

3745-27-10 Ground water monitoring program for a sanitary landfill facility.

(A) Applicability.

(1) General applicability. In accordance with the schedule in paragraphs (A)(2) and (A)(3) of this rule, the owner or operator of a sanitary landfill facility shall implement a ground water monitoring program capable of determining the impact of the 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 sanitary landfill facility. The ground water monitoring program shall have the following elements:

- (a) A ground water detection monitoring program which shall be documented within a ground water detection monitoring plan. The ground water detection monitoring plan shall be submitted into the operating record in accordance with rule 3745-27-09 of the Administrative Code. The ground water detection monitoring plan shall include but is not limited to a description of the following:
 - (i) A monitoring system in accordance with paragraph (B) of this rule.
 - (ii) Sampling and analysis procedures, including an appropriate statistical method, in accordance with paragraph (C) of this rule.
 - (iii) Detection monitoring procedures, including monitoring frequency and a parameter list, in accordance with paragraph (D) of this rule.
- (b) A ground water quality assessment monitoring program to be implemented in accordance with paragraph (E). A ground water quality assessment monitoring program includes but is not limited to the following:
 - (i) A ground water quality assessment plan in accordance with paragraphs (E)(3) and (E)(4) of this rule.
 - (ii) Determinations of rate, extent, and concentration of waste-derived constituents detected in the ground water in accordance with paragraph (E)(5) of this rule.
 - (iii) Notification to persons residing on or owning land above the contaminant plume in accordance with paragraph (E)(10) of this rule.
 - (iv) Submission of a ground water quality assessment report in accordance with paragraph (E)(6) of this rule.
 - (v) Where applicable, the requirements of paragraphs (B) to (D) of this rule.
 - (vi) Where applicable, submission of a compliance monitoring plan in accordance with paragraph (E)(7) of this rule.
- (c) A corrective measures program to be implemented in accordance with paragraph (F) of this rule. A corrective measures program includes but is not limited to the following:
 - (i) A corrective measures plan in accordance with paragraphs (F)(2) and (F)(3) of this rule.

- (ii) Proposed concentration levels in accordance with paragraph (F)(7) of this rule.
- (iii) A public meeting held to discuss the results of the ground water quality assessment report and corrective measures plan with interested persons in accordance with paragraph (F)(4) of this rule.
- (iv) Selection and implementation of a corrective measure in accordance with paragraph (F)(10) of this rule.
- (v) Where applicable, the requirements of paragraphs (B) to (D) of this rule.

(2) Schedule for implementation of revisions to the ground water monitoring program.

- (a) The owner or operator of an operating sanitary landfill facility subject to rule 3745-27-19 of the Administrative Code, shall make any applicable revisions to the facility ground water monitoring program, submit revisions to the operating record, and implement any measures required by amendments to this rule not later than two hundred seventy days after the effective date of the rule.
- (b) The owner or operator of a sanitary landfill facility that is subject to post closure care in accordance with rule 3745-27-14 of the Administrative Code and that ceased acceptance of waste after March 1, 1990, as determined by the notification required by paragraph (E) of rule 3745-27-11 of the Administrative Code, shall revise their ground water monitoring program to comply with this rule.

The owner or operator of a facility subject to rule 3745-27-09 of the Administrative Code shall submit and implement revisions to the operating record not later than two hundred seventy days after the effective date of this rule. The owner or operator of a facility not subject to rule 3745-27-09 of the Administrative Code shall implement the revisions and submit copies of the revisions to Ohio EPA and the approved health department not later than two hundred seventy days after the effective date of this rule.

[Comment: Owners and operators are only required to revise the portions of the facility's current ground water monitoring plans that do not comply with the amendments to this rule and are not required to submit a whole new plan. All variance approvals issued under the provisions of this rule continue in effect.]

[Comment: All owners or operators of facilities currently operating, and those that have closed since March 1, 1990, shall amend the closure plans and ground water monitoring program plans to comply with this rule. The only exception to this requirement is for those owners or operators required to follow a past version of this rule by an order of the director.]

- (c) The owner or operator of a sanitary landfill facility that is subject to post closure care in accordance with rule 3745-27-14 of the Administrative Code and is conducting a ground water monitoring program under findings and orders issued by the director shall continue monitoring, pursuant to the findings and orders.
- (d) The owner or operator of a sanitary landfill facility conducting a ground water monitoring program subject to paragraph (A)(2)(c) of this rule may request, on forms prescribed by the director, to comply with rule 3745-27-10 of the Administrative Code except for the provisions of paragraph (A)(2)(c) of this rule. Upon the director's approval of the request, the owner or operator shall then

comply with rule 3745-27-10 of the Administrative Code except for the provisions of paragraph (A)(2)(c) of this rule.

[Comment: There are landfill facilities currently required to follow past versions of this rule due to orders from the director. Paragraph (A)(2)(c) of this rule allows these facilities to continue to follow the orders issued by the director. Paragraph (A)(2)(d) of this rule allows the owners or operators of facilities under orders to follow past versions of this rule to request modification of the applicable order to allow them to follow the current version of this rule.]

- (3) The owner or operator shall implement and comply with the requirements of a ground water quality assessment monitoring program when required by paragraph (E) of this rule and a "corrective measures program" when required by paragraph (F) of this rule. Implementation shall be in accordance with the time frames specified in paragraphs (E) and (F) of this rule.
- (4) For the purposes of this rule, the ground water monitoring program, which includes the detection monitoring program, and where required, the assessment monitoring and corrective measures programs, are implemented upon the commencement of sampling of ground water monitoring wells in accordance with paragraphs (D), (E), or (F) of this rule.
- (5) A qualified ground water scientist shall certify, in accordance with rule 3745-27-09 of the Administrative Code, any ground water detection monitoring plan, the ground water quality assessment plan, the compliance monitoring plan, and the corrective measures plan, and any revisions thereof and reports and data, submitted in accordance with this rule.
- (6) The ground water monitoring program shall be documented within the operating record. Any revisions to the ground water monitoring program shall be submitted to the operating record in accordance with rule 3745-27-09 of the Administrative Code prior to implementation of the revisions. The owner or operator of a facility not subject to rule 3745-27-09 of the Administrative Code shall submit copies of the revisions to Ohio EPA and the approved health department prior to implementation of the revisions. No approval is necessary prior to implementing the revisions to the ground water monitoring program unless specifically required by this rule.

(B) Ground water monitoring system.

- (1) The ground water monitoring system, for detection monitoring, assessment monitoring, or corrective measures, shall consist of 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 background ground water that has not been affected by past or present operations at the sanitary landfill facility.
 - (b) Represent the quality of the ground water passing directly downgradient of the limits of solid waste placement.

The director may require or otherwise authorize an owner or operator to conduct surface water monitoring (i.e. seeps, springs or streams) as part of the ground water monitoring system in areas where it may not be practical to place a well. Such surface water samples shall be representative of ground water quality passing directly downgradient of the limits of solid waste placement.

[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 the recompacted clay liner of the sanitary 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 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 that are 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 owner or operator shall document in the operating record, in accordance with rule 3745-27-09 of the Administrative Code, the design, installation, development, maintenance and abandonment of any monitoring wells, piezometers, and other measurement, sampling, and analytical devices.
 - (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 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 shall be as follows:
 - (a) Based on site specific hydrogeologic information including that information listed in paragraphs (C)(3)(a) to (C)(3)(g) of rule 3745-27-06 of the Administrative Code.
 - (b) Capable of detecting a release from the sanitary landfill facility to the ground water at the closest practicable location to the limits of solid waste placement.
- (5) The owner or operator shall evaluate, at least annually until the end of the post-closure care period, the ground water surface elevation data obtained in accordance with paragraph (C)(3) 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 including potentiometric maps for every geologic unit monitored shall be included in a report to be submitted to the appropriate Ohio EPA district office

not later than twelve months from the previous report submitted to comply with this paragraph. If the evaluation shows that paragraph (B) of this rule is no longer satisfied, the owner or operator shall immediately revise the number, location, or depth of the monitoring wells to bring the ground water monitoring system into compliance with this requirement and place documentation of the revision into the operating record in accordance with paragraph (B)(3)(d) of this rule.

(C) The owner or operator shall comply with the following requirements regarding ground water sampling, analysis, and statistical methods:

(1) General requirements. The ground water monitoring program shall include consistent sampling and analysis procedures and statistical methods that are protective of human health 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), (D), (E), or (F) of this rule. The following shall be included in the ground water detection monitoring plan, ground water quality assessment monitoring plan, compliance monitoring plan, and corrective measures plan:

(a) A written sampling and analysis plan, which documents the sampling and analysis procedures that shall be utilized in the ground water monitoring program. The owner or operator is required to use the procedures documented within the sampling and analysis plan.

[Comment: The analysis methods used, including method detection limits and practical quantitation limits for the constituents analyzed, do not have to be documented within the sampling and analysis plan. They do have to be submitted with the analysis data as required in paragraph (C)(10) of this rule.]

(b) The statistical method selected by the owner or operator shall be in accordance with paragraphs (C)(6) and (C)(7) of this rule.

(c) The statistical determination of a statistically significant increase over background for a monitoring parameter shall be in accordance with paragraph (C)(8) of this rule.

(d) The number of samples collected shall be in accordance with paragraph (C)(9) of this rule.

(e) Submission of ground water and statistical analysis shall be in accordance with paragraph (C)(10) of this rule.

(2) A sampling and analysis 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) Detection of immiscible layers.

(c) Collection of ground water samples, including the following:

(i) Well evacuation.

(ii) Sample withdrawal.

(iii) Sample containers and handling.

(iv) Sample preservation.

(d) 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.

(e) Decontamination of equipment.

(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 duplicate samples during each sampling event.

(ii) Collection of field and equipment blanks if non-dedicated sampling equipment is used.

(iii) Collection of trip blanks.

The number of duplicate samples, field blanks, trip blanks, and equipment blanks shall be enough to adequately demonstrate the accuracy of the analysis results.

(h) The identification of well maintenance problems encountered during routine sampling of the wells and the process to assure that necessary maintenance is performed.

(3) Ground water elevations.

(a) Measurement of ground water elevations.

(i) Ground water elevations shall be measured in all wells to be sampled that round of sampling prior to any purging and sampling.

(ii) The total depth of the monitoring wells shall be measured in all wells at least annually for those wells that do not have a dedicated pump installed. The depth of monitoring wells with a dedicated pump shall be measured whenever maintenance allows and the dedicated pump is removed for service or replacement.

(iii) Ground water elevations in all wells monitoring the same units or portion of units of a sanitary landfill facility shall be measured within a period of time short enough to avoid temporal variations in ground water flow which could preclude an accurate determination of ground water flow rate and direction, but within a period of time not to exceed twenty-four hours.

(b) The owner or operator shall semiannually determine ground water flow directions in the uppermost aquifer system and all significant zones of saturation monitored. For sampling events other than semiannual or background monitoring events, the owner or operator shall determine ground water flow directions for any zone monitored whenever more than half of the wells in that zone are

sampled during that event.

- (c) Potentiometric maps shall be constructed using the collected ground water elevation measurements and shall be included with the sampling data submittal.
- (4) The owner or operator shall establish background ground water quality, unless the exception in paragraph (C)(5) of this rule applies, by analyzing ground water samples collected from hydraulically upgradient wells for each of the monitoring parameters or constituents required in the ground water monitoring program.
- (5) Background ground water quality at a sanitary landfill facility may be based on sampling of wells that are not hydraulically upgradient where either of 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.
- (6) Statistical methods. Not later than ninety days after completing collection of the eight background samples necessary to comply with paragraphs (D)(5)(a)(ii) and (D)(5)(b)(ii) of this rule but not later than four hundred fifty days after implementing the ground water monitoring program, the owner or operator shall 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)(5) of this rule. The statistical method specified shall ensure protection of human health and the environment and shall comply with the performance standards outlined in paragraph (C)(7) of this rule. The owner or operator shall submit to the operating record any changes made to the statistical method. For owners or operators not subject to rule 3745-27-09 of the Administrative Code, submit to Ohio EPA any changes made to the statistical method. This submission of the revised statistical method shall be made thirty days prior to submitting to the operating record and Ohio EPA the first set of ground water analytical data analyzed using the revised statistical method. The statistical method specified shall be selected from one of the following:
 - (a) 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 monitoring well is compared to the upper tolerance or prediction limit.
 - (b) A control chart approach that gives control limits for each constituent.
 - (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 the mean of each monitoring well and the background mean levels for each constituent.
 - (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 the median of each monitoring well and the background median levels for each constituent.

- (e) Another statistical test method submitted by the owner or operator and approved by the director or the director's authorized representative.

[Comment: The statistical method to be used during the initial statistical comparison required under paragraph (D)(5) of this rule needs to be submitted not later than ninety days after collecting the eighth background sample. If it is anticipated that the statistical method to be used will be an intrawell method, then the statistical plan shall be submitted not later than ninety days after the eighth sample has been collected from the well in question. If it is anticipated that the statistical method to be used will be an interwell method, then the statistical plan shall be submitted ninety days after a total of eight samples have been collected from the background wells. The eight background samples collected shall be evenly distributed across all background wells.]

- (7) Performance standards for statistical methods. Any statistical method chosen in accordance with paragraph (C)(6) 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 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.
 - (d) If a tolerance interval or a prediction interval is used to evaluate ground water 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 safety and the environment. These 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 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 using an intra-well statistical method under the ground water detection monitoring program, the owner or operator shall submit to the operating record in accordance with rule 3745-27-09 of the Administrative Code a demonstration that the ground water has not been affected by the landfill within the relevant wells. The owner or operator of a facility not subject to rule 3745-27-09 of the Administrative Code shall submit copies of the revisions to Ohio EPA and the approved health department.
- (8) Determination of a statistically significant increase over background. The owner or operator shall determine whether or not there is a statistically significant increase over background for each parameter or constituent required to be statistically analyzed within the ground water monitoring program. The owner or operator shall make this determination each time the owner or operator assesses ground water quality. To determine whether a statistically-significant increase 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)(6) and (C)(7) of this rule.
- (9) Sample number. The number of samples collected to establish ground water quality data shall be consistent with the appropriate statistical procedures determined pursuant to paragraphs (C)(6) and (C)(7) of this rule. The sampling procedures shall be those specified under paragraph (D) of this rule for detection monitoring, paragraph (E) of this rule for assessment or compliance monitoring, and paragraph (F) of this rule for corrective measures.
- (10) Submission of results. All ground water elevation, sample analysis, and statistical analysis results generated in accordance with paragraphs (B), (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 an accompanying text shall be submitted to Ohio EPA in a form specified by the director or his authorized representative. The data and accompanying text required to be submitted in accordance with this paragraph shall be placed in the operating record in accordance with rule 3745-27-09 of the Administrative Code. The accompanying text shall consist of at a minimum the following:
- (a) Lab data sheets.
 - (b) Field and laboratory quality assurance/quality control (QA/QC) data.
 - (c) Chain of custody and sample receipt forms including preservation methods.
 - (d) Data summary tables.
 - (e) Statistical analysis results and summary tables including the results from any test for normality conducted on the semiannual sampling event data being submitted.
 - (f) The potentiometric maps required by paragraph (C)(3) of this rule.

- (g) A description of the analysis methods used including method detection limits, and practical quantitation limits for the constituents analyzed.

[Comment: The items requested in paragraph (C)(10) of this rule, may be submitted on an electronic format compatible with Ohio EPA software.]

(D) Ground water detection monitoring program. The owner or operator shall comply with the following requirements regarding ground water detection monitoring:

(1) Monitoring parameters. The owner or operator shall determine the concentration or value of the parameters listed in appendix I to this rule in ground water in accordance with paragraph (D) of this rule.

(2) Alternate monitoring parameter list.

(a) The owner or operator of a sanitary landfill facility may propose in writing to delete any of the monitoring parameters contained in appendix I to this rule to meet the requirements of paragraphs (D)(5) to (D)(7) of this rule. The director may approve the alternative list of monitoring parameters if the removed parameters are not reasonably expected to be in or derived from the waste contained or deposited in the sanitary landfill facility. Upon approval by the director or the director's authorized representative, the owner or operator may use the alternative list. The owner or operator shall at a minimum consider the following factors in proposing an alternative parameter list:

(i) Which of the parameters specified in appendix I to this rule shall be deleted from the parameters required to be monitored in paragraph (D)(5) of this rule.

(ii) The types, quantities, and concentrations of constituents in wastes managed at the sanitary landfill facility.

(iii) The concentrations of the constituents in the leachate contained in appendix I to this rule from the relevant units of the sanitary landfill facility.

(iv) Any other relevant information that the director or the director's authorized representative deems necessary.

(b) The owner or operator of a sanitary landfill facility may delete 1,2- Dibromoethane (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) from the constituents used to meet paragraphs (D)(5) to (D)(7) of this rule upon demonstration that there has never been a confirmed detection of EDB or DBCP in the ground water at the sanitary landfill facility.

(c) The owner or operator of a new sanitary landfill facility may delete 1,2- Dibromoethane (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) from the constituents used to meet paragraphs (D)(5) to (D)(7) of this rule upon demonstration that there has never been a confirmed detection of EDB or DBCP in the ground water at the sanitary landfill facility during the first one hundred eighty days (four samples) of ground water monitoring.

(3) Alternate inorganic parameter list. The owner or operator of a sanitary landfill facility may propose in writing that an alternative list of inorganic indicator parameters be used to meet paragraph (D)(5) of this rule in lieu of some or all of the inorganic parameters listed in appendix I to this rule. The director shall approve the alternative inorganic indicator parameters if the alternative list will provide a reliable indication of inorganic releases from the sanitary landfill facility to the ground water. Upon approval by

the director or the director's authorized representative, the owner or operator shall use the alternative list. The owner or operator shall, at a minimum, consider the following factors in proposing an alternative inorganic parameter list:

- (a) The types, quantities, and concentrations of constituents in wastes managed at the sanitary landfill facility.
 - (b) The mobility, stability, and persistence of waste constituents or their reaction products in the unsaturated zone beneath the sanitary landfill facility.
 - (c) The detectability of the indicator parameters, waste constituents, and their reaction products in the ground water.
 - (d) The concentrations or values and coefficients of variation of monitoring parameters or constituents in the background ground water quality.
- (4) Alternative parameters for low-yield wells not screened in the uppermost aquifer system. The owner or operator may propose in writing, that an alternative list of any of the monitoring parameters contained in appendix I to this rule be used to meet paragraph (D)(5)(c) of this rule for those monitoring wells not screened in the uppermost aquifer system that cannot produce enough water within a twenty-four hour period to allow for the analysis of all of the required parameters. Upon approval by the director or the director's authorized representative, the owner or operator may use the alternative parameter list. The owner or operator shall at a minimum consider the following factors in proposing an alternative list for low-yield wells not screened in the uppermost aquifer:
- (a) Whether the monitoring well is constructed in accordance with paragraph (B)(3) of this rule.
 - (b) Whether the well screen is properly placed across the significant zone or saturation in order to maximize yield.
 - (c) A calculation of the maximum sustainable yield of the significant zone of saturation.
 - (d) Field data demonstrating the time necessary for the well to recover completely after purging.
 - (e) The amount of water needed to analyze for all required parameters. This should include a discussion of which parameters will be deleted and the amount of water needed to analyze for these deleted parameters as well as the listing of the parameters which will be analyzed for in the samples and how much water is required to analyze for these parameters.
- (5) Monitoring parameters, frequency, and location. The owner or operator shall monitor the ground water monitoring well system in accordance with the following:
- (a) For monitoring wells screened within the uppermost aquifer system beneath the sanitary landfill facility, the owner or operator shall, during the active life of the facility (including final closure) and the post-closure care period, monitor the wells:
 - (i) For one of the following parameter lists:
 - (a) Parameters 1 through 66 contained in appendix I to this rule.
 - (b) The alternative parameter list approved in accordance with paragraphs (D)(2) or (D)(3) of this

rule.

(ii) At least semiannually by collecting the following samples:

(a) During the initial one hundred and eighty days after implementing the ground water detection monitoring program, the owner or operator shall collect a minimum of four independent samples from each monitoring well screened in the uppermost aquifer system (background and downgradient). After collection of the initial four samples not later than one hundred eighty days after implementing the ground water monitoring program, the owner or operator shall collect a minimum of four additional, independent samples from each monitoring well screened in the uppermost aquifer system (background and downgradient) on a quarterly sampling schedule until a minimum total of eight independent samples are obtained to establish background. The eight or more independent samples obtained from each monitoring well shall be analyzed for parameters specified in paragraph (D)(5)(a)(i) of this rule and shall be used to establish background to fulfill the statistical analysis provisions of this rule. The owner or operator of a sanitary landfill facility with an existing ground water monitoring system may use existing data to meet the provisions of this paragraph provided the information required pursuant to paragraph (C) of this rule is available.

[Comment: Existing data to meet the provision of the above rule is allowed provided that the sampling and analysis procedures used to collect and analyze the sample are documented, available for review and consistent with paragraph (C)(1) of this rule.]

(b) Beginning two years after implementing the ground water detection monitoring program and continuing during subsequent semiannual sampling events, at least one sample from each monitoring well screened in the uppermost aquifer system (background and downgradient) must be collected and analyzed for the parameters specified in paragraph (D)(5)(a)(i) of this rule.

(iii) Beginning with receiving the results from the first monitoring event collected pursuant to paragraph (D)(5)(a)(ii)(b) of this rule and semiannually thereafter, by statistically analyzing the results from wells screened in the uppermost aquifer system for the parameters specified in paragraph (D)(5)(a)(i) of this rule.

(b) For monitoring wells not screened in the uppermost aquifer system at the sanitary landfill facility, the owner or operator shall, during the active life of the facility (including final closure) and the post-closure care period, monitor the wells:

(i) For one of the following parameter lists:

(a) Parameters numbered 18, 25, 33, 61, 63, 64, 65, and 66, contained in appendix I to this rule.

(b) The alternate parameter list approved in accordance with paragraph (D)(2), (D)(3) or (D)(4) of this rule.

(ii) At least semiannually by collecting the following samples:

(a) During the initial one hundred and eighty days after implementing the ground water detection monitoring program, the owner or operator shall collect a minimum of four independent samples from each monitoring well not screened in the uppermost aquifer system (background and downgradient) After collection of the initial four samples not later than one hundred eighty days after implementing the ground water monitoring program, the owner or operator shall collect a minimum of four additional, independent samples from each monitoring well not screened in the uppermost aquifer system (background and downgradient) on a quarterly sampling schedule until a minimum total of eight independent samples are obtained to establish background. The eight or more independent samples obtained from each monitoring well shall be analyzed for the parameters specified in paragraph (D)(5)(b)(i) of this rule and shall be used to establish background to fulfill the statistical analysis provisions of this rule. The owner or operator of a sanitary landfill facility with an existing ground water monitoring system may use existing data to meet the provisions of this paragraph provided the information required pursuant to paragraph (C) of this rule is available.

[Comment: Existing data to meet the provisions of the above rule is allowed provided that the sampling and analysis procedures used to collect and analyze the sample are documented, available for review and consistent with paragraph (C)(1) of this rule.]

(b) Beginning two years after implementing the ground water detection monitoring program and continuing during subsequent semiannual sampling events, at least one sample from each monitoring well not screened in the uppermost aquifer system (background and downgradient) must be collected and analyzed for the parameters specified in paragraph (D)(5)(b)(i) of this rule.

(iii) Beginning with receiving the results from the first monitoring event collected pursuant to paragraph (D)(5)(b)(ii)(b) of this rule and at least semiannually thereafter, by statistically analyzing the results from monitoring wells not screened within the uppermost aquifer system for the parameters specified in paragraph (D)(5)(b)(i) of this rule.

(c) All monitoring wells shall be monitored for constituents contained in appendix I to this rule or the alternative parameter list approved in accordance with paragraph (D)(2), (D)(3), or (D)(4) of this rule at least annually during the active life of the sanitary landfill facility (including final closure) and during the post-closure care period.

(d) At least one sample from each well in the monitoring system per sampling event shall be field analyzed for parameters 67, 68, and 69 listed in appendix I to this rule.

(e) If a new well or replacement well is to be added to an existing monitoring system, the owner or operator shall statistically analyze the ground water analysis data from the well in accordance with the applicable rules as soon as possible but not later than two years from the date that the well is added to the monitoring system.

(6) Alternative sampling and statistical analysis frequency. During the active life (including final closure) of a sanitary landfill facility and the post-closure care period, the owner or operator may propose in writing

an alternative frequency for ground water sampling and statistical analysis required by paragraph (D)(5) of this rule. The director or the director's authorized representative may approve a proposed alternative frequency provided the alternative frequency sampling and analysis frequency is not less than annual. Upon approval by the director or the director's authorized representative, the owner or operator may use the alternative sampling or analysis frequency. The owner operator shall at a minimum consider the following factors in proposing an alternative sampling and 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 sanitary landfill facility and the downgradient monitoring well system.
 - (e) Resource value of the uppermost aquifer system.
- (7) Determination of a statistically significant increase over background in detection monitoring parameters.
- (a) The owner or operator shall comply with paragraph (D)(7)(b) of this rule, if the owner or operator determines a statistically significant change, according to the statistical procedures specified in paragraphs (C)(6) and (C)(7) of this rule, for any of the following:
 - (i) Parameters 1 through 66 contained in appendix I to this rule, or the alternate parameter list approved in accordance with paragraphs (D)(2) and (D)(3) of this rule in samples from monitoring wells screened in the uppermost aquifer system.
 - (ii) Parameters 18, 25, 33, 61, 63, 64, 65, and 66 contained in appendix I to this rule or the alternate parameter list approved in accordance with paragraphs (D)(2), (D)(3), and (D)(4) of this rule in samples for all monitoring wells not screened in the uppermost aquifer system.
 - (b) The owner or operator shall submit a written notification to Ohio EPA of a statistically significant increase over background not later than seventy-five days after withdrawing a sample from the well; that upon analysis demonstrates a statistically significant change. A copy of this notification shall be placed in the operating record in accordance with rule 3745-27-09 of the Administrative Code. The notification must indicate which wells and parameters have shown a statistically significant increase over background levels.
 - (c) Demonstration of a false positive. The owner or operator may do one of the following to demonstrate a false positive:
 - (i) Use the "1 of M" resampling method to demonstrate that the statistically significant increase over background was a false positive. The "1 of M" resampling method to be used shall be documented within the statistical analysis plan required by paragraph (C)(6) of this rule and shall be protective of human health and safety and the environment. The number of resamples to be used shall be documented with the statistical method specified by the owner or operator as

required by paragraph (C)(6) of this rule. If the owner or operator demonstrates using the "1 of M" 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 submit a report certified by a qualified ground water scientist documenting the demonstration to Ohio EPA not later than one hundred and eighty days after initial sampling.

[Comment: The "1 of M resampling method" is a statistical resampling procedure to verify the statistically significant increase over background determined for the first sample taken from a monitoring well. The number of resamples used with the method will vary depending on the number of background samples available. The number of resamples usually does not exceed two. As an example, for the Ohio EPA, a "1 of 2 method" means the original sample plus one resample with the analysis data from both samples having to demonstrate a statistically significant increase above background in order for the owner or operator to make a new determination of the concentration of any contaminant released and the rate and extent of migration of the contaminants release to ground water.]

- (ii) Demonstrate that statistically significant increase over background resulted from a source other than the sanitary landfill, or error in the sampling, analysis, or statistical evaluation, or from natural variation in ground water quality. A report certified by a qualified ground water scientist documenting this demonstration shall be submitted to the appropriate Ohio EPA district office not later than ninety days after initial sampling. Upon notification by the director that the report does not successfully demonstrate that the statistically significant increase over background resulted from a source other than the sanitary landfill, or error in the sampling, analysis, or statistical evaluation, or from natural variation in ground water quality, the owner or operator shall comply with the provisions of paragraph (E) of this rule.

[Comment: The reports under paragraph (D)(7)(c) of this rule are required to be certified by a qualified ground water scientist in accordance with paragraph (A)(5) of this rule.]

(E) Ground water quality assessment monitoring program. The owner or operator shall comply with the following requirements regarding ground water quality assessment monitoring::

- (1) General requirements. Upon determining a statistically significant increase above background in accordance with paragraph (D)(7) of this rule, the owner or operator shall implement a ground water quality assessment program and submit a ground water quality assessment plan in accordance with either of the following:
 - (a) Not later than two hundred ten days after detection of a statistically significant increase above background.
 - (b) Not later than ninety days after notification by the director that the report submitted under paragraph (D)(7)(c)(ii) of this rule does not successfully make the required demonstration if the owner or operator has submitted a demonstration in accordance with paragraph (D)(7)(c)(ii) of this rule.

[Comment: The ground water quality assessment plan is required to be certified by a qualified ground water scientist in accordance with paragraph (A)(5) of this rule. The ground water quality assessment plan is a self-implementing plan which does not require approval from Ohio EPA prior to

implementation by the owner or operator.]

- (2) The owner or operator may undertake during the implementation of the ground water quality assessment program, activities necessary to prevent the continued release of waste-derived constituents from the regulated unit to the ground water. Any activities undertaken by the owner or operator in accordance with this paragraph shall be in compliance with all applicable federal and Ohio statutes and regulations.
- (3) Ground water quality assessment plan elements. The plan to be submitted in accordance with paragraph (E)(3) of this rule shall include at a minimum detailed descriptions of the following:
 - (a) Hydrogeologic conditions at the sanitary landfill facility.
 - (b) The detection monitoring program implemented by the sanitary landfill facility, including the following:
 - (i) The number, location, depth, and construction of detection monitoring wells with documentation.
 - (ii) A summary of detection monitoring ground water analytical data with documentation of the results.
 - (iii) A summary of statistical analyses applied to the data.
 - (c) The investigatory approach to be followed during the assessment, including but not limited to the following:
 - (i) The proposed number, location, depth, installation method, and construction of assessment monitoring wells.
 - (ii) The proposed methods for gathering additional hydrogeologic information.
 - (iii) The planned use of supporting methodology (i.e., soil gas or geophysical surveys).
 - (d) The techniques, procedures, and analytical equipment to be used for ground water sampling during the assessment. This description shall include those sampling and analysis elements listed within paragraph (C)(2) of this rule.
 - (e) Data evaluation procedures, including but not limited to the following:
 - (i) Planned use of statistical data evaluation for the ground water quality assessment program or for compliance monitoring.
 - (ii) Planned use of computer models.
 - (iii) Planned use of previously gathered information.
 - (iv) Criteria which will be utilized to determine if additional assessment activities are warranted.
 - (f) A schedule of implementation which incorporates the requirements specified in paragraph (E)(4) of this rule.
 - (g) Provisions for installing additional wells, as necessary, for determining the nature and extent of any release of waste-derived constituents per paragraph (E)(5) of this rule.

(h) Provisions for installing at least one additional monitoring well at the facility boundary in the direction of downgradient ground water flow from the affected well and as many additional wells as necessary to meet the provisions of paragraph (E)(5) of this rule.

(4) Assessment monitoring schedule, frequency, and parameters.

(a) Not later than the date required to submit the ground water quality assessment plan in accordance with paragraph (E)(1) of this rule, the owner or operator shall sample the affected wells and analyze the samples for all waste-derived constituents, including all constituents listed in appendix I and appendix II to this rule. Any background wells within the flow path or closest to the affected well and screened within the same geologic unit as the affected well shall be sampled and analyzed for parameters contained in appendix I and appendix II to this rule.

(b) Not later than seventy-five days after commencing the sampling required in paragraph (E)(4)(a) of this rule, sample all monitoring wells screened within the same geologic units at the facility as the affected well, not sampled under paragraph (E)(4)(a) of this rule. These samples shall be analyzed for those waste-derived constituents found to be above background levels in the affected monitoring wells sampled under paragraph (E)(4)(a) of this rule.

(c) The owner or operator shall sample all monitoring wells in the ground water quality assessment monitoring program; as follows. A monitoring well is considered part of the ground water quality assessment monitoring program if the well is needed or used to meet the provisions of paragraph (E)(5) of this rule:

(i) At least semiannually for the following:

(a) All parameters contained in appendix I to this rule or the alternative parameter list approved under paragraph (D)(2) or (D)(3) of this rule.

(b) All the constituents reported to the director in accordance with paragraph (E)(4)(c) of this rule.

(ii) At least annually for one of the following.

(a) All parameters contained in appendix II to this rule.

(b) The remaining parameters contained in appendix II to this rule if the director has deleted one or more parameters contained in appendix II to this rule in accordance with (E)(4)(e) of this rule.

(d) Not later than seventy-five days after sampling the ground water monitoring wells in accordance with paragraph (E)(5)(a) of this rule and after all subsequent samplings, the owner or operator shall place a notice in the operating record identifying all constituents that have been detected. The owner or operator shall send a copy of this notice to the appropriate Ohio EPA district office and the approved health department.

[Comment: Paragraph (C)(10) of this rule requires all ground water analysis and statistical analysis results to be submitted to the operating record not later than seventy-five days after sampling a monitoring well.]

- (e) Not later than one hundred eighty days after implementing the ground water quality assessment plan, the owner or operator shall collect additional statistically independent samples (a minimum of four) from any background well sampled pursuant to paragraph (E)(4)(a) of this rule that does not have at least four independent analysis results of each waste-derived constituent detected in the monitoring wells, demonstrating a statistically significant increase.

[Comment: Except for paragraph(E)(8)(a) of this rule, no statistical evaluation of any data is required to be performed under the ground water quality assessment program.]

- (f) Upon the written request of the owner or operator, the director may delete any of the monitoring parameters contained in appendix II to this rule for a sanitary landfill facility if the owner or operator can show that the deleted constituents are not reasonably expected to be in or derived from the waste contained in the sanitary landfill facility.
- (g) After sampling in accordance with paragraph (E)(4)(a) of this rule, the owner or operator may delete 1,2- Dibromoethane (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) from the constituents used to meet paragraph (E) of this rule upon demonstration that there has never been a confirmed detection of EDB or DBCP in the ground water at the sanitary landfill facility.

- (h) Ground water monitoring wells not used to make a determination according to paragraph (E)(5) of this rule shall continue to be monitored in accordance with the ground water monitoring program applicable to those wells prior to the initiation of assessment monitoring.

[Comment: If a well was in compliance with the requirements of the ground water detection monitoring program prior to initiation of the ground water assessment monitoring program and the well is not necessary to make a determination in accordance with paragraph (E)(5) of this rule, then the well shall continue to be monitored under the ground water detection monitoring program requirements as the ground water assessment monitoring program continues.]

- (5) A determination of rate, extent, and concentration. The owner or operator shall implement the "ground water quality assessment plan" which satisfies the requirements of paragraphs (E)(3) (E)(4) of this rule and at a minimum determines the following:

- (a) The rate and extent of migration of the waste-derived constituents in the ground water.
- (b) The concentrations of the waste-derived constituents in the ground water.

This shall include portions of the contaminant plume that exist beyond the facility boundary, unless the owner or operator demonstrates to the director that, despite the owner or operator's best efforts, the owner or operator was unable to obtain the necessary permission to undertake such action. At a minimum, the owner or operator shall submit a copy of their written access request and if a response is provided, a copy of the written statement from the off-site property owner indicating that off-site access is denied. The owner or operator is not relieved of all responsibility to clean up a release that has migrated beyond the facility boundary where off-site access is denied. On-site measures to address such releases will be determined on a case-by-case basis.

- (6) Ground water assessment report. The owner or operator shall make a determination according to

paragraph (E)(5) of this rule within the time frame specified in the submitted ground water quality assessment plan. The owner or operator shall submit to the director, not later than fifteen days after making a determination, a written ground water quality assessment report containing an assessment of the ground water quality including all data generated as part of implementation of the ground water quality assessment plan.

- (7) After complying with paragraph (E)(5) of this rule, if the release of waste-derived constituents to ground water as characterized within the report required under paragraph (E)(6) of this rule exclusively consists of one or more of parameters numbered 63 through 78 of appendix I to this rule, then the owner or operator may submit a compliance monitoring plan with the ground water quality assessment report submitted in accordance with paragraph (E)(6) of this rule to Ohio EPA and to the operating record in accordance with rule 3745-27-09 of the Administrative Code instead of a corrective measures plan as required under paragraph (F) of this rule. The owners or operators of facilities not subject to rule 3745-27-09 of the Administrative Code may submit the compliance monitoring plan with the ground water quality assessment report submitted in accordance with paragraph (E)(6) of this rule to Ohio EPA. This section of the rule is also applicable to sites meeting the above criteria that have previously submitted corrective measures plans that have not been approved as of the effective date of this rule. These facilities may submit a compliance monitoring plan as an addendum to the existing corrective measures plan. The owner or operator complying with the provisions of this paragraph of this rule is exempt from complying with paragraph (E)(11) of this rule, but shall comply with paragraphs (C)(10), (E)(9) and (E)(10) of this rule.

The compliance monitoring plan shall be implemented with the first semiannual sampling event that occurs after the submittal of the compliance monitoring plan. The compliance monitoring plan shall at a minimum include the following:

[Comment: Activities conducted while in compliance monitoring are to demonstrate that the contamination released to the environment continues to be non-hazardous and that the source control measures implemented have limited the growth of the contaminant plume, prevented new contaminants from being released, and stopped the increase in the concentrations of the contaminants already released.]

- (a) A description of the monitoring wells to be sampled. The wells to be sampled during compliance monitoring shall at a minimum include all wells that were sampled in order to make a determination under paragraph (E)(5) of this rule.
- (b) A description of the techniques, procedures, and analytical equipment to be used for ground water sampling during compliance monitoring. This description shall include those sampling and analysis elements listed within paragraph (C)(2) of this rule.
- (c) Provisions for sampling the monitoring wells designated under paragraph (E)(7)(a) of this rule on a semiannual basis and analyzing the samples for the following:
- (i) For monitoring wells screened within the uppermost aquifer system beneath the sanitary landfill facility, the parameters required under paragraph (D)(5)(a) of this rule and the waste-derived contaminants determined to have been released from the landfill to the ground water.

- (ii) For monitoring wells not screened within the uppermost aquifer system beneath the sanitary landfill facility, the parameters required under paragraph (D)(5)(b) of this rule and the waste-derived constituents determined to have been released from the landfill to the ground water.
- (d) Provisions for sampling the monitoring wells designated under paragraph (E)(7)(a) of this rule on an annual basis and analyzing the samples for the parameters required under paragraph (D)(5)(c) of this rule.
- (e) Provisions for sampling the monitoring wells designated under paragraph (E)(7)(a) of this rule for the schedule and parameters required under paragraph (D)(5)(d) of this rule.
- (f) Provisions for performing statistical analysis on the semiannual analytical results. Statistical analysis shall be performed using the appropriate statistical procedures specified within paragraphs (C)(6) and (C)(7) of this rule. For statistical analysis, the owner or operator shall do the following:
 - (i) For contaminants determined to have been released to the ground water in accordance with paragraph (E)(5) of this rule, sample and analyze the monitoring wells designated under paragraph (E)(7)(a) of this rule at least eight times during the initial year of compliance monitoring to establish a new, intrawell background unless otherwise approved by the director. Statistical analysis shall commence with the first semiannual sampling event following completion of collecting the background samples.
 - (ii) Commence statistically analyzing the sampling results of constituents to be monitored in accordance with paragraph (E)(7)(c) of this rule and not being monitored in accordance with paragraph (E)(7)(f)(i) of this rule with the initial sampling event required under this paragraph.

[Comment: The above rule requires that all contaminants released from the facility have a new intrawell statistical background established for them prior to statistically analyzing the results. For those constituents that have not been released from the facility, the old statistical background data set used for detection monitoring is still appropriate to use and statistical analysis may begin for these constituents with the first sampling event required under this paragraph.]
- (g) Provisions for fulfilling paragraph (E)(5) of this rule in accordance with paragraph (E) of this rule when a statistically significant increase is determined for parameters 1 through 62 of appendix I to this rule.

[Comment: If a statistical analysis demonstrates a statistically significant increase over background in concentration for parameters 1 through 62 of appendix I to this rule, then the facility is required to update the ground water quality assessment plan and determine the concentration of any contaminant released as well as the rate and extent of migration of the contaminants.]
- (h) Provisions for sampling the monitoring wells designated under paragraph (E)(7)(a) of this rule for the parameters listed in appendix II to this rule if any parameter not included within parameters 1 through 62 of appendix I to this rule demonstrates a statistically significant increase over the new

background established under the provisions of paragraph (E)(7)(f) of this rule. If any constituent from appendix II to this rule is detected above background, then the owner or operator shall commence provisions for fulfilling paragraph (E)(5) of this rule in accordance with paragraph (E) of this rule. If no parameters from appendix II to this rule are detected above background, and the parameters detected above background are limited to parameters 63 through 78 of appendix I to this rule, then the owner or operator shall revise the compliance monitoring plan and implement the revised compliance monitoring plan during the next regularly scheduled semiannual sampling event.

[Comment: If a statistical analysis demonstrates a statistically significant increase over the new background in concentration for any parameter other than parameters 1 through 62 of appendix I to this rule, then the facility is required to sample for the parameters within appendix II to this rule. If a parameter contained in appendix II to this rule is detected above background, then the owner or operator is required to update the ground water quality assessment plan and determine the concentration of any contaminant released as well as the rate and extent of migration of the contaminants.]

- (i) Provisions for continuing to implement the compliance monitoring plan until the end of the post-closure care period for the sanitary landfill facility unless otherwise approved by the director.
- (j) Activities necessary to prevent the continued release of waste-derived constituents to the ground water. The described activities shall be implemented with the submittal of the compliance monitoring plan. The director may require additional activities necessary to prevent the continued release of waste-derived constituents to the ground water.
- (k) Provisions for demonstration of a false positive. The owner or operator shall include in the compliance monitoring plan provisions to perform one of the following as appropriate to demonstrate a false positive:
 - (i) Use the "1 of M resampling method" to demonstrate that the statistically significant increase over background was a false positive. The "1 of M resampling method" to be used shall be documented within the statistical analysis plan required by paragraph (C)(6) of this rule and shall be protective of human health and safety and the environment. The number of resamples to be used shall be documented with the statistical method specified by the owner or operator as required by paragraph (C)(6) of this rule. If the owner or operator demonstrates using the "1 of M resampling method" that the statistically significant increase over background was a false positive, then the owner or operator may continue with ground water monitoring as specified within the submitted compliance monitoring plan. The owner or operator shall submit a report documenting the demonstration to Ohio EPA not later than one hundred eighty days after initial sampling.
 - (ii) Demonstrate that a source other than the sanitary landfill facility caused the contamination or that the statistically significant increase over background resulted from error in the sampling, analysis, statistical evaluation, or natural variation in ground water quality. A report documenting this demonstration must be submitted to and approved by the director or the director's authorized representative. If not later than one hundred eighty days after the initial sampling the owner or operator does not obtain approval, then the owner or operator shall comply with the provisions of the compliance monitoring plan consistent with paragraphs (E)(7)(h) to (E)(7)(k) of this rule.

- (8) Reinstatement of detection monitoring.
- (a) If the owner or operator determines that the concentrations of all waste-derived constituents are shown to be at or below background values at the monitoring wells within the assessment monitoring program, or for those wells within a specific assessment monitoring area within an assessment monitoring program using the statistical procedures described in paragraph (C)(6) of this rule for two consecutive sampling events, then the owner or operator may reinstate the detection monitoring program described in paragraphs (C) and (D) of this rule by notifying the director.
 - (b) The owner or operator may demonstrate that a source other than the sanitary landfill facility caused the contamination, or that the statistically significant change resulted from error in sampling, analysis, or statistical evaluation, or from natural variation in ground water quality. A report documenting this demonstration must be submitted to director and 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)(10) and (F) of this rule.
- (9) Semiannual determination of rate, extent, and concentration. If the owner or operator determines, based on the determination made according to paragraph (E)(5) 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)(5) 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. The owner or operator shall submit documentation of the semiannual determination of rate, extent, and concentration with the reports required to be submitted in accordance with paragraph (E)(10) of this rule.
- (10) Notification of adjacent landowners. After the determination of rate, extent, and concentration in accordance with paragraph (E)(5) of this rule, the owner or operator shall notify by certified mail or any other form of mail accompanied by a receipt all persons who own land or reside on the land that directly overlies, or is reasonably expected to overlie, any part of the plume of the contamination, as determined in accordance with paragraph (E)(4) of this rule, of the rate, extent, and concentration of the waste-derived constituents in the ground water. The owner or operator shall place the return receipts or other evidence of notification into the operating record. Annually, the owner or operator shall re-notify persons or notify additional persons based on the results of the determinations of rate, extent, and concentration in accordance with paragraph (E)(4) of this rule until released from this obligation by the director.
- (11) Semiannual assessment activities report. Upon implementation of the ground water quality assessment plan submitted under paragraph (E)(2) of this rule, the owner or operator shall submit a report on the activities being conducted at the facility as part of implementation of the ground water quality assessment plan to the appropriate Ohio EPA district office and to the approved health department. All monitoring and reporting required by paragraph (E) of this rule shall continue until the director releases the owner or operator from this obligation or approves a corrective measure in accordance with paragraph (F)(10) of this rule. Any documents or data previously submitted by the owner or operator

during the six month period need not be submitted with the semiannual report. Previously submitted documents or data shall be referenced within the semiannual report as having been submitted. This report shall be submitted semiannually and contain the following:

- (a) A narrative description of all assessment activities that have occurred since the previous report.
- (b) All data generated as part of the assessment program since the previous report.

(F) Corrective measures program.

- (1) General requirements. Unless otherwise specified in paragraph (E)(7) or (E)(8) of this rule, upon determining in accordance with paragraph (E) of this rule that waste-derived contaminants have been detected in the ground water the owner or operator shall implement a corrective measures program plan capable of evaluating all practicable ground water remediation procedures, attaining the concentration level for waste-derived contaminants detected in the ground water, controlling the source of the release, identifying specific ground water monitoring requirements to monitor the effectiveness of the corrective measures, and eliminating further releases. The owner or operator shall implement the corrective measures program in accordance with the corrective measures plan and this rule.
- (2) Corrective measures plan. Unless otherwise specified in paragraph (E)(7) or (E)(8) of this rule, and not later than one hundred and eighty days after making a determination in accordance with paragraph (E)(5) of this rule, the owner or operator shall submit a corrective measures plan to the director and into the operating record. The corrective measures plan shall evaluate all practicable remediation procedures which are available for remediating any contamination discovered during assessment monitoring. 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)(7) of this rule.
 - (c) Control the source of releases to reduce or eliminate, to the maximum 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.
 - (e) Contain a revised ground water corrective measures monitoring plan which identifies specific ground water monitoring requirements to monitor the effectiveness of the corrective measures. The ground water corrective measures monitoring plan shall at a minimum contain provisions:
 - (i) For determining semiannually, that ground water remediation standards established in accordance with paragraph (F)(7) of this rule are achieved for those contaminants determined to have been released to ground water.
 - (ii) For semiannual monitoring for the presence above background levels of parameters numbered 1-66 of appendix I to this rule determined not to have been released to ground water.
 - (iii) Which meet the applicable provisions of paragraphs (B) to (D) of this rule.

- (3) The owner or operator shall evaluate each proposed remediation procedure within the corrective measures plan. 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.
 - (viii) Time until full protection is achieved.
 - (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 ease or difficulty of implementing potential remedies based on consideration of the following types of factors:
 - (i) Degree of difficulty associated with constructing the technologies.
 - (ii) Expected operation reliability of the technologies.
 - (iii) Availability of necessary equipment and specialists.
 - (f) The degree to which community concerns are addressed by a potential corrective measure.
 - (g) 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.

- (h) A schedule for initiating and completing each remediation procedure discussed in the plan. 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 the environment from contaminant exposure prior to completion of the remediation procedure.
 - (vi) Practicable capability of the owner or operator.
 - (vii) Other relevant factors.
- (i) 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.
- (j) Practical capability of the owner or operator.
- (k) Other relevant factors.

(4) Public meeting. The owner or operator shall:

- (a) Not later than thirty days after submitting the corrective measures plan to the director, place copies of the ground water quality assessment report and the corrective measures plan in the nearest public library, or other publicly accessible equivalent location, to the affected sanitary landfill facility. The owner or operator shall periodically revise and update the copies, but not later than the annual update of the operating record in accordance with rule 3745-27-09 of the Administrative Code. The

copies shall be made available to the public until a remedy is selected by the director.

- (b) Not later than sixty days after submitting the corrective measures plan to the director, discuss the results and content of the ground water quality assessment report and the corrective measures plan in a public meeting with interested and affected parties. The owner or operator shall provide adequate and reasonable public notice of the meeting, and the public meeting must be held at a place and time reasonably convenient to the interested and affected parties.
 - (c) Solicit public comment on the proposed corrective measures plan. Any public comments received shall be placed in the operating record and submitted to the appropriate Ohio EPA district office and the approved health department.
- (5) The director or the director's authorized representative may require the owner or operator to evaluate, as part of the corrective measures study, one or more specific potential remediation procedures.
- (6) Interim corrective measures. 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), (F)(3), and (F)(7) 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) Actual or potential contamination of drinking water supplies or sensitive ecosystems.
 - (iv) Any further degradation of the ground water that may occur if remedial action is not initiated expeditiously.
 - (v) Weather conditions that may cause waste-derived constituents to migrate or be released.
 - (vi) 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.
 - (vii) Other situations that threaten human health and the environment.
- (7) Ground water remediation standards. The corrective measures plan shall propose a concentration level for each waste-derived constituent which has been detected in the ground water at a statistically significant level. 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 environment receptors, then the following apply:
 - (i) For constituents for which maximum contaminant levels have been promulgated under Chapter 3745-81 of the Administrative Code, the maximum contaminant level for that constituent.
 - (ii) For constituents for which maximum contaminant levels have not been promulgated, the background concentration for the constituent from wells in accordance paragraphs (C)(4) and (C)(5) of this rule.
 - (iii) If the owner or operator can demonstrate to the director that a waste-derived constituent is already present in the ground water at a background level, then the proposed concentration levels shall not be set below background levels unless the director determines that cleanup to levels below background levels is necessary to protect human health and the environment and such cleanup is in connection with an area-wide remedial action under other authorities.
- (c) In establishing the proposed concentration levels that meet the requirements of paragraph (F)(7)(b) of this rule, the permittee 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) The director or the director's authorized representative may establish an alternative ground water remediation standard for constituents for which maximum contaminant levels have not been established. These ground water remediation standards shall be appropriate health based levels that satisfy the following criteria:
 - (i) The level is derived in a manner consistent with federal guidelines for assessing the health risks of environmental pollutants.
 - (ii) The level is based on scientifically valid studies conducted in accordance with standard laboratory practices.
 - (iii) For known or suspected carcinogens, the proposed concentration levels shall be established at concentration levels below those that represent a cumulative (due to lifetime exposure) excess upper-bound lifetime cancer risk to an individual within the 1×10^{-4} to 1×10^{-6} range.
 - (iv) For systematic toxicants, 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. For the purposes of this rule, "systematic toxicants" include toxic chemicals that cause effects other than cancer or mutation.
- (8) Determination that remediation is not necessary. The director may determine that remediation of a release of waste-derived constituents from the sanitary landfill facility is not necessary if the owner or operator

demonstrates one of the following:

- (a) The ground water is additionally contaminated by substances that have originated from a source other than the sanitary landfill facility and those substances are present in concentrations such that cleanup of the release from the sanitary landfill facility would provide no significant reduction in risk to actual or potential receptors.
 - (b) The constituents present in ground water that:
 - (i) Is not currently or reasonably expected to be a source of drinking water.
 - (ii) Is not hydraulically connected with waters to which the waste-derived constituents are migrating or are likely to migrate in concentrations that would exceed the ground water remediation standards established under paragraph (F)(7) of this rule.
 - (c) Remediation of releases is technically impractical.
 - (d) Remediation results in unacceptable cross-media impacts.
- (9) A determination by the director pursuant to paragraph (F)(8) of this rule shall not affect the director's authority to require the owner or operator to undertake source control measures or other measures that may be necessary to eliminate or minimize further releases to ground water, to prevent exposure to ground water, or to remediate ground water to concentrations that are technically practicable and significantly reduce threats to human health and the environment.
- (10) Selection of corrective measure. The director shall select from the corrective measures plan, or designate according to paragraph (F)(6) of this rule, the corrective measure which best meets the criteria listed in paragraphs (F)(2), (F)(3), and (F)(7) of this rule. The owner or operator shall implement the corrective measure designated by the director in accordance with the schedule of implementation selected by the director.
- [Comment: Upon the selection of a corrective measure by the director, the owner or operator shall comply with the financial assurance requirements of rule 3745-27-18 of the Administrative Code.]
- (11) Determination that a corrective measure not technically practicable. 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 for the remediation procedure selected under paragraphs (F)(10) of this rule is not technically practicable. In making such a determination, the director shall consider the following:
- (a) The owner's or operator's efforts to achieve compliance with the requirements.
 - (b) Whether other currently available or new methods or techniques could practicably achieve compliance with the requirements.
- (12) Alternative measures. 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 procedures, 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)(10) of this rule, or an interim measure required under paragraph (F)(6) of this rule, shall be managed in a manner:
 - (a) That is protective of human health and the environment.
 - (b) That complies with applicable laws and regulations.
- (14) Semiannual corrective measures activities report. The owner or operator shall submit to the appropriate Ohio EPA district office and the approved health department, upon implementation of the remediation procedure chosen under paragraph (F)(10) of this rule, a report of the activities being conducted at the facility as part of implementation of the corrective measures program. Any documents or data previously submitted by the owner or operator during the semiannual period need not be submitted with the semiannual report. Previously submitted documents or data shall be referenced within the semiannual report as having been submitted. 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.
- (15) Completion of corrective measures. The corrective measures selected pursuant to paragraph (F)(10) of this rule shall be considered complete when the following occur:
 - (a) The owner or operator complies with the ground water remediation standards established under paragraph (F)(7) of this rule at all points within the plume of contamination that lie beyond the limits of waste placement.
 - (b) Compliance with the ground water remediation standards established under paragraph (F)(7) of this rule has been achieved by demonstrating semiannually via ground water monitoring that the contamination has not exceeded the ground water remediation standards for a period of three years or until the end of the post-closure care period, whichever is longer, using the statistical procedures and performance standards in paragraphs (C)(6) and (C)(7) of this rule. The director may specify an alternative length of time during which the owner or operator shall demonstrate that the contamination has not exceeded the ground water protection standards taking into account the following considerations:
 - (i) Extent and concentration of the contamination.
 - (ii) Behavior characteristics of the contamination in the ground water.

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

(iv) Characteristics of the ground water.

(c) All actions required to complete the corrective measure have been satisfied.

(16) Certification corrective measures completed. Not later than fourteen days after completion of the corrective measure, the owner or operator shall certify to the director that the corrective measure has been completed in compliance with paragraph (F)(15) of this rule. The certification shall be signed by the owner or operator and a qualified ground water scientist. A copy of the certification shall be placed in the operating record. Upon approval by the director of the certification, the owner or operator shall be released from the financial assurance requirements for corrective measures under rule 3745-27-18 of the Administrative Code.

(G) Incorporation by reference. The text of the incorporated materials is not included in this rule. The materials listed in paragraph (G)(2) of this rule are hereby made a part of this rule. For materials subject to change, only the specific version specified in this rule is incorporated. Any amendment or revision to a referenced document is not incorporated until this rule has been amended to specify the new version.

(1) Availability. The statistical methods can be found in publications including but not limited to, "Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities." Unified guidance. EPA/R-09-007. U.S. EPA. 2009. Office of resource conservation and recovery program implementation and information division. U.S. environmental protection agency.
<http://www.epa.gov/osw/hazard/correctiveaction/resources/guidance/sitechar/gwstats/unified-guid.pdf>. However, many of the documents are also available for inspection and copying at most public libraries and "The State Library of Ohio."

(2) Incorporated materials. Appropriate statistical methods, including the following:

(a) "1 of M resampling method."

(b) "Analysis of variance (ANOVA) model."

(c) "Control charts."

(d) "Prediction intervals."

(e) "Tolerance intervals."

Effective: 01/01/2017

Five Year Review (FYR) Dates: 08/01/2016 and 01/01/2022

CERTIFIED ELECTRONICALLY

Certification

10/13/2016

Date

Promulgated Under: 119.03
Statutory Authority: 3734.02, 3734.12
Rule Amplifies: 3734.02, 3734.12
Prior Effective Dates: 3/10/1990, 6/1/1994, 8/15/2003

Appendix I

Compound: ¹	CAS RN: ²
1) Antimony ³	7440-36-0
2) Arsenic ³	7440-38-2
3) Barium ³	7440-39-3
4) Beryllium ³	7440-41-7
5) Cadmium ³	7440-43-9
6) Chromium ³	7440-47-3
7) Cobalt ³	Total
8) Copper ³	7440-50-8
9) Lead ³	7439-92-1
10) Nickel ³	7440-02-0
11) Selenium ³	7782-49-2
12) Silver ³	Total
13) Thallium ³	7440-28-0
14) Vanadium ³	7440-62-2
15) Zinc ³	7440-66-6
16) Acetone	67-64-1
17) Acrylonitrile	107-13-1
18) Benzene	71-43-2
19) Bromochloromethane	74-97-5
20) Bromodichloromethane	75-27-4
21) Bromoform; Tribromomethane	75-25-2
22) Carbon disulfide	75-15-0
23) Carbon tetrachloride	56-23-5
24) Chlorobenzene	108-90-7
25) Chloroethane; Ethyl chloride	75-00-3
26) Chloroform; Trichloromethane	67-66-3
27) Dibromochloromethane; Chlorodibromomethane	124-48-1
28) 1,2-Dibromo-3-chloropropane; DBCP	96-12-8
29) 1,2 Dibromoethane; Ethylene dibromide; EDB	106-93-4
30) o-Dichlorobenzene; 1,2-Dichlorobenzene	95-50-1
31) p-Dichlorobenzene; 1,4-Dichlorobenzene	106-46-7
32) trans-1,4-Dichloro-2-butene	110-57-6
33) 1,1-Dichloroethane; Ethylidene chloride	75-34-3

34) 1,2-Dichloroethane; Ethylidene dichloride	107-06-2
35) 1,1-Dichloroethylene; 1,1-Dichloroethene; Vinylidene chloride	75-35-4
36) cis-1,2-Dichloroethylene; cis-1,2-Dichloro- ethene	156-59-2
37) trans-1,2-Dichloroethylene; trans-1,2-Dichloro- ethene	156-60-5
38) 1,2-Dichloropropane; Propylene dichloride	78-87-5
39) cis-1,3-Dichloropropene	10061-01-5
40) trans-1,3-Dichloropropene	10061-02-6
41) Ethylbenzene	100-41-4
42) 2-Hexanone; Methyl butyl ketone	591-78-6
43) Methyl bromide; Bromomethane	74-83-9
44) Methyl chloride; Chloromethane	74-87-3
45) Methylene bromide; Dibromomethane	74-95-3
46) Methylene chloride; Dichloromethane	75-09-2
47) Methyl ethyl ketone; MEK; 2-Butanone	78-93-3
48) Methyl iodide; iodomethane	74-88-4
49) 4-Methyl-2-pentanone; Methyl isobutyl ketone	108-10-1
50) Styrene	100-42-5
51) 1,1,1,2-Tetrachloroethane	630-20-6
52) 1,1,2,2-Tetrachloroethane	79-34-5
53) Tetrachloroethylene; Tetrachloroethene; Perchloroethylene	127-18-4
54) Toluene	108-88-3
55) 1,1,1-Trichloroethane; Methylchloroform	71-55-6
56) 1,1,2-Trichloroethane	79-00-5
57) Trichloroethylene; Trichloroethene	79-01-6
58) Trichlorofluoromethane; CFC-11	75-69-4
59) 1,2,3-Trichloropropane	96-18-4
60) Vinyl acetate	108-05-4
61) Vinyl chloride	75-01-4
62) Xylenes	1330-20-7
63) Ammonia	7664-41-7
64) Chloride	
65) Sodium	
66) Potassium	
67) Temperature	
68) pH	

69) Specific conductance	
70) Total dissolved solids	
71) Total alkalinity	
72) Nitrate-nitrite	
73) Sulfate	14808-79-8
74) Magnesium	7439-95-4
75) Calcium	7440-70-2
76) Turbidity	
77) Iron	7439-89-6
78) Manganese	7439-96-5

Note 1: Common names are those widely used in government regulations, scientific publications, and commerce; synonyms exist for many chemicals.

Note 2: Chemical Abstract Service registry number.

Note 3: 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 4: 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 II

Compound: ¹	CAS RN: ²
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,5,8,8ahexahydro(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 ⁴	7440-36-0
14) Arsenic ⁴	7440-38-2
15) Barium ⁴	7440-39-3
16) Benzene	71-43-2
17) Benzo[a]anthracene; Benzanthracene	56-55-3
18) Benzo[b]flouranthene; Benz[e]jacephenanthylene	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 ⁴	7440-41-7
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-Hexachlorocyclo hexane, (1a,2a,3b,4a,5a, 6b)	58-89-9
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'-Dichlorodi-isopropyl ether; DCIP; 2,2'-oxybis[1-Chloropropane]	108-60-1

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 ⁴	7440-43-9
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 ⁴	7440-47-3
52) Chrysene	218-01-9
53) Cobalt ⁴	
54) Copper ⁴	7440-50-8
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-Dichloroethylenylidene)bis [4-chlorobenzene]	72-55-9
62) 4,4'-DDT; 1,1'-(2,2,2-Trichloroethylidene)bis [4-chlorobenzene]	50-29-3

63) Diallylate; 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-dirnethanonaphthalene [2,3-b]oxirene, (1aa,2b,2aa,3b,6b,6aa,7b,7aa)	60-57-1
90) Diethyl phthalate; 1,2-Benzenedicarboxylic acid, Diethyl ester	84-66-2
91) 0,0-Diethyl 0-2-Pyrazinyl phosphorothioate; Thionazin	297-97-2
92) Dirnethoate; Phosphorodithoic acid 0,0-Dimethyl-S-[2-(nethylamino) - 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'-Dirnethylbenzidine; 3,3'-Dirnethyl[1,1'-biphenyl]-4,4'-diarnine	119-93-7

96) 2, 4-Dirnethylphenol; 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-rnethylphenol; 2-Methyl 4,6-dinitrophenol	534-52-1
100) 2,4-Dinitrophenol	51-28-5
101) 2,4-Dinitrotoluene; l-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) Diphenylarnine; N-phenylbenzenamine	122-39-4
106) Disulfoton; Phosphorodithioic acid 0,0-diethyl8- [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-benzodioxathiepin, 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-benzodioxathiepin, 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-benzodioxathiepin, 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-tahydro-b] oxirene, (1aa,2b,2ab,3a,6a,6ab,7b,7aa)	72-20-8
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*)	7421-93-4
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, 0-[4-[(dimethylamino) sulfonyl]phenyl]O,O-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)	1024-57-3
120) Hexachlorobenzene	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)	465-73-6
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-decachloroocta hydro-1,3,4-methano-2H-cyclobuta[cd9]pentalen-2-one	143-50-0
132) Lead ⁴	7439-92-1
133) Mercury ⁴	Total
134) Methacrylonitrile; 2-Methyl-2-propenenitrile	126-98-7
135) Methapyrilene; N,N-dimethyl-N'-2-pyridinyl-N'-/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 ⁴	7440-02-0
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-Ni trosodi-n-butylamine; N-Butyl-N-Ni troso-1-butanamine	924-16-3
161) N-Nitrosodiethylamine; N-Ethyl-N-nitroso ethanamine	55-18-5
162) N-Nitrosodimethylamine; N-Methyl-N-nitroso methananmine	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-N1trosopyrrolidine	930-55-2
168) 5-Nitro-o-toluidine; 2-Methyl-5-nitrobenzenamine	99-55-8
169) Parathion; Phosphorothioic acid, 0,0-diethyl 0-(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, 0,0-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	94-59-7
183) Selenium ⁴	7782-49-2
184) Silver ⁴	Total
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; 2,3,7,8-TCDD; 2,3,7,8-Tetrachlorodibenzo- p-dioxin 1746-01-6 Dibenzo[b,e][1,4]dioxin, 2,3,7,8-tetrachloro-	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 ⁴	7440-28-0
195) Tin ⁴	Total
196) Toluene; Methylbenzene	108-88-3
197) o-Toluidine; 2-Methylbenzenamine	95-53-4
198) Toxanhene	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 ⁴	7440-62-2
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 ⁴	7440-66-6

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" (*a*) =alpha; "b" = small case "b"; and "B" (*B*) = 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 57-74-9 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 a-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).