



Ohio Administrative Code

Rule 3745-30-08 Ground water monitoring program.

Effective: May 28, 2021

(A) Applicability. The owner or operator, of a new industrial waste landfill or residual waste landfill facility, an existing industrial waste landfill or residual waste landfill facility undergoing a lateral or vertical expansion, and of any industrial waste landfill or residual waste landfill facility undergoing closure in accordance with rule 3745-30-09 of the Administrative Code shall implement and maintain a ground water monitoring program capable of determining the impact of the landfill facility on the quality of ground water occurring within the uppermost aquifer system and all significant zones of saturation above the uppermost aquifer system underlying the landfill facility. The ground water monitoring program shall comply with paragraphs (B) to (F) of this rule and shall be protective of human health and safety and the environment. The ground water monitoring program shall be documented as a written ground water monitoring program plan as part of a landfill facility's permit to install application or closure plan, as applicable. The ground water monitoring program plan shall describe the owner or operator's program and how the plan complies with this rule. The ground water monitoring program shall be implemented upon final approval of the permit to install application or closure plan. The owner or operator shall use the methods documented in the plan. Changes to an approved plan shall be submitted to Ohio EPA sixty days before implementation of those changes.

(B) Monitoring system.

(1) The ground water monitoring system shall include a sufficient number of wells, installed at appropriate locations and depths, to yield ground water samples from both the uppermost aquifer system and any significant zones of saturation that exist above the uppermost aquifer system. The ground water monitoring system shall meet the following:

- (a) Represent the quality of the ground water that has not been affected by past or present operations at the landfill facility.
- (b) Represent the quality of the ground water passing directly downgradient of the limits of solid



waste placement.

(c) Include surface water monitoring of seeps, springs, or streams in addition to or as a partial alternative to the ground water monitoring if proposed by the owner or operator or required by the director. Such surface water monitoring shall include provisions for sampling procedures, constituents to be analyzed, and analyzing the resulting data.

(2) For an uppermost aquifer system more than one hundred fifty feet beneath base of the waste or the recompacted clay liner of the landfill facility, the ground water monitoring system shall consist of a sufficient number of wells, installed at appropriate locations and depths, to yield ground water samples from an adequate number of significant zones of saturation, in accordance with paragraphs (B)(1)(a) and (B)(1)(b) of this rule, to ensure detection of any contaminant release from the facility.

(3) All monitoring wells included in the ground water monitoring program shall be designed, installed, and developed in a manner that allows the collection of ground water samples that are representative of ground water quality in the geologic unit being monitored, and in accordance with the following criteria:

(a) Monitoring wells shall be cased in a manner that maintains the integrity of the monitoring well boreholes.

(b) The annular space, 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) The minimization of the passage of formation materials into the well.

(ii) The monitoring of discrete portions of the uppermost aquifer system or any significant zones of saturation above the uppermost aquifer system.

(d) The design, installation, development, maintenance procedures, and abandonment of any



monitoring wells, piezometers, and other measurement, sampling, and analytical devices shall be documented in the ground water monitoring program plan.

(e) The monitoring wells, piezometers, and other measurement, sampling, and analytical devices shall be operated and maintained to perform to design specifications throughout the life of the ground water monitoring program.

(f) Monitoring wells constructed or used for the purposes of this rule are not required to comply with Chapter 3745-9 of the Administrative Code.

(4) The number, spacing, and depth of ground water monitoring wells included in the ground water monitoring system shall be as follows:

(a) Based on site-specific hydrogeologic information.

(b) Capable of detecting a release from the landfill facility to the ground water at the closest practicable location to the limits of IMW placement.

(5) Unless the ground water is monitored to satisfy the requirements of paragraphs (E) and (F) of this rule, the owner or operator shall at a minimum annually evaluate the ground water surface elevation data obtained in accordance with paragraph (C)(2) of this rule to determine whether the requirements of paragraph (B) of this rule for locating the monitoring wells continue to be satisfied. The results of this evaluation shall be included in the report required by rule 3745-30-14 of the Administrative Code. If the evaluation shows that paragraph (B) of this rule is no longer satisfied, the owner or operator shall immediately modify the number, location, or depth of the monitoring wells to bring the ground water monitoring system into compliance.

(C) Sampling, analysis, and statistical methods.

(1) The ground water monitoring program shall include consistent sampling and analysis procedures that are protective of human health and safety and the environment and that are designed to ensure monitoring results that provide an accurate representation of ground water quality at the background and downgradient wells installed in accordance with paragraph (B) of this rule. Sampling and



analysis procedures employed in the ground water monitoring program shall be documented in a sampling and analysis plan included in the ground water monitoring program plan required by paragraph (A) of this rule and be available for inspection at the landfill facility. The owner or operator shall use the methods documented in the sampling and analysis plan. Changes to the plan shall be submitted to Ohio EPA not later than sixty days prior to implementation. At a minimum, the plan shall include a detailed description of the equipment, procedures, and techniques to be used for the following:

(a) Measurement of ground water elevations.

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

(i) Well evacuation.

(ii) Sample withdrawal.

(iii) Sample containers and handling.

(iv) Sample preservation.

(c) Performance of field analysis, including the following:

(i) Procedures and forms for recording raw data and the exact location, time, and facility-specific conditions associated with the data acquisition.

(ii) Calibration of field devices.

(d) Decontamination of equipment.

(e) Analysis of ground water samples.

(f) Chain of custody control, including the following:



- (i) Standardized field tracking reporting forms to record sample custody in the field prior to and during shipment.
- (ii) Sample labels containing all information necessary for effective sample tracking.
- (g) Field and laboratory quality assurance and quality control, including the following:
 - (i) Collection of replicate samples.
 - (ii) Submission of field-bias blanks.
 - (iii) Potential interferences.
- (2) Ground water elevations shall be measured within a single twenty-four-hour period in all monitoring wells at least semi-annually and in each well prior to purging and sampling. The owner or operator shall determine, for the uppermost aquifer system and for all significant zones of saturation monitored, the direction of ground water flow at least semi-annually. The ground water elevations and direction of flow shall be shown on a potentiometric map with the sampling data submitted in accordance with paragraph (C)(8) of this rule.
- (3) Unless establishing background in accordance with paragraph (C)(4) of this rule, the owner or operator shall establish background ground water quality by analyzing ground water samples collected from hydraulically upgradient wells for each of the monitoring parameters or constituents required in the particular ground water monitoring program that applies to the landfill facility as determined by paragraph (D), (E), or (F) of this rule.
- (4) Background ground water quality at existing landfill facilities may be based on sampling of wells that are not hydraulically upgradient where the following occur:
 - (a) Hydrogeologic conditions do not allow the owner or operator to determine which wells are upgradient.
 - (b) Sampling of other wells will provide an indication of background ground water quality that is as



representative or more representative than that provided by upgradient wells.

(5) Not later than ninety days after obtaining the final sample that completes the initial year of ground water monitoring, 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)(4) of this rule. The statistical method specified shall ensure protection of human health and safety and the environment and shall comply with the performance standards outlined in paragraph (C)(6) of this rule. The statistical method specified shall be selected from the following:

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

(b) A control chart approach that gives control limits for each parameter.

(c) A parametric analysis of variance ("ANOVA") followed by multiple comparisons procedures to identify statistically significant evidence of contamination. This shall include estimation and testing of the contrasts between the mean for each monitoring well and the background mean levels for each parameter.

(d) An analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. This shall include estimation and testing of the contrasts between each monitoring well's median and the background medial levels for each parameter.

(e) Another statistical test method submitted by the owner or operator and approved by Ohio EPA.

(6) Any statistical method chosen in accordance with paragraph (C)(5) of this rule shall comply with the following performance standards as appropriate:

(a) The statistical method used to evaluate ground water monitoring data shall be appropriate for the distribution of chemical parameters or waste-derived constituents. If the distribution of the chemical



parameters or waste-derived constituents is shown by the owner or operator to be inappropriate for a normal theory test, then the data should be transformed or a distribution free theory test should be used. If the distributions for the constituents differ, more than one statistical method may be needed.

(b) If an individual well comparison procedure is used to compare an individual monitoring well constituent concentration with background constituent concentrations or a ground water concentration level, the test shall be conducted at a type I error level not less than 0.01 for each testing period. If multiple comparisons procedures are used, the type I experimentwise error rate for each testing period shall be not less than 0.05; however, the type I error rate of not less than 0.01 for individual monitoring well comparisons shall be maintained. This performance standard does not apply for tolerance intervals, prediction intervals, or control charts.

(c) If a control chart approach is used to evaluate ground water monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and safety and the environment. The parameter values shall be determined after considering the number of samples in the background database, the data distribution, and the range of the concentration values for each parameter.

(d) If a tolerance interval or a prediction interval is used to evaluate ground water monitoring data, then the levels of confidence and the percentage of the population contained in any tolerance or prediction interval shall be protective of human health and safety and the environment. These statistical parameters shall be determined after considering the number of samples in the background data base, the data distribution, and the range of the concentration values for each constituent of concern.

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

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



(g) Background data can be added only in blocks of data resulting from the analysis of four or more statistically independent samples after the data have been statistically compared to the current background data and no statistical differences are detected, unless another method is deemed acceptable to Ohio EPA.

(h) Prior to initially using an intra-well statistical method for the detection monitoring program, the owner or operator shall demonstrate the ground water is not impacted by a release from the landfill facility within the relevant well, unless approved otherwise by Ohio EPA.

(7) The owner or operator shall determine if there is a statistically significant increase (or change in the case of pH) from background values for each parameter or constituent required by paragraph (D), (E), or (F) of this rule, as applicable. The owner or operator shall make this statistical determination either semi-annually, if paragraph (D) of this rule applies, or as specified in the ground water quality assessment program required by paragraph (E) of this rule if that paragraph applies, or in the corrective measure selected in accordance with paragraph (F) of this rule if that paragraph applies. To determine whether a statistically significant increase or decrease has occurred, the owner or operator shall compare the ground water quality of each parameter or constituent at each downgradient ground water monitoring well to the background value of that parameter or constituent according to the statistical procedures specified in paragraphs (C)(5) and (C)(6) of this rule.

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

(D) Detection monitoring.

(1) The owner or operator shall determine the concentration or value of the applicable parameters from the applicable list contained in appendix C to this rule for the owner or operator's waste. The concentration or value shall be determined in accordance with paragraphs (D)(3) to (D)(6) of this rule.



(2) The owner or operator of an industrial waste landfill or a residual waste landfill facility may propose an alternative list of parameters to meet the requirements of paragraphs (D)(3) to (D)(6) of this rule. The list of alternative parameters shall be submitted by the owner or operator and acknowledged by Ohio EPA prior to use. The alternative parameter list shall be indicative of the waste streams deposited at the landfill facility and shall be protective of human health and safety and the environment. At a minimum, the alternative parameter list shall specify the following:

(a) The parameters to be analyzed in the ground water samples during the initial year of ground water monitoring in accordance with paragraph (D)(3) of this rule.

(b) The parameters to be analyzed in the ground water samples at least semi-annually in accordance with paragraph (D)(4) of this rule.

(c) The parameters to be analyzed in the ground water samples at least annually after the initial year in accordance with paragraph (D)(5) of this rule.

(d) The parameters specified in paragraph (D)(2)(b) of this rule to have their analytical results statistically evaluated in accordance with paragraph (D)(4) of this rule.

(e) The chemical composition of the IMW which have been, and are to be, deposited at the landfill facility.

(f) The chemical composition of leachate, if available, from an existing landfill facility being used to dispose of a similar waste.

(g) Any other relevant information that Ohio EPA deems necessary.

(3) During the initial year of ground water monitoring, which shall commence prior to waste placement for newly permitted landfill facilities, the initial background concentrations or values shall be established for the background water quality parameters specified either in appendix C to this rule for the owner or operator's waste or in the alternative parameter list approved in accordance with paragraph (D)(2) of this rule. The sampling frequency shall be at least quarterly for the initial year of ground water monitoring. The number and kinds of samples collected to establish background water



quality for those background water quality parameters that are also listed as indicator parameters for the owner or operator's waste in appendix C to this rule, shall be consistent with the appropriate statistical procedures employed pursuant to paragraphs (C)(5) and (C)(6) of this rule. The sample size shall be as large as necessary to ensure with reasonable confidence that a contaminant release from the facility will be detected. The sampling frequency shall assure, to the greatest extent technically feasible, that an independent sample is obtained, by reference to the monitored zone of saturation, effective porosity, hydraulic conductivity, hydraulic gradient, and the fate and transport characteristics of the potential contaminants.

(4) After the initial year, all monitoring wells shall be sampled at least semi-annually and the samples analyzed for the indicator parameters specified either in appendix C to this rule for the owner or operator's waste or in the alternative parameter list approved in accordance with paragraph (D)(2) of this rule. The owner or operator shall statistically analyze the results for these required indicator parameters in accordance with paragraph (C)(7) of this rule. The number and kinds of samples collected shall be consistent with the statistical method used to analyze the data and shall be as often as necessary to ensure, with reasonable confidence, that a contaminant release to the ground water from the facility will be detected.

(5) After the initial year, all monitoring wells shall be sampled at least annually and the samples analyzed for the water quality annual parameters specified either in appendix C to this rule for the owner or operator's waste or in the alternative parameter list approved in accordance with paragraph (D)(2) of this rule.

(6) Ground water samples shall be field analyzed for temperature, specific conductance, and pH whenever a sample is withdrawn from a monitoring well.

(7) An alternative frequency for ground water sampling or statistical analysis required by paragraph (D)(5) of this rule may be proposed, in writing, by the owner or operator during the active life (including final closure) of a landfill facility and the post-closure care period. The alternative frequency shall not be less than annually. Upon acknowledgment by Ohio EPA, the owner or operator may use the alternative sampling or analysis frequency. At a minimum, the owner or operator shall consider the following factors in proposing an alternative sampling or analysis frequency:



- (a) Lithology of the aquifer system and all stratigraphic units above the uppermost aquifer system.
 - (b) Hydraulic conductivity of the uppermost aquifer system and all stratigraphic units above the uppermost aquifer system.
 - (c) Ground water flow rates for the uppermost aquifer system and all zones of saturation above the uppermost aquifer system.
 - (d) Minimum distance between the upgradient edge of the limits of waste placement of the landfill facility and the downgradient monitoring well system.
 - (e) Resource value of the uppermost aquifer system.
- (8) If the owner or operator determines, for two consecutive semi-annual statistical determination periods, that at any monitoring well there has been a statistically significant increase (or change in the case of pH) from background values for one or more of the applicable indicator parameters specified in appendix C to this rule according to the statistical method specified by the owner or operator pursuant to paragraphs (C)(5), (C)(6), and (D)(9) of this rule, the owner or operator shall notify Ohio EPA not later than fifteen days after receiving the second period's statistical or analytical results which indicate a statistically significant change. The notification shall indicate which parameters have shown a statistically significant change from background levels.
- (9) The owner or operator may demonstrate that a source other than the landfill facility is the cause of the contamination or that the statistically significant increase results from error in the sampling, analysis, or statistical evaluation, or from natural variation in ground water quality.
- (a) When resampling demonstrates the increase to be an error, the resampling results shall be submitted to Ohio EPA in accordance with paragraph (C)(8) of this rule. If the owner or operator demonstrates using a resampling method that the statistically significant increase over background was a false positive, then the owner or operator may return to detection monitoring. The owner or operator shall comply with paragraphs (D)(8) to (D)(12) of this rule until this demonstration is submitted.



(b) When the owner or operator demonstrates that the statistically significant increase to be an error in statistical procedure or from natural variation in ground water quality, a report documenting this demonstration shall be submitted as an addendum to the results and data required in paragraph (C)(8) of this rule to Ohio EPA. Until notification by the director that the report does not successfully demonstrate that the statistically significant increase over background resulted from an error in statistical evaluation or from natural variation in ground water quality, the owner or operator shall comply with paragraphs (D)(1) to (D)(9) of this rule. Upon notification by the director that the report does not successfully demonstrate that the statistically significant increase over background resulted from an error in statistical evaluation or from natural variation in ground water quality, the owner or operator shall comply with the provisions of paragraphs (D)(8) and (D)(10) to (D)(12) of this rule.

(10) Not later than fifteen days after notifying Ohio EPA in accordance with paragraph (D)(8) of this rule, the owner or operator shall sample the leachate or the affected well and analyze for constituents as follows:

(a) For facilities with leachate collection systems completely or partially underlying the waste disposal area, the leachate collection system shall be sampled and analyzed for those parameters listed in appendix B to this rule. Not later than seventy-five days after sampling the leachate collection system, the affected well shall be sampled and analyzed for the waste-derived constituents detected in the sample from the leachate collection system, unless otherwise authorized by Ohio EPA.

(b) For facilities without leachate collection systems, the affected well shall be sampled and analyzed for those parameters listed in appendix C to this rule, unless otherwise authorized by Ohio EPA.

(11) Not later than ninety days after sampling the affected well in accordance with paragraph (D)(10) of this rule, the owner or operator shall sample all background wells for all waste-derived constituents detected in the samples from the affected well.

(12) Not later than ninety days after sampling the background wells as required by paragraph (D)(11) of this rule, the owner or operator shall sample all monitoring wells not sampled in accordance with the provisions of paragraphs (D)(10) and (D)(11) of this rule and those samples shall be analyzed for those waste-derived constituents found to be above background levels in the affected monitoring



wells sampled in accordance with paragraph (D)(10) of this rule.

(13) If the owner or operator determines, based on the results of the sampling required by paragraph (D)(10), (D)(11), or (D)(12) of this rule, that there has not been an increase above background levels of waste-derived constituents at any monitoring well downgradient of the facility, the owner or operator shall submit a report certified by a qualified ground water scientist documenting the demonstration to Ohio EPA. The owner or operator may return to detection monitoring until notification is received from the director stating that the report failed to successfully demonstrate that there was not an increase above background levels of waste-derived constituents at any monitoring well downgradient of the facility.

(14) Ohio EPA or the director, as applicable, may consider the following information submitted by the owner or operator when evaluating a request made under paragraphs (D)(13), (E)(5), and (E)(7) of this rule:

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

(E) Assessment.

(1) Not later than one hundred eighty days after conducting the sampling required under paragraph (D)(12) of this rule, the owner or operator shall submit to Ohio EPA and implement a specific plan for a ground water quality assessment program to determine the concentration and the rate and extent of migration of waste-derived constituents in the ground water at the landfill facility. At a minimum, the plan shall include the following:

- (a) A summary of the hydrogeologic conditions at the landfill facility.
- (b) A description of the detection monitoring program implemented by the 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.
 - (iii) A summary of statistical analyses applied to the data.
- (c) A detailed description of 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 method for gathering additional hydrogeologic information.
 - (iii) The planned use of supporting methodology (i.e., soil gas or geophysical) survey.
- (d) A detailed description of the techniques, procedures, and analytical equipment to be used for ground water sampling during the assessment including but not limited to the items listed in paragraphs (C)(1)(a) to (C)(1)(g) of this rule.
- (e) A detailed description of the data evaluation procedures to be used including but not limited to the following:
- (i) Planned use of statistical data evaluation.
 - (ii) Planned use of computer models.
 - (iii) Planned use of previously gathered information.
 - (iv) Criteria that will be utilized to determine if additional assessment activities are warranted.



(f) A schedule of implementation.

(2) The owner or operator shall implement the ground water quality assessment program that satisfies the requirements of paragraph (E)(1) of this rule to determine the concentrations and the rate and extent of migration of the waste-derived constituents in the ground water. The owner or operator shall make this determination within the time frame specified in the submitted ground water quality assessment program. Not later than fifteen days after making this determination, the owner or operator shall submit a written report to Ohio EPA containing an assessment of the ground water quality including all data generated as part of implementation of the ground water quality assessment program.

(3) All monitoring wells not affected by the ground water quality assessment program required by paragraph (E) of this rule shall be monitored in accordance with paragraphs (C) and (D) of this rule.

(4) On a semiannual basis, the owner or operator shall analyze the applicable indicator parameters contained in appendix C to this rule and those constituents determined to be released. On an annual basis, the owner or operator shall analyze all the parameters applicable for the facility contained in appendix C to this rule until relieved by the director in accordance with paragraph (F)(16) of this rule.

(5) If the owner or operator determines, based on the results of the determination made according to paragraph (E)(2) of this rule, that no waste-derived constituents from the facility have entered the ground water, then the owner or operator may reinstate the detection monitoring program described in paragraphs (C) and (D) of this rule upon submittal of a notification to the director. The owner or operator shall comply with the provisions of paragraph (E) of this rule until notification is received from the director that the report failed to successfully demonstrate that waste-derived constituents from the facility have not entered the ground water.

(6) If the owner or operator determines, based on the determination made according to paragraph (E)(2) of this rule, that waste-derived constituents from the facility have entered the ground water, then the owner or operator shall continue to make the determination required in accordance with paragraph (E)(2) of this rule. The determination shall be made on a semiannual basis, unless an alternative time interval is established by Ohio EPA, until the owner or operator is released from the



obligation to implement the ground water quality assessment program by Ohio EPA.

(7) If the owner or operator determines, based on the determination made in accordance with paragraph (E)(2) of this rule, that waste-derived constituents from the facility have entered the ground water, then the owner or operator may, prior to meeting the requirements of paragraph (F) of this rule, request that the director approve a compliance monitoring program at the facility. Any request made under this paragraph shall include a description of the compliance monitoring program that includes the following:

(a) The monitoring wells to be included in the compliance monitoring program.

(b) The constituents for which ground water samples will be analyzed and the proposed concentration level for each constituent, which shall act as a ground water trigger level. The ground water trigger levels shall be established using the criteria described in paragraph (F)(5) of this rule.

(c) The sampling frequency, which shall be at a minimum annually, of all compliance monitoring wells and background wells for all waste-derived constituents.

(d) The techniques, procedures, and analytical equipment to be used for ground water sampling including but not limited to the items listed in paragraphs (C)(1)(a) to (C)(1)(g) of this rule.

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

(f) A description of the statistical method to be used in evaluating the ground water analytical data generated under paragraph (E)(7)(e) of this rule. The statistical method shall be selected from those statistical methods contained in paragraph (C)(5) of this rule and shall meet all criteria listed in paragraphs (C)(5) and (C)(6) of this rule.

(g) Provisions for determining, at a minimum semi-annually, if there has been a statistically



significant increase above the trigger levels for those constituents specified under paragraph (E)(7)(b) of this rule. This determination shall be consistent with the criteria stated in paragraph (C)(7) of this rule.

(h) Provisions for controlling the source of releases in order to reduce or eliminate, to the extent practicable, further releases of waste-derived constituents into the environment.

(i) Provisions for submitting a corrective measures plan in accordance with paragraph (F) of this rule if a statistically significant increase above the trigger levels for those constituents specified under paragraph (E)(7)(b) of this rule is detected and confirmed.

(F) Corrective measures.

(1) Unless a notification has been received from the director in accordance with paragraph (E)(5) or (E)(7) of this rule, the owner or operator shall submit a corrective measures study to Ohio EPA not later than one hundred eighty days after making the determination in accordance with paragraph (E)(2) of this rule, or not later than one hundred eighty days after submitting a request in accordance with paragraph (E)(7) of this rule. This study shall evaluate all practicable remediation procedures which are available for remediating any contamination discovered during the ground water quality assessment. At a minimum, the evaluated remediation procedures shall do the following:

(a) Be protective of human health and safety and the environment.

(b) Attain the proposed ground water concentration levels specified in accordance with paragraph (F) of this rule.

(c) Control the source of releases to reduce or eliminate, to the extent practicable, further releases of waste-derived constituents into the environment.

(d) Comply with standards for management of wastes as specified in paragraph (F)(13) of this rule.

(2) The owner or operator shall evaluate each proposed remediation procedure within the corrective measures study. At a minimum, the evaluation shall 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. The assessment of the effectiveness shall include the degree of certainty that the remediation procedure will prove successful. Factors to be considered include the following:

(i) Magnitude of reduction of existing risks.

(ii) Magnitude of residual risks in terms of likelihood of further releases due to waste remaining following implementation of a remediation procedure.

(iii) The type and degree of long-term management required, including monitoring, operation, and maintenance.

(iv) Short-term risks that may affect the community, workers, or the environment during implementation of such a remediation procedure, including potential threats to human health and safety and the environment associated with excavation, transportation, redisposal, or containment.

(v) Potential for human and environmental receptor exposure to remaining wastes, considering the potential threat to human health and safety and the environment associated with excavation, transportation, redisposal, or containment.

(vi) Long-term reliability of the engineering and institutional controls.

(vii) Potential need for replacement of the remediation procedure.

(b) The effectiveness of the remediation procedure in controlling the source in order to reduce further releases, including the following:

(i) The extent to which containment practices will reduce further releases.

(ii) The extent to which treatment technologies may be used.



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



- (i) Current and future uses.
 - (ii) Proximity and withdrawal rate of users.
 - (iii) Ground water quantity and quality.
 - (iv) The potential damage to wildlife, crops, vegetation, and physical structures resulting from exposure to waste constituents.
 - (v) The hydrogeologic characteristics of the facility and surrounding area.
 - (vi) Ground water removal and treatment costs.
 - (vii) The cost and availability of alternative water supplies.
- (3) Unless a notification has been received from the director in accordance with paragraph (E)(5) or (E)(7) of this rule, the owner or operator shall make public notice of the existence of the assessment report and the corrective measures study and place those documents in the public library closest to the facility for public inspection not later than one hundred eighty days after making a first determination in accordance with paragraph (E)(2) of this rule.
- (4) The director may require the owner or operator to evaluate, as part of the corrective measures study, one or more specific potential remediation procedures.
- (5) If, at any time during the assessment described in paragraphs (E) and (F) of this rule, the director determines that the facility threatens human health or safety or the environment, the director may require the owner or operator to implement the following measures:
- (a) Notify all persons, via certified mail or any other form of mail accompanied by a receipt, who own the land or reside on the land that directly overlies or lies adjacent to any part of the plume of contamination.
 - (b) Take any interim measures necessary to ensure the protection of human health and safety and the



environment. Interim measures should, to the extent practicable, be consistent with the objectives of and contribute to the performance of any remediation procedure that may be required pursuant to paragraphs (F)(1), (F)(2), and (F)(6) of this rule. The following factors shall be considered in determining whether interim measures are necessary:

- (i) The amount of time required to develop and implement a final remediation procedure.
 - (ii) Actual or potential exposure of nearby populations or environmental receptors to waste-derived constituents.
 - (iii) Any further degradation of the ground water that may occur if remedial action is not initiated expeditiously.
 - (iv) Weather conditions that may cause waste-derived constituents to migrate or be released.
 - (v) Risks of fire, explosion, or potential for exposure to waste-derived constituents as a result of an accident or failure of a container or handling system.
 - (vi) Other situations that threaten human health and safety and the environment.
- (6) The corrective measures study shall propose a concentration level for each waste-derived constituent that has been detected in the ground water at levels above background levels. The concentration levels shall be established as follows:
- (a) To be protective of human health and safety and the environment.
 - (b) Unless an alternative level is deemed necessary to protect environmental receptors, to conform to the following:
 - (i) For known or suspected carcinogens, the proposed concentration levels shall be established at concentration levels below those that represent a cumulative excess upper-bound lifetime risk to an individual within the 1×10^{-4} to 1×10^{-6} range.



(ii) For noncarcinogens, the proposed concentration levels shall be reduced to levels to which the human population (including sensitive subgroups) could be exposed on a daily basis without appreciable risk of deleterious effects during a lifetime.

(c) In establishing the proposed concentration levels that meet the requirements of paragraph (F)(6)(b) of this rule, the owner or operator shall consider the following:

(i) Multiple contaminants in the ground water.

(ii) Exposure threat to sensitive environmental receptors.

(iii) Other site-specific exposure or potential exposure to ground water.

(iv) The reliability, effectiveness, practicability, and other relevant factors of the remediation procedure.

(d) For ground water that is a current or potential source of drinking water, the owner or operator shall evaluate and justify any concentration level that is higher than a federal safe drinking water act maximum contaminant level or a secondary drinking water standard.

(e) The proposed concentration levels shall not be set below background levels unless the director determines the following:

(i) Cleanup to levels below background levels is necessary to protect human health and safety and the environment.

(ii) Such cleanup is in connection with an area-wide remedial action under other authorities.

(7) The director shall select from the corrective measures report, or designate according to paragraph (F)(4) of this rule, the remediation procedure which best meets the criteria listed in paragraphs (F)(1), (F)(2) and (F)(6) of this rule. The owner or operator shall implement the remediation procedure selected by the director in accordance with the schedule of implementation selected by the director.



(8) In implementing the remediation procedure selected by the director in accordance with paragraph (F)(7) of this rule, the owner or operator shall achieve the designated concentration levels, as determined by paragraph (F)(6) of this rule, at all points within the plume of contamination that lie beyond the limits or solid waste placement.

(9) Upon completion of the remediation procedure, when the ground water quality meets the designated concentration levels as specified in paragraphs (F)(6) and (F)(8) of this rule, the owner or operator shall demonstrate on a semiannual basis for a period of five years or until the landfill facility's post-closure care period ends, whichever is longer, that the designated concentration levels have not been exceeded as provided in paragraph (F)(8) of this rule before being released from compliance with the ground water monitoring requirements.

(10) If the concentrations of the constituents monitored in accordance with paragraph (F)(9) of this rule exceed the concentration levels determined in accordance with paragraph (F)(6) of this rule, the owner or operator shall reimplement the designated remediation procedure or submit new remediation procedures in accordance with the criteria in paragraphs (F)(1) and (F)(2) of this rule.

(11) The director may determine, based on information developed by the owner or operator after implementation of the remediation procedure has begun, or from other information, that compliance with the requirements for the remediation procedure selected under paragraphs (F)(1) and (F)(2) of this rule is not technically practicable. In making such a determination, the director shall consider the following:

(a) The owner or operator's efforts to achieve compliance with the requirements.

(b) Whether other currently available or new methods or techniques could practicably achieve compliance with the requirements.

(12) If the director determines that compliance with a remediation procedure requirement is not technically practicable, then the director may require that the owner or operator do the following:

(a) Implement alternative measures to control human or environmental receptor exposure to residual



contamination, as necessary, to protect human health and safety and the environment.

(b) Implement alternative measures for control of the sources of contamination, or for removal or decontamination of equipment, units, devices, or structures required to implement the remediation procedure, that achieve the following:

(i) Is technically practicable.

(ii) Is consistent with the overall objective of the remediation procedure.

(13) All IMW that are managed pursuant to a remediation procedure required under paragraph (F)(8) of this rule, or an interim measure required under paragraph (F)(5) of this rule, shall be managed in the following manner:

(a) That is protective of human health and safety and the environment.

(b) That complies with applicable laws and regulations.

(14) Remediation procedures selected pursuant to paragraphs (F)(1) and (F)(2) of this rule shall be considered complete when compliance with the ground water concentration levels established under paragraph (F)(6) of this rule have been achieved, and all actions required to complete the remediation procedure have been satisfied.

(15) Upon completion of the remediation procedure, the owner or operator shall submit certification that the remediation procedure has been completed to Ohio EPA. The certification shall be signed by the owner or operator and by an independent professional skilled in the appropriate technical discipline.

(16) When, upon receipt of the certification and in consideration of any other relevant information, the director determines that the remediation procedure has been completed in accordance with paragraph (F)(14) of this rule, the director shall release the owner or operator from continuing performance of the approved remediation procedure. This approval shall not exempt the owner or operator from meeting the requirements of paragraphs (F)(9) and (F)(10) of this rule.



(17) The owner or operator shall submit, upon implementation of the remediation procedure chosen under paragraph (F)(7) of this rule, a report of the activities being conducted at the facility as part of implementation of the chosen remediation procedure. This report shall be submitted semiannually and contain the following:

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