

3745-30-08

Ground water monitoring program.**(A) Applicability.**

- (1) The owner or operator, of any new residual or industrial solid waste landfill facility, of all lateral and vertical expansions of any existing residual or industrial solid waste landfill facility, of any facility where the owner or operator is required to submit a permit to install application in response to division (A)(3) or (A)(4) of section 3734.05 of the Revised Code, and of any landfill facility undergoing closure according to rule 3745-30-09 of the Administrative Code or rule 3745-29-11 of the Administrative Code, shall implement and maintain a ground water monitoring program capable of determining the impact of the landfill facility on the quality of ground water occurring within the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system underlying the landfill facility. The ground-water monitoring program shall comply with paragraphs (B) to (F) of this rule and shall be protective of human health and safety and the environment. The ground water monitoring program shall be documented as a written ground water monitoring program plan and submitted to the director as part of a landfill facility's permit to install application or closure plan. The ground water monitoring program plan shall describe the owner or operator's program and how the plan complies with this rule. The ground water monitoring program shall be implemented when the director issues final approval of the permit to install application or closure plan. The owner or operator shall use the methods documented in the plan. Changes to an approved plan shall be submitted to Ohio EPA sixty days before implementation of those changes.

- (2) The owner or operator of an industrial solid waste landfill facility, permitted and operating under Chapter 3745-29 of the Administrative Code, subject to any operational requirements in rule 3745-29-19 of the Administrative Code, subject to any closure requirements in rule 3745-29-11 of the Administrative Code, or subject to any post-closure requirements in rule 3745-29-14 of the Administrative Code, shall comply with the requirements of this rule and as follows:
 - (a) A ground water monitoring plan previously submitted as part of an industrial solid waste landfill facility permit to install or closure plan shall be revised to comply with this rule and submitted to Ohio EPA within two hundred seventy days after the effective date of this rule. The previously submitted plan shall remain in effect until sixty days after the revised plan is submitted.

 - (b) Unless otherwise ordered, an alternate parameter list previously approved by the director or his authorized representative shall remain in effect.

[Comment: The owner/operator of an industrial solid waste landfill regulated under rule 3745-29-10 of the Administrative Code is only required to revise the portions of their current ground water monitoring plan that do not comply with this rule and are not required to submit a whole new plan. All variance approvals issued per rule 3745-29-10 of the Administrative Code continue in effect.]

- (c) A permit applicant acting to comply with paragraph (C)(3)(e) of rule 3745-29-06 of the Administrative Code shall analyze the ground water for all of the parameters in paragraph (H) in appendix III C(H) of to this rule.
- (d) An owner or operator acting to comply with paragraph (M)(5) of rule 3745-29-19 of the Administrative Code shall analyze the leachate for all of the parameters in paragraph (H) in appendix III C (H) of to this rule.

(B) Monitoring system.

- (1) The ground water monitoring system shall include a sufficient number of wells, installed at appropriate locations and depths, to yield ground water samples from both the uppermost aquifer system and any significant zones of saturation that exist above the uppermost aquifer system that do the following:
 - (a) Represent the quality of the ground water that has not been affected by past or present operations at the landfill facility.
 - (b) Represent the quality of the ground water passing directly downgradient of the limits of solid waste placement.
 - (c) Based on site-specific situations, surface water monitoring of seeps, springs, or streams in addition to or as a partial alternative to the ground water monitoring may be proposed by the owner or operator or may be required by the director.

[Comment: The director's authorization to conduct surface water monitoring under this rule should include provisions for: sampling procedures; constituents to be analyzed; and analyzing the resulting data.]

- (2) Where the uppermost aquifer system exists more than one hundred fifty feet beneath base of the waste or the recompacted clay liner of the landfill facility,

the ground water monitoring system shall consist of a sufficient number of wells, installed at appropriate locations and depths, to yield ground water samples from an adequate number of significant zones of saturation, in accordance with paragraphs (B)(1)(a) and (B)(1)(b) of this rule, to ensure detection of any contaminant release from the facility.

- (3) All monitoring wells, included in the ground water monitoring program shall be designed, installed, and developed in a manner that allows the collection of ground water samples that are representative of ground water quality in the geologic unit being monitored, and in accordance with the following criteria:
 - (a) Monitoring wells shall be cased in a manner that maintains the integrity of the monitoring well boreholes.
 - (b) The annular space (i.e., the space between the borehole and the well casing) above the sampling depth shall be sealed to prevent the contamination of the samples and the ground water.
 - (c) The casing shall be screened or perforated and surrounded by sand or gravel in such a way that allows for the following:
 - (i) For the minimization of the passage of formation materials into the well.
 - (ii) For the monitoring of discrete portions of the uppermost aquifer system or any significant zones of saturation above the uppermost aquifer system.
 - (d) The design, installation, development, maintenance procedures, and abandonment of any monitoring wells, piezometers, and other measurement, sampling, and analytical devices shall be documented in the ground water monitoring program plan.
 - (e) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices shall be operated and maintained to perform to design specifications throughout the life of the ground water monitoring program.
 - (f) Monitoring wells constructed or used for the purposes of this rule are not required to comply with Chapter 3745-9 of the Administrative Code.
- (4) The number, spacing, and depth of ground water monitoring wells, included in

the ground-water monitoring system shall be as follows:

- (a) Based on site-specific hydrogeologic information.
 - (b) Capable of detecting a release from the landfill facility to the ground water at the closest practicable location to the limits of solid waste placement.
- (5) Unless the ground water is monitored to satisfy the requirements of paragraphs (E) and (F) of this rule, the owner or operator shall, at least annually, evaluate the ground water surface elevation data obtained in accordance with paragraph (C)(2) of this rule to determine whether the requirements of paragraph (B) of this rule for locating the monitoring wells continue to be satisfied. The results of this evaluation shall be included in the report required in accordance with rule 3745-30-14 of the Administrative Code. If the evaluation shows that paragraph (B) of this rule is no longer satisfied, the owner or operator shall immediately modify the number, location, and/or depth of the monitoring wells to bring the ground-water monitoring system into compliance with this requirement.

(C) Sampling, analysis, and statistical methods.

- (1) The ground water monitoring program shall include consistent sampling and analysis procedures that are protective of human health and safety and the environment and that are designed to ensure monitoring results that provide an accurate representation of ground water quality at the background and downgradient wells installed in accordance with paragraph (B) of this rule. Sampling and analysis procedures employed in the ground water monitoring program shall be documented in a sampling and analysis plan which shall be included in the ground water monitoring program plan required by paragraph (A) of this rule, and which shall also be available for inspection at the landfill facility. The owner or operator shall use the methods documented in the sampling and analysis plan. Changes to the plan shall be submitted to Ohio EPA sixty days before implementation. This plan shall, at a minimum, include a detailed description of the equipment, procedures, and techniques to be used for the following:
 - (a) Measurement of ground water elevations.
 - (b) Collection of ground water samples, including the following:
 - (i) Well evacuation.

- (ii) Sample withdrawal.
 - (iii) Sample containers and handling.
 - (iv) Sample preservation.
 - (c) Performance of field analysis, including the following:
 - (i) Procedures and forms for recording raw data and the exact location, time, and facility-specific conditions associated with the data acquisition.
 - (ii) Calibration of field devices.
 - (d) Decontamination of equipment.
 - (e) Analysis of ground water samples.
 - (f) Chain of custody control, including the following:
 - (i) Standardized field tracking reporting forms to record sample custody in the field prior to and during shipment.
 - (ii) Sample labels containing all information necessary for effective sample tracking.
 - (g) Field and laboratory quality assurance and quality control, including the following:
 - (i) Collection of replicate samples.
 - (ii) Submission of field-bias blanks.
 - (iii) Potential interferences.
- (2) Ground water elevations shall be measured within a single twenty-four-hour period in all monitoring wells at least semi-annually and in each well prior to purging and sampling. The owner or operator shall determine, for the uppermost aquifer system and for all significant zones of saturation

monitored, the direction of ground-water flow at least semi-annually. The ground water elevations and direction(s) of flow shall be shown on a potentiometric map(s) submitted with the sampling data.

- (3) The owner or operator shall establish background ground water quality, unless the exception in paragraph (C)(4) of this rule applies, by analyzing ground water samples collected from hydraulically upgradient well(s) for each of the monitoring parameters or constituents required in the particular ground water monitoring program that applies to the landfill facility as determined by paragraph (D), (E), or (F) of this rule.
- (4) Background ground water quality at existing landfill facilities may be based on sampling of wells that are not hydraulically upgradient where the following occur:
 - (a) Hydrogeologic conditions do not allow the owner or operator to determine which wells are upgradient.
 - (b) Sampling of other wells will provide an indication of background ground water quality that is as representative or more representative than that provided by upgradient wells.
- (5) The owner or operator shall, within ninety days of obtaining the final sample which completes the initial year of ground water monitoring, specify one of the following statistical methods to be used in evaluating ground water monitoring data. The statistical method chosen shall be conducted separately for each of the parameters required to be statistically evaluated in paragraph (D)(4) of this rule. The statistical method specified shall ensure protection of human health and safety and the environment and shall comply with the performance standards outlined in paragraph (C)(6) of this rule. The statistical method specified shall be selected from the following:
 - (a) A tolerance or prediction interval procedure in which an interval for each parameter is established from the distribution of the background data, and the level of each parameter in each monitoring well is compared to the upper tolerance or prediction limit.
 - (b) A control chart approach that gives control limits for each parameter.
 - (c) A parametric analysis of variance ("ANOVA") followed by multiple comparisons procedures to identify statistically significant evidence of contamination. This shall include estimation and testing of the contrasts

between each monitoring well's mean and the background mean levels for each parameter.

- (d) An analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. This shall include estimation and testing of the contrasts between each monitoring well's median and the background medial levels for each parameter.
 - (e) Another statistical test method submitted by the owner or operator and approved by the director or his authorized representative.
- (6) Any statistical method chosen in accordance with paragraph (C)(5) of this rule shall comply with the following performance standards as appropriate:
- (a) The statistical method used to evaluate ground water monitoring data shall be appropriate for the distribution of chemical parameters or waste-derived constituents. If the distribution of the chemical parameters or waste-derived constituents is shown by the owner or operator to be inappropriate for a normal theory test, then the data should be transformed or a distribution free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed.
 - (b) If an individual well comparison procedure is used to compare an individual monitoring well constituent concentration with background constituent concentrations or a ground water concentration level, the test shall be conducted at a type I error level not less than 0.01 for each testing period. If multiple comparisons procedures are used, the type I experimentwise error rate for each testing period shall be not less than 0.05; however, the type I error rate of not less than 0.01 for individual monitoring well comparisons shall be maintained. This performance standard does not apply for tolerance intervals, prediction intervals, or control charts.
 - (c) If a control chart approach is used to evaluate ground water monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and safety and the environment. The parameter values shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration values for each parameter.

- (d) If a tolerance interval or a prediction interval is used to evaluate ground water monitoring data, then the levels of confidence and the percentage of the population contained in any tolerance or prediction interval shall be protective of human health and safety and the environment. These statistical parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.
 - (e) The statistical method shall account for data below the limit of detection with one or more statistical procedures that ensure protection of human health and safety and the environment. Any practical quantitation limit (PQL) used in the statistical method shall be the lowest concentration level that can be reliably achieved within the specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.
 - (f) 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.
 - (g) Background data can be added only in blocks of data resulting from the analysis of four or more statistically independent samples after the data have been statistically compared to the current background data and no statistical differences are detected, unless another method is deemed acceptable to the director.
 - (h) Prior to initially using an intra-well statistical method for the detection monitoring program, the owner or operator shall demonstrate the ground water is not impacted by a release from the landfill facility within the relevant well(s), unless approved otherwise by Ohio EPA.
- (7) The owner or operator shall determine whether or not there is a statistically significant increase (or change in the case of pH) from background values for each parameter or constituent required by paragraph (D), (E), or (F) of this rule, as applicable. The owner or operator shall make this statistical determination either semi-annually, if paragraph (D) of this rule applies, or as specified in the ground water quality assessment plan required by paragraph (E) of this rule if that paragraph applies, or as specified by the director in the corrective measure selected in accordance with paragraph (F) of this rule if that paragraph applies. To determine whether a statistically significant increase or decrease has occurred, the owner or operator shall compare the ground water quality of each parameter or constituent at each downgradient ground water monitoring well to the background value of that parameter or

constituent according to the statistical procedures specified in paragraphs (C)(5) and (C)(6) of this rule.

- (8) All ground water analysis results, statistical analysis results, and ground-water elevation data generated in accordance with paragraphs (C), (D), (E), and (F) of this rule shall be submitted to Ohio EPA not later than seventy-five days after sampling the well. All ground water data and accompanying text shall be submitted on a form specified by the director.

(D) Detection monitoring.

- (1) The owner or operator shall determine the concentration or value of the applicable parameters from the applicable list(s) in appendix ~~HHC~~ ofo this rule for the owner or operator's waste(s). The concentration or value shall be determined in accordance with paragraphs (D)(3) to (D)(6) of this rule.
- (2) The owner or operator of a residual or industrial waste landfill may propose an alternate list of parameters to meet the requirements of paragraphs (D)(3) to (D)(6) of this rule. The list of alternate parameters shall be submitted by the owner or operator and approved by the director prior to use. The alternate parameter list shall be indicative of the waste stream(s) deposited at the landfill facility and shall be protective of human health and safety and the environment. In proposing the alternate parameter list, the owner or operator shall, at a minimum, specify the following:
 - (a) The parameters to be analyzed in the ground water samples during the initial year of ground water monitoring in accordance with paragraph (D)(3) of this rule.
 - (b) The parameters to be analyzed in the ground water samples at least semi-annually in accordance with paragraph (D)(4) of this rule.
 - (c) The parameters to be analyzed in the ground water samples at least annually after the initial year in accordance with paragraph (D)(5) of this rule.
 - (d) The parameters specified in paragraph (D)(2)(b) of this rule to have their analytical results statistically evaluated in accordance with paragraph (D)(4) of this rule.
 - (e) The chemical composition of the solid waste(s) which have been, and are to be, deposited at the landfill facility.

- (f) The chemical composition of leachate, if available, from an existing landfill facility being used to dispose of a similar waste(s).
- (g) Any other relevant information that the director deems necessary.
- (3) During the initial year of ground water monitoring, which shall commence prior to waste placement for newly permitted landfill facilities, the initial background concentrations or values shall be established for the background water quality parameters specified either in appendix ~~HHC~~ to this rule for the owner or operator's waste(s) or in the alternate parameter list approved in accordance with paragraph (D)(2) of this rule. The sampling frequency shall be at least quarterly for the initial year of ground water monitoring. The number and kinds of samples collected to establish background water quality for those background water quality parameters which are also listed as indicator parameters for the owner or operator's waste(s) in appendix ~~HHC~~ to this rule, shall be consistent with the appropriate statistical procedures employed pursuant to paragraphs (C)(5) and (C)(6) of this rule. The sample size shall be as large as necessary to ensure with reasonable confidence that a contaminant release from the facility will be detected. The sampling frequency shall assure, to the greatest extent technically feasible, that an independent sample is obtained, by reference to the monitored zone of saturation, effective porosity, hydraulic conductivity, hydraulic gradient, and the fate and transport characteristics of the potential contaminants.
- (4) After the initial year, all monitoring wells shall be sampled at least semi-annually and the samples analyzed for the indicator parameters specified either in appendix ~~HHC~~ to this rule for the owner or operator's waste(s) or in the alternate parameter list approved in accordance with paragraph (D)(2) of this rule. The owner or operator shall statistically analyze the results for these required indicator parameters in accordance with paragraph (C)(7) of this rule. The number and kinds of samples collected shall be consistent with the statistical method used to analyze the data and shall be as often as necessary to ensure, with reasonable confidence, that a contaminant release to the ground water from the facility will be detected.
- (5) After the initial year, all monitoring wells shall be sampled at least annually and the samples analyzed for the water quality annual parameters specified either in appendix ~~HHC~~ to this rule for the owner or operator's waste(s) or in the alternate parameter list approved in accordance with paragraph (D)(2) of this rule.
- (6) Ground water samples shall be field analyzed for temperature, specific conductance, and pH whenever a sample is withdrawn from a monitoring

well.

- (7) An alternative frequency for ground water sampling and/or statistical analysis required by paragraph (D)(5) of this rule may be proposed, in writing, by the owner or operator during the active life (including final closure) of a landfill facility and the post-closure care period. The director or his authorized representative may approve a proposed alternative frequency provided that the alternative sampling frequency and/or analysis frequency is not more than annually. Upon approval by the director or his authorized representative, the owner or operator may use the alternative sampling/analysis frequency. The owner or operator shall, at a minimum, consider the following factors in proposing an alternative sampling and/or analysis frequency:
- (a) Lithology of the aquifer system and all stratigraphic units above the uppermost aquifer system.
 - (b) Hydraulic conductivity of the uppermost aquifer system and all stratigraphic units above the uppermost aquifer system.
 - (c) Ground water flow rates for the uppermost aquifer system and all zones of saturation above the uppermost aquifer system.
 - (d) Minimum distance between the upgradient edge of the limits of waste placement of the landfill facility and the downgradient monitoring well system.
 - (e) Resource value of the uppermost aquifer system.
- (8) If at any monitoring well, the owner or operator determines, for two consecutive semi-annual statistical determination periods, that there has been a statistically significant increase (or change in the case of pH) from background values for one or more of the applicable indicator parameters specified in appendix ~~HHC~~ ~~of~~ ~~to~~ this rule according to the statistical method specified by the owner or operator pursuant to paragraphs (C)(5), (C)(6), and (D)(9) of this rule, the owner or operator shall notify Ohio environmental protection agency not later than fifteen days after receiving the second period's statistical or analytical results which indicate a statistically significant change. The notification must indicate which parameters have shown a statistically significant change from background levels.
- (9) The owner or operator may demonstrate that a source other than the landfill facility is the cause of the contamination or that the statistically significant

increase results from error in the sampling, analysis, or statistical evaluation, or from natural variation in ground water quality.

- (a) When resampling demonstrates the increase to be an error, the resampling results shall be submitted to Ohio EPA in accordance with paragraph (C)(8) of this rule. If the owner or operator demonstrates using a resampling method that the statistically significant increase over background was a false positive, then the owner or operator may return to detection monitoring. The owner or operator shall comply with paragraphs (D)(8) to (D)(12) of this rule until this demonstration is submitted.
 - (b) When the owner or operator demonstrates that the statistically significant increase to be an error in statistical procedure or from natural variation in ground water quality, a report documenting this demonstration shall be submitted as an addendum to the results and data required in paragraph (C)(8) of this rule for approval by the director or his authorized representative. The owner or operator shall comply with paragraphs (D)(8) to (D)(12) of this rule until the demonstration report is approved.
- (10) The owner or operator shall, within fifteen days of notifying Ohio EPA in accordance with paragraph (D)(8) of this rule, sample the leachate and/or the affected well(s) and analyze for constituents as follows:
- (a) For facilities with leachate collection systems completely or partially underlying the waste disposal area, comply with one of the following:
 - (i) For facilities not characterizing their leachate, class I residual waste facilities, and industrial solid waste facilities, the leachate collection system shall be sampled and analyzed for those parameters listed in appendix ~~HB~~ ~~oft~~ rule 3745-27-10 of the Administrative Code and then within seventy-five days of sampling the leachate collection system, the affected well(s) shall be sampled and analyzed for the waste-derived constituents detected in the sample(s) from the leachate collection system, unless otherwise approved by the director or his authorized representative.
 - (ii) For class II, III, and IV residual waste facilities with previously characterized leachate in accordance with paragraph (F) of rule 3745-30-03 of the Administrative Code, rule 3745-30-04 of the Administrative Code, or rule 3745-30-14 of the Administrative

Code, the affected well(s) shall be sampled and analyzed for all waste-derived constituents that have been detected and reported in the leachate.

- (b) For facilities without leachate collection systems comply with one of the following:
- (i) For facilities not characterizing their leachate, class I residual waste facilities, and industrial solid waste facilities, the affected well(s) shall be sampled and analyzed for those parameters listed in appendix ~~HB~~ of to rule 3745-27-10 of the Administrative Code, unless otherwise approved by the director or his authorized representative.
 - (ii) For class II, III, and IV residual waste facilities, the affected well(s) shall be sampled and analyzed for those parameters listed in appendix ~~HB~~ of to this rule, unless otherwise approved by the director or his authorized representative.
- (11) The owner or operator shall, within ninety days of sampling the affected well(s) in accordance with paragraph (D)(10) of this rule, sample all background wells for all waste-derived constituents detected in the samples from the affected well(s).
- (12) The owner or operator shall, within ninety days of sampling the background wells as required by paragraph (D)(11) of this rule, sample all monitoring wells not sampled in accordance with the provisions of paragraphs (D)(10) and (D)(11) of this rule and those samples shall be analyzed for those waste-derived constituents found to be above background levels in the affected monitoring wells sampled in accordance with paragraph (D)(10) of this rule.
- (13) If the owner or operator determines, based on the results of the sampling required by paragraph (D)(10), (D)(11), or (D)(12) of this rule, that there has not been an increase above background levels of waste-derived constituents at any monitoring well downgradient of the facility, then the owner or operator shall request that the director approve reinstatement of the detection monitoring program described in paragraphs (C) and (D)(1) to (D)(8) of this rule. Until the director or his authorized representative approves reinstatement of the detection monitoring program, the owner or operator shall continue to comply with paragraphs (D)(10) to (D)(12) and (E) of this rule.
- (14) The director may consider the following information submitted by the owner

or operator when evaluating a request made under paragraphs (D)(13), (E)(5), and (E)(7) of this rule:

- (a) The type of constituents and concentrations found in ground water monitoring wells at the facility;
- (b) The ground water use and quality in the vicinity of the facility; and
- (c) Potential threats to human health or safety and the environment.

(E) Assessment

(1) The owner or operator shall, within one hundred eighty days of conducting the sampling required under paragraph (D)(12) of this rule, submit to Ohio EPA and implement a specific plan for a ground water quality assessment program to determine the concentration and the rate and extent of migration of waste-derived constituents in the ground water at the landfill facility. This plan shall, at a minimum, include:

- (a) A summary of the hydrogeologic conditions at the landfill facility; and
- (b) A description of the detection monitoring program implemented by the landfill facility, including:
 - (i) The number, location, depth, and construction of detection monitoring wells with documentation; and
 - (ii) A summary of detection monitoring ground water analytical data; and
 - (iii) A summary of statistical analyses applied to the data; and
- (c) A detailed description of the investigatory approach to be followed during the assessment, including but not limited to:
 - (i) The proposed number, location, depth, installation method, and construction of assessment monitoring wells; and
 - (ii) The proposed method(s) for gathering additional hydrogeologic information; and

- (iii) The planned use of supporting methodology (i.e., soil gas or geophysical survey(s)); and
 - (d) A detailed description of the techniques, procedures, and analytical equipment to be used for ground water sampling during the assessment, including but not limited to, the items listed in paragraphs (C)(1)(a) to (C)(1)(g) of this rule.
 - (e) A detailed description of the data evaluation procedures to be used, including but not limited to:
 - (i) Planned use of statistical data evaluation; and
 - (ii) Planned use of computer models; and
 - (iii) Planned use of previously gathered information; and
 - (iv) Criteria which will be utilized to determine if additional assessment activities are warranted; and
 - (f) A schedule of implementation.
- (2) The owner or operator shall implement the ground water quality assessment plan which satisfies the requirements of paragraph (E)(1) of this rule to determine The concentrations and the rate and extent of migration of the waste-derived constituents in the ground water. The owner or operator shall make this determination within the time frame specified in the submitted ground water quality assessment plan. The owner or operator shall submit to Ohio EPA, not later than fifteen days after making this determination, a written report containing an assessment of the ground water quality including all data generated as part of implementation of the ground water quality assessment plan.
- (3) All monitoring wells not affected by the ground water quality assessment program required by paragraph (E) of this rule shall be monitored in accordance with paragraphs (C) and (D) of this rule.
- (4) The owner or operator shall Analyze on a semiannual basis the applicable indicator parameters in appendix ~~HIC~~ of to this rule and those constituents determined to be released and on an annual basis all the parameters applicable for the facility in appendix ~~HIC~~ to this rule until relieved by the director in

accordance with paragraph (D)(9), (E)(5), or (F)(16) of this rule.

- (5) If the owner or operator determines, based on the results of the determination made according to paragraph (E)(2) of this rule, that no waste-derived constituents from the facility have entered the ground water, then the owner or operator shall request that the director approve reinstatement of the detection monitoring program described in paragraphs (C) and (D) of this rule. Until the director approves reinstatement of the detection monitoring program, the owner or operator shall comply with paragraphs (E)(6) and (F) of this rule.
- (6) If the owner or operator determines, based on the determination made according to paragraph (E)(2) of this rule, that waste-derived constituents from the facility have entered the ground water, then the owner or operator shall continue to make the determination required in accordance with paragraph (E)(2) of this rule on a semiannual basis until released from this obligation by the director or unless an alternate time interval is established by the director.
- (7) If the owner or operator determines, based on the determination made according to paragraph (E)(2) of this rule, that waste-derived constituents from the facility have entered the ground water, then the owner or operator may, prior to meeting the requirements of paragraph (F) of this rule, request that the director approve a compliance monitoring program at the facility. Any request made under this paragraph shall include a description of the compliance monitoring program including the following:
 - (a) The monitoring wells to be included in the compliance monitoring program.
 - (b) The constituents for which ground water samples will be analyzed and the proposed concentration level for each constituent, which shall act as a ground water trigger level. The ground water trigger levels shall be established using the criteria described in paragraph (F)(5) of this rule.
 - (c) The sampling, at least annually, of all compliance monitoring wells and background wells for all waste-derived constituents.
 - (d) The techniques, procedures, and analytical equipment to be used for ground water sampling including, but not limited to, the items listed in paragraphs (C)(1)(a) to (C)(1)(g) of this rule.
 - (e) The sampling of all compliance wells specified under paragraph (E)(7)(a)

of this rule at least semi-annually and the analysis of those samples for those constituents specified under paragraph (E)(7)(b) of this rule. The frequency of sampling shall be consistent with the statistical method used to analyze the data and shall be determined based on the criteria listed in paragraph (D)(4) of this rule.

- (f) A description of the statistical method to be used in evaluating the ground water analytical data generated under paragraph (E)(7)(e) of this rule. The statistical method shall be selected from those statistical methods contained in paragraph (C)(5) of this rule and shall meet all criteria listed in paragraphs (C)(5) and (C)(6) of this rule.
- (g) Provisions for determining, at least semi-annually, if there has been a statistically significant increase above the trigger levels for those constituents specified under paragraph (E)(7)(b) of this rule. This determination shall be consistent with the criteria stated in paragraph (C)(7) of this rule.
- (h) Provisions for controlling the source(s) of releases in order to reduce or eliminate, to the extent practicable, further releases of waste-derived constituents into the environment.
- (i) Provisions for submitting a corrective measures plan in accordance with paragraph (F) of this rule if a statistically significant increase above the trigger levels for those constituents specified under paragraph (E)(7)(b) of this rule is detected and confirmed.

(F) Corrective measures.

- (1) Unless excused in accordance with paragraph (E)(5) or (E)(7) of this rule, the owner or operator shall submit a corrective measures study to the director not later than one hundred eighty days after making the determination in accordance with paragraph (E)(2) of this rule, or not later than one hundred eighty days after submitting a request in accordance with paragraph (E)(7) of this rule. This study shall evaluate all practicable remediation procedures which are available for remediating any contamination discovered during the ground water quality assessment. The evaluated remediation procedures shall, at a minimum do the following:
 - (a) Be protective of human health and safety and the environment.
 - (b) Attain the proposed ground water concentration levels specified in

accordance with paragraph (F) of this rule.

- (c) Control the source(s) of releases to reduce or eliminate, to the extent practicable, further releases of waste-derived constituents into the environment.
 - (d) Comply with standards for management of wastes as specified in paragraph (F)(13) of this rule.
- (2) The owner or operator shall evaluate each proposed remediation procedure within the corrective measures study. This evaluation shall, at a minimum, consider the following:
- (a) Any potential remediation procedure, which shall be assessed for the long-term and short-term effectiveness and the protection it affords. This shall include the degree of certainty that the remediation procedure will prove successful. Factors to be considered include the following:
 - (i) Magnitude of reduction of existing risks.
 - (ii) Magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of a remediation procedure.
 - (iii) The type and degree of long-term management required, including monitoring, operation, and maintenance.
 - (iv) Short-term risks that may affect the community, workers, or the environment during implementation of such a remediation procedure, including potential threats to human health and safety and the environment associated with excavation, transportation, redisposal, or containment.
 - (v) Potential for human and environmental receptor exposure to remaining wastes, considering the potential threat to human health and safety and the environment associated with excavation, transportation, redisposal, or containment.
 - (vi) Long-term reliability of the engineering and institutional controls.
 - (vii) Potential need for replacement of the remediation procedure.

- (b) The effectiveness of the remediation procedure in controlling the source in order to reduce further releases, including the following:
 - (i) The extent to which containment practices will reduce further releases.
 - (ii) The extent to which treatment technologies may be used.
- (c) The need to coordinate with, and obtain necessary approvals and permits from, other agencies.
- (d) The available capacity and location of needed treatment, storage, and disposal services.
- (e) The performance, reliability, ease of implementation, and potential impacts of the potential remediation procedures, including safety impacts, cross-media impacts, and control of exposure to any residual contamination.
- (f) A schedule for initiating and completing each remediation procedure discussed in the study. In establishing this schedule, the owner or operator shall consider the following:
 - (i) The extent and nature of any contamination.
 - (ii) The practical capability of remedial technologies to achieve compliance with ground water concentration levels established in accordance with paragraph (F)(6) of this rule and other objectives of the remediation procedure.
 - (iii) The availability of treatment or disposal capacity for wastes managed during implementation of the remediation procedure.
 - (iv) The desirability of utilizing technologies that are not currently available, but which may offer significant advantages over currently available technologies in terms of protection, reliability, safety, or the ability to achieve remedial objectives.
 - (v) Potential risks to human health and safety and the environment from contaminant exposure prior to completion of the remediation

procedure.

(vi) Practicable capability of the owner or operator.

(vii) Other relevant factors.

(g) Resource value of the aquifer system, including the following:

(i) Current and future uses.

(ii) Proximity and withdrawal rate of users.

(iii) Ground water quantity and quality.

(iv) The potential damage to wildlife, crops, vegetation, and physical structures resulting from exposure to waste constituents.

(v) The hydrogeologic characteristics of the facility and surrounding area.

(vi) Ground water removal and treatment costs.

(vii) The cost and availability of alternate water supplies.

(3) Unless excused in accordance with paragraph (E)(5) or (E)(7) of this rule, the owner or operator shall make public notice of the existence of the assessment report and the corrective measures study and place those documents in the public library closest to the facility for public inspection not later than one hundred eighty days after making a first determination in accordance with paragraph (E)(2) of this rule.

(4) The director or his authorized representative may require the owner or operator to evaluate, as part of the corrective measures study, one or more specific potential remediation procedure(s).

(5) If, at any time during the assessment described in paragraphs (E) and (F) of this rule, the director determines that the facility threatens human health or safety or the environment, the director may require the owner or operator to implement the following measures:

- (a) Notify all persons, via certified mail or any other form of mail accompanied by a receipt, who own the land or reside on the land that directly overlies or lies adjacent to any part of the plume of contamination.
- (b) Take any interim measures deemed necessary by the director to ensure the protection of human health and safety and the environment. Interim measures should, to the extent practicable, be consistent with the objectives of and contribute to the performance of any remediation procedure that may be required pursuant to paragraphs (F)(1), (F)(2), and (F)(6) of this rule. The following factors may be considered by the director in determining whether interim measures are necessary:
 - (i) The amount of time required to develop and implement a final remediation procedure.
 - (ii) Actual or potential exposure of nearby populations or environmental receptors to waste-derived constituents.
 - (iii) Any further degradation of the ground water that may occur if remedial action is not initiated expeditiously.
 - (iv) Weather conditions that may cause waste-derived constituents to migrate or be released.
 - (v) Risks of fire, explosion, or potential for exposure to waste-derived constituents as a result of an accident or failure of a container or handling system.
 - (vi) Other situations that threaten human health and safety and the environment.
- (6) The corrective measures study shall propose a concentration level for each waste-derived constituent which has been detected in the ground water at levels above background levels. These shall be established as follows:
 - (a) The proposed concentration levels in the ground water shall be protective of human health and safety and the environment.
 - (b) Unless an alternate level is deemed necessary to protect environmental receptors, then the following apply:

- (i) For known or suspected carcinogens, the proposed concentration levels shall be established at concentration levels below those that represent a cumulative excess upper-bound lifetime risk to an individual within the 1×10^4 to 1×10^{-6} range.
 - (ii) For noncarcinogens, the proposed concentration levels shall be reduced to levels to which the human population (including sensitive subgroups) could be exposed on a daily basis without appreciable risk of deleterious effects during a lifetime.
- (c) In establishing the proposed concentration levels that meet the requirements of paragraph (F)(6)(b) of this rule, the owner or operator shall consider the following:
 - (i) Multiple contaminants in the ground water.
 - (ii) Exposure threat to sensitive environmental receptors.
 - (iii) Other site-specific exposure or potential exposure to ground water.
 - (iv) The reliability, effectiveness, practicability, and other relevant factors of the remediation procedure.
- (d) For ground water that is a current or potential source of drinking water, the owner or operator shall evaluate and justify any concentration level that is higher than a federal safe drinking water act maximum contaminant level or a secondary drinking water standard.
- (e) The proposed concentration levels shall not be set below background levels unless the director determines the following:
 - (i) Cleanup to levels below background levels is necessary to protect human health and safety and the environment.
 - (ii) Such cleanup is in connection with an area-wide remedial action under other authorities.
- (7) The director shall select from the corrective measures report, or designate according to paragraph (F)(4) of this rule, the remediation procedure which best meets the criteria listed in paragraphs (F)(1), (F)(2) and (F)(6) of this

rule. The owner or operator shall implement the remediation procedure designated by the director in accordance with the schedule of implementation selected by the director.

- (8) In implementing the remediation procedure approved by the director in accordance with paragraph (F)(7) of this rule, the owner or operator shall achieve the designated concentration levels, as determined by paragraph (F)(6) of this rule, at all points within the plume of contamination that lie beyond the limits or solid waste placement.
- (9) Upon completion of the remediation procedure, when the ground water quality meets the designated concentration levels as specified in paragraphs (F)(6) and (F)(8) of this rule, the owner or operator shall demonstrate on a semiannual basis for a period of five years or until the landfill facility's post-closure care period ends, whichever is longer, that the designated concentration levels have not been exceeded as provided in paragraph (F)(8) of this rule before being released from compliance with the ground water monitoring requirements.
- (10) If the concentrations of the constituents monitored in accordance with paragraph (F)(9) of this rule exceed the concentration levels determined in accordance with paragraph (F)(6) of this rule, the owner or operator shall reimplement the designated remediation procedure or submit new remediation procedures in accordance with the criteria in paragraphs (F)(1) and (F)(2) of this rule.
- (11) The director may determine, based on information developed by the owner or operator after implementation of the remediation procedure has begun, or from other information, that compliance with the requirements(s) for the remediation procedure selected under paragraphs (F)(1) and (F)(2) of this rule is not technically practicable. In making such a determination, the director shall consider the following:
 - (a) The owner or operator's efforts to achieve compliance with the requirement(s).
 - (b) Whether other currently available or new methods or techniques could practicably achieve compliance with the requirements.
- (12) If the director determines that compliance with a remediation procedure requirement is not technically practicable, then the director may require that the owner or operator do the following:

- (a) Implement alternate measures to control human or environmental receptor exposure to residual contamination, as necessary, to protect human health and safety and the environment.
 - (b) Implement alternate measures for control of the sources of contamination, or for removal or decontamination of equipment, units, devices, or structures required to implement the remediation procedure(s), that are both of the following:
 - (i) Technically practicable.
 - (ii) Consistent with the overall objective of the remediation procedure.
- (13) All solid wastes that are managed pursuant to a remediation procedure required under paragraph (F)(8) of this rule, or an interim measure required under paragraph (F)(5) of this rule, shall be managed in the following manner:
- (a) That is protective of human health and safety and the environment.
 - (b) That complies with applicable laws and regulations.
- (14) Remediation procedures selected pursuant to paragraphs (F)(1) and (F)(2) of this rule shall be considered complete when compliance with the ground-water concentration levels established under paragraph (F)(6) of this rule have been achieved, and all actions required to complete the remediation procedure have been satisfied.
- (15) Upon completion of the remediation procedure, the owner or operator shall submit to the director certification that the remediation procedure has been completed. The certification must be signed by the owner or operator and by an independent professional(s) skilled in the appropriate technical discipline(s).
- (16) When, upon receipt of the certification and in consideration of any other relevant information, the director determines that the remediation procedure has been completed in accordance with paragraph (F)(14) of this rule, the director shall release the owner or operator from continuing performance of the approved remediation procedure. This approval shall not exempt the owner or operator from meeting the requirements of paragraphs (F)(9) and (F)(10) of this rule.

- (17) The owner or operator shall submit, upon implementation of the remediation procedure chosen under paragraph (F)(7) of this rule, a report of the activities being conducted at the facility as part of implementation of the chosen remediation procedure. This report shall be submitted semiannually and contain the following:
- (a) A narrative description of all remedial activities that have occurred since the previous report.
 - (b) All data generated as part of the remedial activities at the facility.

Effective:

Five Year Review (FYR) Dates: 01/29/2015

Certification

Date

Promulgated Under: 119.03
Statutory Authority: 3734.02, 3734.12
Rule Amplifies: 3734.02, 3734.12
Prior Effective Dates: 1/13/1992, 8/15/2003

Appendix A

Parameter	CAS Registry Number
1) Acetone.	67-64-1
2) Acrylonitrile.	107-13-1
3) Benzene.	71-43-2
4) Bromochloromethane.	74-97-5
5) Bromodichloromethane.	75-27-4
6) Bromoform; Tribromomethane	75-25-2
7) Carbon disulfide	75-15-0
8) Carbon tetrachloride	56-23-5
9) Chlorobenzene.	108-90-7
10) Chloroethane; Ethyl chloride.	75-00-3
11) Chloroform; Trichloromethane	67-66-3
12) Dibromochloromethane; Chlorodibromomethane.....	124-48-1
13) 1,2-Dibromo-3-chloropropane; DBCP.	96-12-8
14) 1,2-Dibromomethane; Ethylene dibromide; EDB.	106-93-4
15) o-Dichlorobenzene; 1,2-Dichlorobenzene	95-50-1
16) p-Dichlorobenzene; 1,4-Dichlorobenzene	106-46-7
17) trans-1,4-Dichloro-2-butene.	110-57-6
18) 1,1-Dichloroethane; Ethylidene chloride.	75-34-3
19) 1,2-Dichloroethane; Ethylidene dichloride.	107-06-2
20) 1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	75-35-4
21) cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene	156-59-2
22) trans-1,2-Dichloroethylene; trans-1,2-Dichloroethene.	156-60-5
23) 1,2-Dichloropropane; Propylene dichloride.	78-87-5
24) cis-1,3-Dichloropropene.	10061-01-5
25) trans-1,3-Dichloropropene.	10061-02-6
26) Ethylbenzene	100-41-4
27) 2-Hexanone; Methyl butyl ketone.	591-78-6
28) Methyl bromide; Bromomethane	74-83-9
29) Methyl chloride; Chloromethane	74-87-3
30) Methylene bromide; Dibromomethane.	74-95-3
31) Methylene chloride; Dichloromethane.	75-09-2
32) Methyl ethyl ketone; MEK; 2-Butanone	78-93-3
33) Methyl iodide; iodomethane	74-88-4
34) 4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1
35) Styrene.	100-42-5
36) 1,1,1,2-Tetrachloroethane.	630-20-6
37) 1,1,2,2-Tetrachloroethane.	79-34-5

38) Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	127-18-4
39) Toluene.	108-88-3
40) 1,1,1-Trichloroethane; Methylchloroform.	71-55-8
41) 1,1,2-Trichloroethane.	79-00-5
42) Trichloroethylene; Trichloroethene.	79-01-6
43) Trichloroflouromethane; CFC-11.	75-69-4
44) 1,2,3-Trichloropropane.	96-18-4
45) Vinyl acetate.	108-05-4
46) Vinyl chloride.	75-01-4
47) Xylene (total).	includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330-20-7).

Appendix
B

Compound	CAS RN2
1) Acenaphthene; 1,2-Dihydroacenaphthylene	83-32-9
2) Acenaphthylene	208-96-8
3) Acetone; 2-Propanone	67-64-1
4) Acetonitrile; Methyl cyanide	75-05-8
5) Acetophenone; 1-Phenylethanone	98-86-2
6) 2-Acetylaminoflourene; 2-AAF; N-9H-flouren-2-yl-acetamide	53-96-3
7) Acrolein; 2-Propenal	107-02-8
8) Acrylonitrile; 2-Propenenitrile	107-13-1
9) Aldrin; 1,2,3,4,10,10-hexachlora-1,4,4a,5,8,8a-hexahydro(1a,4a,4ab,5a,8a,8ab)-1,4:5,8-Dimethanonaphthalene	309-00-23
10) Allyl chloride; 3-Chloro-1-propene	107-05-1
11) 4-Aminobiphenyl; [1,1'-Biphenyl]-4-amine	92-67-1
12) Anthracene	120-12-7
13) Antimony	See note 4
14) Arsenic	See note 4
15) Barium	See note 4
16) Benzene	71-43-2
17) Benzo[a]anthracene; Benzanthracene	56-55-3
18) Benzo[b]flouranthene; Benz[e]acephenanthylene	205-99-2
19) Benzo[k]flouranthene	207-08-9
20) Benzo[ghi]perylene	191-24-2
21) Benzo[a]pyrene	50-32-8
22) Benzyl alcohol; Benzenemethanol	100-51-6
23) Beryllium	See note 4
24) alpha-BHC; 1,2,3,4,5,6-Hexachlorocyclohexane, (1a,2a,3b,4a,5b,6b)	319-84-63
25) beta-BHC; 1,2,3,4,5,6-Hexachlorocyclohexane, (1a,2b,3a,4b,5a,6b)	319-85-73
26) delta-BHC; 1,2,3,4,5,6-Hexachlorocyclohexane, (1a,2a,3a,4b,5a,6b)	319-86-83
27) gamma-BHC; Lindane; 1,2,3,4,5,6-Hexachlorocyclohexane, (1a,2a,3b,4a,5a,6b)	58-89-93
28) bis(2-Chloroethoxy)methane; 1,1'-[methylenebis(oxy)]bis[2-chloroethane]	111-91-1
29) bis(2-Chloroethyl) ether; Dichloroethyl ether; 1,1'-oxybis[2-Chloroethane]	111-44-4
30) bis-(2-Chloro-1-methylethyl) Ether; 2,2'-Dichlorodiisopropyl ether; DCIP; 2,2'-oxybis[1-Chloropropane]	108-60-15
31) bis(2-Ethylhexyl) Phthalate; 1,2-Benzenedicarboxylic acid, bis(2-Ethylhexyl) ester	117-81-7
32) Bromochloromethane; Chlorobromomethane	74-97-5
33) Bromodichloromethane; Dibromochloromethane	75-27-4
34) Bromoform; Tribromomethane	75-25-2
35) 4-Bromophenyl phenyl ether; 1-Bromo-4-phenoxy-benzene	101-55-3
36) Butyl benzyl phthalate; Benzyl butyl phthalate; 1,2-Benzenedicarboxylic acid, Butyl phenylmethyl ester	85-68-7
37) Cadmium	See note 4

38)	Carbon disulfide	75-15-0
39)	Carbon tetrachloride; Tetrachloromethane	56-23-5
40)	Chlordane; 1,2,4,5,6,8,8-octochloro-2,3,3a,4,7,7a-hexahydro-4,7-methano-1H-indene.	See note 6
41)	p-Chloroaniline; 4-Chlorobenzenamine.....	106-47-8
42)	Chlorobenzene.....	108-90-7
43)	Chlorobenzilate; 4-Chloro-a-(4-Chlorophenyl)-a-Hydroxybenzeneacetic acid, Ethyl ester	510-15-6
44)	p-Chloro-m-Cresol; 4-Chloro-3-Methylphenol.....	59-50-7
45)	Chloroethane; Ethyl chloride.....	75-00-3
46)	Chloroform; Trichloromethane.....	67-66-3
47)	2-Chloronaphthalene.....	91-58-7
48)	2-Chlorophenol.....	95-57-8
49)	4-Chlorophenyl phenyl ether; 1-Chloro-4-phenoxy benzene...	7005-72-3
50)	Chloroprene; 2-Chloro-1,3-butadiene.....	126-99-8
51)	Chromium	See note 4
52)	Chrysene.....	218-01-9
53)	Cobalt	See note 4
54)	Copper	See note 4
55)	m-Cresol; 3-Methylphenol.....	108-39-4
56)	o-Cresol; 2-Methylphenol.....	95-48-7
57)	p-Cresol; 4-Methylphenol.....	106-44-5
58)	Cyanide.....	57-12-5
59)	2,4-D; 2,4-Dichlorophenoxyacetic acid.....	94-75-7
60)	4,4'-DDD; 1,1'-(2,2-Dichloroethylidene)bis [4-chlorobenzene].....	72-54-8
61)	4,4'-DDE; 1,1'-(2,2-Dichloroethenylidene)bis [4-chlorobenzene].....	72-55-9
62)	4,4'-DDT; 1,1'-(2,2,2-Trichloroethylidene)bis [4-chlorobenzene].....	50-29-3
63)	Diallate; bis(1-Methylethyl)-carbamoithic acid S-(2,3-Dichloro-2-propenyl) ester.....	2303-16-4
64)	Dibenz[a,h]anthracene.....	53-70-3
65)	Dibenzofuran.....	132-64-9
66)	Dibromocholormethane; Chlorodibromomethane.....	124-48-1
67)	1,2-Dibromo-3-chloropropane; DBCP.....	96-12-8
68)	1,2-Dibromoethane; Ethylene dibromide; EDB	106-93-4
69)	Di-n-butyl phthalate; 1,2-Benzenedicarboxylic acid dibutyl ester.....	84-74-2
70)	o-Dichlorobenzene; 1,2-Dichlorobenzene.....	95-50-1
71)	m-Dichlorobenzene; 1,3-Dichlorobenzene.....	541-73-1
72)	p-Dichlorobenzene; 1,4-Dichlorobenzene.....	106-46-7
73)	3,3'-Dichlorobenzidine; 3,3'-Dichloro-[1,1'-bi phenyl]-4,4'-diamine.....	91-94-1
74)	trans-1,4-Dichloro-2-butene.....	110-57-6
75)	Dichlorodifluoromethane; CFC 12.....	75-71-8
76)	1,1-Dichloroethane; Ethylidene chloride.....	75-34-3
77)	1,2-Dichloroethane; Ethylene dichloride.....	107-06-2
78)	1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride.....	75-35-4
79)	cis-1,2-Dichloroethylene; cis-1,2-Dichloroethene.....	156-59-2
80)	trans-1,2-Dichloroethylene; trans-1,2-Dichloro ethene	156-60-5

81)	2,4-Dichlorophenol.....	120-83-2
82)	2,6-Dichlorophenol.....	87-65-0
83)	1,2-Dichloropropane; Propylene dichloride.....	78-87-5
84)	1,3-Dichloropropane; Trimethylene dichloride.....	142-28-9
85)	2,2-Dichloropropane; Isopropylidene chloride.....	594-20-7
86)	1,1-Dichloropropene; 1,1-Dichloro-1-propene.....	563-58-6
87)	cis-1,3-Dichloropropene;.....	10061-01-5
88)	trans-1,3-Dichloropropene.....	10061-02-6
89)	Dieldrin; 3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a, 7,7a-octahydro-2,7:3,6-dimethanonaphthalene [2,3-b]oxirene, (1aa,2b,2aa,3b,6b,6aa,7b,7aa).....	60-57-13
90)	Diethyl phthalate; 1,2-Benzenedicarboxylic acid, Diethyl ester.....	84-66-2
91)	O,O-Diethyl O-2-Pyrazinyl phosphorothioate; Thionazin. . .	297-97-2
92)	Dimethoate; Phosphorodithioic acid O,O-Dimethyl-S- [2-(methylamino)-2-oxoethyl] ester.....	60-51-5
93)	p-(Dimethylamino)azobenzene; N,N-Dimethyl-4- (phenylazo)benzenamine.....	60-11-7
94)	7,12-Dimethylbenz[a]anthracene.....	57-97-6
95)	3,3'-Dimethylbenzidine; 3,3'-Dimethyl[1,1'bi phenyl]-4,4'-diamine.....	119-93-7
96)	2,4-Dimethylphenol; m-Xylenol.....	105-67-9
97)	Dimethyl phthalate; 1,2-Benzenedicarboxylic acid, dimethyl ester.....	131-11-3
98)	m-Dinitrobenzene.....	99-65-0
99)	4,6-Dinitro-o-cresol; 4,6-Dinitro-2-methylphenol; 2-Methyl-4,6-dinitrophenol.....	534-52-1
100)	2,4-Dinitrophenol.....	51-28-5
101)	2,4-Dinitrotoluene; 1-Methyl-2,4-dinitrobenzene.....	121-14-2
102)	2,6-Dinitrotoluene; 2-Methyl-1,3-dinitrobenzene.....	606-20-2
103)	Dinoseb; DMBP; 2-sec-Butyl-4,6-dinitrophenol; 2-(1-Methylpropyl)-4,5-dinitrophenol.....	88-85-7
104)	Di-n-octyl phthalate; 1,2-Benzenedicarboxylic acid, Dioctyl ester.....	117-84-0
105)	Diphenylamine; N-phenylbenzenamine.....	122-39-4
106)	Disulfoton; Phosphorodithioic acid O,O-diethyl S-[2-(ethylthio)ethyl] ester.....	298-04-4
107)	Endosulfan I; 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9, 9a-hexahydro-6,9-methano-2,4,3-benzodioxo thiepin, 3-oxide.....	959-98-8
108)	Endosulfan II; 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9, 9a-hexahydro-6,9-methano-2,4,3-benzodioxo thiepin, 3-oxide (3a,5aa,6b,9b,9aa).....	33213-65-93
109)	Endosulfan sulfate; 6,7,8,9,10,10-hexachloro-1,5,5a,6,9, 9a-hexahydro-6,9-methano-2,4,3-benzodioxo thiepin, 3-3-dioxide.....	1031-07-8
110)	Endrin; 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a- octahydro-2,7:3,6-dimethanonaphth[2,3- b]oxirene, (1aa,2b,2ab,3a,6a,6ab,7b,7aa).....	72-20-83
111)	Endrin aldehyde; 2,2a,3,3,4,7-hexachlorodecahydro- 1,2,4-methenocyclopenta[cd]pentalene-5-carboxaldehyde, (1a,2b,2ab,4b,4ab,5b,6ab,6bb,7r*).....	7421-93-43

112)	Ethylbenzene.....	100-41-4
113)	Ethyl methacrylate; 2-Methyl-2-propenoic acid, ethyl ester.....	97-63-2
114)	Ethyl methanesulfonate; Methanesulfonic acid, ethyl ester.....	62-50-0
115)	Famphur; Phosphorothioic acid, O-[4-[(dimethylamino) sulfonyl]phenyl]0,0-dimethyl ester.....	52-85-7
116)	Flouranthene.....	206-44-0
117)	Flourene; 9H-flourene.....	86-73-7
118)	Heptachlor; 1,4,5,6,7,8,8-heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-1H-indene.....	76-44-8
119)	Heptachlor epoxide; 2,3,4,5,6,7,7-Heptachloro-1a,1b,5,5a,6,6a-hexahydro-2,5-methano-2h-indeno [1,2-b]oxirene, (1aa,1bb,2a,5a,5ab,6b,6aa).....	1024-57-33
120)	Hexachorobenzene.....	118-74-1
121)	Hexachlorobutadiene; 1,1,2,3,4,4-Hexachloro-1,3-butadiene.....	87-68-3
122)	Hexachlorocyclopentadiene; 1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene.....	77-47-4
123)	Hexachloroethane.....	67-72-1
124)	Hexachloropropene; 1,1,2,3,3,3-Hexachloro-1-propene.....	1888-71-7
125)	2-Hexanone; Methyl butyl ketone.....	591-78-6
126)	Indeno(1,2,3-cd)pyrene.....	193-39-5
127)	Isobutyl alcohol; 2-Methyl-1-propanol.....	78-83-1
128)	Isodrin; 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-dimethanonaphthalene, (1a,4a,4ab,5b,8b,8ab).....	465-73-63
129)	Isophorone; 3,5,5-Trimethyl-2-cyclohexen-1-one.....	78-59-1
130)	Isosafrole; 5-(1-Propenyl)-1,3-benzodioxole.....	120-58-1
131)	Kepone; 1,1a,3,3a,4,5,5a,5b,6-decachlorocta hydro-1,3,4-methano-2H-cyclobuta[cd9]pentalen-2-one.....	143-50-0
132)	Lead.....	See note 4
133)	Mercury.....	See note 4
134)	Methacrylonitrile; 2-Methyl-2-propenenitrile.....	126-98-7
135)	Methapyrilene; N,N-dimethyl-N'-2-pyridinyl-N'-(1/2-thienylmethyl)-1,2-ethanediamine.....	91-80-5
136)	Methoxychlor; 1,1'-(2,2,2-Trichloroethylidene)bis [4-Methoxybenzene].....	72-43-5
137)	Methyl bromide; Bromomethane.....	74-83-9
138)	Methyl chloride; Chloromethane.....	74-87-3
139)	3-Methylcholanthrene; 1,2-Dihydro-3-methylbenze[j]aceanthrylene.....	56-49-5
140)	Methyl ethyl ketone; MEK; 2-Butanone.....	78-93-3
141)	Methyl iodide; Iodomethane.....	74-88-4
142)	Methyl methacrylate; 2-Methyl-2-propenoic acid, methyl ester.....	80-62-6
143)	Methyl methanesulfonate; Methanesulfonic acid, methyl ester.....	66-27-3
144)	2-Methylnaphthalene.....	91-57-6
145)	Methyl parathion; Parathion methyl; Phosphorothioic acid, 0,0-dimethyl 0-(4-nitrophenyl) ester.....	298-00-0
146)	4-Methyl-2-pentanone; Methyl isobutyl ketone.....	108-10-1

147)	Methylene bromide; Dibromomethane.....	74-95-3
148)	Methylene chloride; Dichloromethane.....	75-09-2
149)	Naphthalene.....	91-20-3
150)	1,4-Naphthoquinone; 1,4-Naphthalenedione.....	130-15-4
151)	1-Naphthylamine; 1-Naphthalenamine.....	134-32-7
152)	2-Naphthylamine; 2-Naphthalenamine.....	91-59-8
153)	Nickel	See note 4
154)	o-Nitroaniline; 2-Nitroaniline; 2-Nitrobenzenamine	88-74-4
155)	m-Nitroaniline; 3-Nitroaniline; 3-Nitrobenzenamine	99-09-2
156)	p-Nitroaniline; 4-Nitroaniline; 4-Nitrobenzenamine . . .	100-01-6
157)	Nitrobenzene	98-95-3
158)	o-Nitrophenol; 2-Nitrophenol.....	88-75-5
159)	p-Nitrophenol; 4-Nitrophenol.....	100-02-7
160)	N-Nitrosodi-n-butylamine; N-Butyl-N-Nitroso-1-butanamine. .	924-16-3
161)	N-Nitrosodiethylamine; N-Ethyl-N-nitroso ethanamine	55-18-5
162)	N-Nitrosodimethylamine; N-Methyl-N-nitroso methanamine .	62-75-9
163)	N-Nitrosodiphenylamine; N-Nitroso-N-phenyl benzenamine.	86-30-6
164)	N-Nitrosodipropylamine; N-Nitroso-N-dipropylamine; di-n-propylnitrosamine; N-Nitroso-N-propyl- 1-propanamine..	621-64-7
165)	N-Nitrosomethylethylamine; N-Methyl-N-nitroso ethanamine.....	10595-95-6
166)	N-Nitrosopiperidine; 1-Nitrosopiperidine.....	100-75-4
167)	N-Nitrosopyrrolidine; 1-Nitrosopyrrolidine.....	930-55-2
168)	5-Nitro-o-toluidine; 2-Methyl-5-nitrobenzenamine	99-55-8
169)	Parathion; Phosphorothioic acid, O,O-diethyl O- (4-nitrophenyl) ester.....	56-38-2
170)	Pentachlorobenzene.....	608-93-5
171)	Pentachloronitrobenzene.....	82-68-8
172)	Pentachlorophenol.....	87-86-5
173)	Phenacetin; N-(4-Ethoxyphenyl)acetamide.....	62-44-2
174)	Phenanthrene.....	85-01-8
175)	Phenol.....	108-95-2
176)	p-Phenylenediamine; 1,4-Benzenediamine.....	106-50-3
177)	Phorate; Phosphorodithioic acid, O,O-Diethyl S- [(ethylthio)methyl] ester.....	298-02-2
178)	Polychlorinated biphenyls; PCBs; aroclors; 1,1'-Biphenyl, chloro derivatives	See note 7
179)	Pronamide; 3,5-Dichloro-N-(1,1-dimethyl-2- propynyl)benzamide.....	23950-58-5
180)	Propionitrile; Ethyl cyanide.....	107-12-0
181)	Pyrene.....	129-00-0
182)	Safrole; 5-(2-Propenyl)-1,3-benzodioxole.....	94-59-1
183)	Selenium	See note 4
184)	Silver	See note 4
185)	Silvex; 2,4,5-TP; 2-(2,4,5-Trichlorophenoxy)propanoic acid.....	93-72-1
186)	Styrene; Ethenylbenzene.....	100-42-5
187)	Sulfide.....	18496-25-8
188)	2,4,5-T; 2,4,5-Trichlorophenoxyacetic acid.....	93-76-5
189)	1,2,4,5-Tetrachlorobenzene.....	95-94-3
190)	1,1,1,2-Tetrachloroethane.....	630-20-6
191)	1,1,2,2-Tetrachloroethane.....	79-34-5

192)	Tetrachloroethylene; Tetrachloroethene; Perchloroethylene.....	127-18-4
193)	2,3,4,6-Tetrachlorophenol.....	58-90-2
194)	Thallium	See note 4
195)	Tin	See note 4
196)	Toluene; Methylbenzene	108-88-3
197)	o-Toluidine; 2-Methylbenzenamine.....	95-53-4
198)	Toxaphene	See note 8
199)	1,2,4-Trichlorobenzene.....	120-82-1
200)	1,1,1-Trichloroethane; Methylchloroform.....	71-55-6
201)	1,1,2-Trichloroethane.....	79-00-5
202)	Trichloroethylene; Trichloroethene.....	79-01-6
203)	Trichlorofluoromethane; CFC-11.....	75-69-4
204)	2,4,5-Trichlorophenol.....	95-95-4
205)	2,4,6-Trichlorophenol.....	88-06-2
206)	1,2,3-Trichloropropane.....	96-18-4
207)	o,o,o-Triethyl phosphorothioate; Phosphorothioic acid, o,o,o-triethyl ester	126-68-1
208)	sym-Trinitrobenzene; 1,3,5-Trinitrobenzene	99-35-4
209)	Vanadium	See note 4
210)	Vinyl acetate; Acetic acid, ethenyl ester	108-05-4
211)	Vinyl chloride; Chloroethene.....	75-01-4
212)	Xylene (total); Dimethylbenzene	See note 9
213)	Zinc	See note 4

- Note 1: Common names are those widely used in government regulation, scientific publications, and commerce; synonyms exist for many chemicals.
- Note 2: Chemical Abstract Service registry number. Where "total" is entered, all species in ground water that contain this element are included.
- Note 3: When numbers and letters appear in this form at the end of a chemical name, i.E. (1a,4a,4aB,5a,8a,8aB), the following applies: "a" = small case "a"; "a" (italic) = alpha; "b" = small case "b"; and "B" (italic) = beta.
- Note 4: Analysis for these compounds shall be representative of the quality background ground water that has not been affected by past or present operations at the sanitary landfill facility and representative of the quality of ground water passing directly downgradient of the limits of solid waste placement.
- Note 5: CAS No. 108-60-1. This substance is often called bis(2-Chloroisopropyl) ether, the name Chemical Abstracts Service applies to its commercial isomer, propane, 2,2"-oxybis[2-Chloro-(CAS RN 39638-32-9)].
- Note 6: Chlordane: This entry includes alpha-chlordane (CAS RN 5103-71-9), beta-Chlordane (CAS RN 5103-74-2), gamma-Chlordane (CAS RN 5566-34-7), and constituents of Chlordane (CAS RN 54-74-9 and CAS RN 12789-03-06).
- Note 7: Polychlorinated biphenols (CAS RN 1336-36-3); This category contains congener chemicals, including constituents of Aroclor 1016 (CAS RN 12674-11-2), Aroclor 1221 (CAS RN 11104-28-2),

Aroclor 1232 (CAS RN 11141-16-5), Aroclor 1242 (CAS RN 53469-21-9), Aroclor 1248 (CAS RN 12672-29-6), Aroclor 1254 (CAS RN 11097-69-1), and Aroclor 1260 (CAS RN 11096-82-5).

Note 8: Toxaphene: This entry includes congener chemicals contained in technical toxaphene (CAS RN 8001-35-2, i.e., chlorinated camphene).

Note 9: Xylene (total): This entry includes o-xylene (CAS RN 96-47-6), m-xylene (CAS RN 108-38-3), p-xylene (CAS RN 106-42-3), and unspecified xylenes (dimethylbenzenes) (CAS RN 1330-20-7).

Appendix C
Ground water monitoring parameters

A. Wastes Generated From Fuel Burning Operations Using Primarily Coal as Fuel [OAC 3745-30-01(B)(1)]

1. Annual Monitoring Parameters

Temperature*
Specific conductance*
pH*
Calcium**
Chloride**
Potassium**
Sodium**
Sulfate**
Arsenic
Barium
Cadmium
Chromium
Iron
Lead
Magnesium
Manganese
Selenium
Total Dissolved Solids
Gross Beta
Gross Alpha

2. Background Water Quality Parameters #

Temperature*
Specific Conductance*
pH*
Calcium**
Chloride**
Potassium**
Sodium**
Sulfate**
Arsenic
Barium
Cadmium
Chromium
Iron
Lead
Magnesium
Manganese
Mercury
Selenium
Silver
Total Organic Carbon
Chemical Oxygen Demand
Total Dissolved Solids
Gross Beta
Gross Alpha
Turbidity
Total Alkalinity
Phenols***
Cyanide***
The Volatile Organic Compounds listed in Appendix A to this rule***

- # Parameters determined at least quarterly for initial year of ground water monitoring
* Parameters determined each time a monitoring well is sampled.
** Indicator parameters to be determined at least semi-annually.
*** Only need to sample for initial quarter unless Director determines otherwise.

B. Waste Generated From Foundry Operations [OAC 3745-30-01(B)(2)]

1. Annual Monitoring Parameters

Temperature*
Specific conductance*
pH*
Copper**
Fluoride**
Iron**
Lead**
Phenols** (*including cresols*)
Sulfate**
Zinc**
Total dissolved solids**
Ammonia
Arsenic
Barium
Cadmium
Chloride
Chromium
Lead
Manganese
Magnesium
Sodium
Turbidity
Formaldehyde
The volatile organic compounds
(VOCs) detected in background
sampling.

2. Background Water Quality Parameters #

Temperature*
Specific conductance*
pH*
Copper**
Fluoride**
Iron**
Lead**
Phenols** (*including cresols*)
Sulfate**
Zinc**
Total dissolved solids**
Ammonia
Arsenic
Barium
Cadmium
Chloride
Chromium
Lead
Manganese
Magnesium
Sodium
Turbidity
Formaldehyde
The volatile organic compounds
(VOCs) listed in appendix A to this
rule***

- # Parameters determined at least quarterly for initial year of ground water monitoring
* Parameters determined each time a monitoring well is sampled.
** Based on waste characterization, the owner or operator shall select four (or more) of the double asterisked parameters as indicator parameters to be determined at least semi-annually. The other double-asterisked parameters remain on the annual list.
*** Only need to sample for initial quarter unless Director determines otherwise.

C. Wastes Generated from Pulp and Papermaking Operations
[OAC 3745-30-01(B)(3)]

1. Annual Monitoring Parameters

Temperature*
 Specific conductance*
 pH*
 Chemical Oxygen Demand**
 Total Alkalinity**
 Sodium**
 Sulfate**
 Ammonia
 Arsenic
 Barium
 Cadmium
 Calcium
 Chloride
 Chromium
 Iron
 Lead
 Magnesium
 Manganese
 Nitrate-nitrite
 Potassium
 Total Dissolved Solids
 Turbidity

2. Background Water Quality Parameters

 Temperature*
 Specific conductance*
 pH*
 Chemical Oxygen Demand**
 Total Alkalinity**
 Sodium**
 Sulfate**
 Ammonia
 Arsenic
 Barium
 Cadmium
 Calcium
 Chloride
 Chromium
 Iron
 Lead
 Magnesium
 Manganese
 Nitrate-nitrite
 Potassium
 Total Dissolved Solids
 Turbidity
 Phenols***
 Cyanide***
 The Volatile Organic Compounds
 listed in Appendix A to this rule***

- # Parameters determined at least quarterly for initial year of ground water monitoring
 * Parameters determined each time a monitoring well is sampled.
 ** Indicator parameters to be determined at least semi-annually.
 *** Only need to sample for initial quarter unless Director determines otherwise.

D.Wastes Generated from Steelmaking Operations[OAC 3745-30-01(B)(4)]

1. Annual Monitoring Parameters

Temperature*
Specific conductance*
pH*
Total Dissolved Solids**
Iron**
Sodium**
Sulfate**
Ammonia
Antimony
Arsenic
Barium
Cadmium
Calcium
Chloride
Chromium
Copper
Lead
Magnesium
Manganese
Mercury
Nickel
Selenium
Sodium
Sulfate
Zinc
Turbidity
Total Organic Carbon
Gross Beta
Gross Alpha

2. Background Water Quality Parameters

Temperature*
Specific conductance*
pH*
Total Dissolved Solids**
Iron**
Sodium**
Sulfate**
Ammonia
Antimony
Arsenic
Barium
Cadmium
Calcium
Chloride
Chromium
Copper
Lead
Magnesium
Manganese
Mercury
Nitrate-Nitrite
Nickel
Selenium
Sodium
Sulfate
Zinc
Turbidity
Total Organic Carbon
Gross Beta
Gross Alpha
Chemical Oxygen Demand
Total Alkalinity
Phenols***
Cyanide***
The Volatile Organic Compounds
listed in Appendix A to this rule***

- # Parameters determined at least quarterly for initial year of ground water monitoring
- * Parameters determined each time a monitoring well is sampled.
- ** Indicator parameters to be determined at least semi-annually.
- *** Only need to sample for initial quarter unless Director determines otherwise.

E. Wastes Generated from Gypsum Processing Plant Operations
[OAC 3745-30-01(B)(5)]

1. Annual Monitoring Parameters

Temperature*
 Specific Conductance* **
 pH* **
 Calcium**
 Sulfate**
 Arsenic
 Barium
 Cadmium
 Chromium
 Chloride
 Iron
 Lead
 Magnesium
 Manganese
 Mercury
 Selenium
 Sodium
 Chemical Oxygen Demand
 Total Alkalinity
 Total Dissolved Solids

2. Background Water Quality Parameters

 Temperature*
 Specific Conductance* **
 pH* **
 Calcium**
 Sulfate**
 Arsenic
 Barium
 Cadmium
 Chromium
 Chloride
 Iron
 Lead
 Magnesium
 Manganese
 Mercury
 Nitrate-Nitrite
 Selenium
 Sodium
 Chemical Oxygen Demand
 Total Alkalinity
 Total Dissolved Solids
 Total Organic Carbon
 Turbidity
 Phenols***
 Cyanide***
 The Volatile Organic Compounds
 listed in Appendix A to this rule***

- # Parameters determined at least quarterly for initial year of ground water monitoring
- * Parameters determined each time a monitoring well is sampled.
- ** Indicator parameters to be determined at least semi-annually.
- *** Only need to sample for initial quarter unless Director determines otherwise.

F. Wastes Generated from Lime Processing Operations

[OAC 3745-30-01(B)(6)]

1. Annual Monitoring Parameters

Temperature*
 Specific conductance*
 pH* **
 Chloride**
 Potassium**
 Sodium**
 Sulfate**
 Total Dissolved Solids**
 Barium
 Iron
 Lead
 Magnesium
 Manganese
 Selenium
 Turbidity
 Chemical Oxygen Demand
 Total Alkalinity
 Gross Beta
 Gross Alpha

2. Background Water Quality Parameters

 Temperature*
 Specific conductance*
 pH* **
 Chloride**
 Potassium**
 Sodium**
 Sulfate**
 Total Dissolved Solids**
 Arsenic
 Barium
 Calcium
 Iron
 Lead
 Magnesium
 Manganese
 Selenium
 Turbidity
 Chemical Oxygen Demand
 Total Alkalinity
 Gross Beta
 Gross Alpha
 Phenols***
 Cyanide***
 The Volatile Organic Compounds
 listed in Appendix A to this rule***

- # Parameters determined at least quarterly for initial year of ground water monitoring
- * Parameters determined each time a monitoring well is sampled.
- ** Indicator parameters to be determined at least semi-annually.
- *** Only need to sample for initial quarter unless Director determines otherwise.

G. Wastes Generated from Portland Cement Operations
[OAC 3745-30-01(B)(7)]

1. Annual Monitoring Parameters

Temperature* Specific
conductance* pH* **
Chloride**
Potassium** Sodium**
Sulfate**
Total Dissolved Solids**
Barium
Chloride
Chromium
Iron
Lead
Magnesium
Manganese
Mercury
Selenium
Turbidity
Chemical Oxygen Demand
Total Alkalinity
Gross Beta
Gross Alpha

2. Background Water Quality Parameters #

Temperature*
Specific Conductance*
pH* **
Chloride**
Potassium**
Sodium**
Sulfate**
Total Dissolved Solids**
Arsenic
Barium
Calcium
Chloride
Chromium
Iron
Lead
Magnesium
Manganese
Mercury
Selenium
Turbidity
Chemical Oxygen Demand
Total Alkalinity
Gross Beta
Gross Alpha
Phenols***
Cyanide***
The Volatile Organic Compounds
listed in Appendix A to this rule***

- # Parameters determined at least quarterly for initial year of ground water monitoring
* Parameters determined each time a monitoring well is sampled.
** Indicator parameters determined at least semi-annually.
*** Only need to sample for initial quarter unless Director determines otherwise.

H. Industrial solid waste facilities permitted and operating under Chapter 3745-29 of the Administrative Code.

1. Annual Monitoring Parameters

Temperature*
Specific conductance*
pH*
Ammonia**
Calcium**
Chloride**
Iron**
Nitrate-nitrite**
Potassium**
Sodium**
Sulfate**
Total alkalinity**
Antimony
Arsenic
Barium
Beryllium
Cadmium
Chromium
Cobalt
Copper
Lead
Magnesium
Manganese
Nickel
Selenium
Silver
Thallium
Vanadium
Zinc
Turbidity
Chemical oxygen demand
Total dissolved solids
The volatile organic compounds
(VOCS) listed in appendix
A to this rule

2. Background Water Quality
Parameters #

Background Water Quality
Parameters are the same as
Annual Monitoring Parameters.

Parameters determined at least quarterly for initial year of ground water monitoring.

Analysis for these parameters shall be representative of the quality background ground water that has not been affected by past or present operations at the landfill facility and representative of the quality of ground water passing directly downgradient of the limits of solid waste placement.

* Parameters field analyzed each time a monitoring well is sampled.

** Indicator parameters determined at least semi-annually.