operating record, and explaining how the selected remedy meets the standards in paragraph 113.10(8)“*b.*”

*b.* Remedies must:

- (1) Be protective of human health and the environment;
- (2) Attain the groundwater protection standards specified pursuant to paragraph 113.10(6)“*h*” or 113.10(6)“*i*”;
- (3) Control the source(s) of releases so as to reduce or eliminate, to the maximum extent practicable, further releases of Appendix II constituents into the environment that may pose a threat to human health or the environment; and
- (4) Comply with standards for management of wastes as specified in paragraph 113.10(9)“*d.*”

*c.* In selecting a remedy that meets the standards of paragraph 113.10(8)“*b.*” the owner or operator shall consider the following evaluation factors:

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

1. Magnitude of reduction of existing risks;
2. Magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of a remedy;
3. The type and degree of long-term management required, including monitoring, operation, and maintenance;
4. Short-term risks that might be posed to the community, workers, or the environment during implementation of such a remedy, including potential threats to human health and the environment associated with excavation, transportation, redisposal, or containment;
5. Time period until full protection is achieved;
6. Potential for exposure of humans and environmental receptors to remaining wastes, considering the potential threat to human health and the environment associated with excavation, transportation, redisposal, or containment;
7. Long-term reliability of the engineering and institutional controls; and
8. Potential need for replacement of the remedy.

(2) The effectiveness of the remedy in controlling the source to reduce further releases based on consideration of the following factors:

1. The extent to which containment practices will reduce further releases; and
2. The extent to which treatment technologies may be used.

(3) The ease or difficulty of implementing a potential remedy(ies) based on consideration of the following factors:

1. Degree of difficulty associated with constructing the technology;
2. Expected operational reliability of the technology;
3. Need to coordinate with and obtain necessary approvals and permits from other agencies;
4. Availability of necessary equipment and specialists; and
5. Available capacity and location of needed treatment, storage, and disposal services.

(4) Practicable capability of the owner or operator, including a consideration of technical and economic capabilities.

(5) The degree to which community concerns, including but not limited to the concerns identified at the public meeting required pursuant to paragraph 113.10(7)“*d.*” are addressed by a potential remedy(ies).

*d.* The owner or operator shall specify as part of the selected remedy a schedule(s) for initiating and completing remedial activities. Such a schedule must require the initiation of remedial activities within a reasonable period of time taking into consideration the factors set forth in subparagraphs 113.10(8) “*d*”(1) to (8). The owner or operator must consider the following factors in determining the schedule of remedial activities:

- (1) Extent and nature of contamination;
- (2) Practical capabilities of remedial technologies in achieving compliance with groundwater protection standards established under paragraph 113.10(6) “*h*” or 113.10(6) “*i*” and other objectives of the remedy;
- (3) Availability of treatment or disposal capacity for wastes managed during implementation of the remedy;
- (4) Desirability of utilizing alternative or experimental technologies that are not widely available, but which may offer significant advantages over already available technologies in terms of effectiveness, reliability, safety, or ability to achieve remedial objectives;
- (5) Potential risks to human health and the environment from exposure to contamination prior to completion of the remedy;
- (6) Resource value of the aquifer including:
  1. Current and future uses;
  2. Proximity and withdrawal rate of users;
  3. Groundwater quantity and quality;
  4. The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents;
  5. The hydrogeologic characteristics of the facility and surrounding land;
  6. Groundwater removal and treatment costs; and
  7. The cost and availability of alternative water supplies;
- (7) Practicable capability of the owner or operator; and
- (8) Other relevant factors.

**113.10(9)** *Implementation of the corrective action plan.*

*a.* Based on the schedule established under paragraph 113.10(8) “*d*” for initiation and completion of remedial activities, the owner or operator must:

- (1) Establish and implement a corrective action groundwater monitoring program that:
  1. At a minimum, meets the requirements of an assessment monitoring program under subrule 113.10(6);
  2. Indicates the effectiveness of the corrective action remedy; and
  3. Demonstrates compliance with groundwater protection standards pursuant to paragraph 113.10(9) “*e*”;
- (2) Implement the corrective action remedy selected under subrule 113.10(8); and
- (3) Take any interim measures necessary to ensure the protection of human health and the environment. Interim measures should, to the greatest extent practicable, be consistent with the objectives of and contribute to the performance of any remedy that may be required pursuant to subrule 113.10(8). The following factors must be considered by an owner or operator in determining whether interim measures are necessary:
  1. Time period required to develop and implement a final remedy;
  2. Actual or potential exposure of nearby populations or environmental receptors to hazardous constituents;
  3. Actual or potential contamination of drinking water supplies or sensitive ecosystems;
  4. Further degradation of the groundwater that may occur if remedial action is not initiated expeditiously;
  5. Weather conditions that may cause hazardous constituents to migrate or be released;
  6. Risk of fire or explosion, or potential for exposure to hazardous constituents as a result of an accident or the failure of a container or handling system; and
  7. Other factors that may pose threats to human health and the environment.

*b.* An owner or operator may determine, based on information developed after implementation of the remedy has begun or other information, that compliance with the requirements of paragraph 113.10(8) “*b*” is not being achieved through the remedy selected. In such cases, the owner or operator must notify the department and implement other methods or techniques that could practicably achieve compliance with the requirements, unless the owner or operator makes the determination under paragraph 113.10(9) “*c*.” The notification shall explain how the proposed alternative methods or techniques will meet the standards in paragraph 113.10(8) “*b*,” or the notification shall indicate that the determination was made pursuant to paragraph 113.10(9) “*c*.” The notification shall also specify a schedule(s) for implementing and completing the remedial activities to comply with paragraph 113.10(8) “*b*” or the alternative measures to comply with paragraph 113.10(9) “*c*.” Within 90 days of approval by the department for the proposed alternative methods or techniques or the determination of impracticability, the owner or operator shall implement the proposed alternative methods or techniques meeting the standards of paragraph 113.10(8) “*b*” or implement alternative measures meeting the requirements of subparagraphs 113.10(9) “*c*”(2) and (3).

*c.* If the owner or operator determines that compliance with requirements under paragraph 113.10(8) “*b*” cannot be practicably achieved with any currently available methods, the owner or operator must:

(1) Obtain certification of a qualified groundwater scientist and approval by the department that compliance with requirements under paragraph 113.10(8) “*b*” cannot be practicably achieved with any currently available methods;

(2) Implement alternate measures to control exposure of humans or the environment to residual contamination, as necessary to protect human health and the environment;

(3) Implement alternate measures for control of the sources of contamination, or for removal or decontamination of equipment, units, devices, or structures that are:

1. Technically practicable; and
2. Consistent with the overall objective of the remedy; and

(4) Notify the department within 14 days that a report justifying the alternate measures prior to implementation has been placed in the operating record.

*d.* All solid wastes that are managed pursuant to a remedy required under subrule 113.10(8), or an interim measure required under subparagraph 113.10(9) “*a*”(3), shall be managed in a manner:

- (1) That is protective of human health and the environment; and
- (2) That complies with applicable RCRA, state and local requirements.

*e.* Remedies selected pursuant to subrule 113.10(8) shall be considered complete when:

(1) The owner or operator complies with the groundwater protection standards established under paragraph 113.10(6) “*h*” or 113.10(6) “*i*” at all points within the plume of contamination that lie beyond the groundwater monitoring well system established under subrule 113.10(2).

(2) Compliance with the groundwater protection standards established under paragraph 113.10(6) “*h*” or 113.10(6) “*i*” has been achieved by demonstrating that concentrations of Appendix II constituents have not exceeded the groundwater protection standard(s) for a period of three consecutive years using the statistical procedures and performance standards in paragraphs 113.10(4) “*g*” and 113.10(4) “*h*.” The department may specify an alternative length of time during which the owner or operator must demonstrate that concentrations of Appendix II constituents have not exceeded the groundwater protection standard(s), taking into consideration:

1. The extent and concentration of the release(s);
2. The behavior characteristics of the hazardous constituents in the groundwater;
3. The accuracy of monitoring or modeling techniques, including any seasonal, meteorological, or other environmental variables that may affect accuracy; and
4. The characteristics of the groundwater.

(3) All actions required by the department to complete the remedy have been satisfied.

*f.* Upon completion of the remedy, the owner or operator must notify the department within 14 days that a certification has been placed in the operating record verifying that the remedy has been completed in compliance with the requirements of paragraph 113.10(9) “*e*.” The certification must be signed by the owner or operator and by a qualified groundwater scientist and approved by the department.

g. When, upon completion of the certification, the owner or operator determines that the corrective action remedy has been completed in accordance with the requirements under paragraph 113.10(9) "e," the owner or operator shall be released from the requirements for financial assurance for corrective action pursuant to subrule 113.14(5).

**113.10(10)** *Annual water quality reports.* The owner or operator shall submit an annual report to the department detailing the water quality monitoring sampling locations and results, assessments, selection of remedies, implementation of corrective action, and the results of corrective action remedies to address SSIs, if any, during the previous year. This report shall include a site map that delineates all monitoring points where water quality samples were taken, and plumes of contamination, if any. The report shall contain a narrative explaining and interpreting all of the data collected during the previous year. The report shall be due each year on a date set by the department in the facility's permit.