

## **15A NCAC 13B .1632 GROUNDWATER SAMPLING AND ANALYSIS REQUIREMENTS**

(a) The owner or operator shall describe consistent sampling and analysis procedures designed to ensure monitoring results that provide an accurate representation of groundwater quality at the background and downgradient wells in the water quality monitoring plan approved in accordance with Rule .1631(f) of this Section. The plan shall include procedures and techniques for sample collection; sample preservation and shipment; analytical procedures; chain of custody control; and quality assurance and quality control.

(b) The groundwater monitoring program shall include sampling and analytical methods for groundwater sampling that measure monitored constituents and other monitoring parameters in groundwater samples.

(c) The sampling procedures and frequency shall be protective of human health and the environment.

(d) Each time groundwater is sampled, groundwater elevations shall be measured in each well prior to purging. The owner or operator shall determine the rate and direction of groundwater flow each time groundwater is sampled. Groundwater elevations in wells that monitor the same waste management area shall be measured within a 24-hour period of time to avoid temporal variations in groundwater flow that could preclude accurate determination of groundwater flow rate and direction. The owner or operator shall determine groundwater elevation and flow as follows:

- (1) To determine accurate groundwater elevations for each monitoring well, the wells shall have been surveyed. If required by G.S. 89C, a licensed professional land surveyor shall survey the wells. [Note: The North Carolina Board of Examiners for Engineers and Surveyors has determined, via a letter dated July 16, 2010, that the surveying pursuant to this Paragraph constitutes practicing surveying under G.S. 89C.] The survey of the wells shall conform to the following levels of accuracy:
  - (A) the horizontal location to the nearest 0.1 foot;
  - (B) the vertical control for the ground surface elevation to the nearest 0.01 foot; and
  - (C) the vertical control for the measuring reference point on the top of the inner well casing to the nearest 0.01 foot.
- (2) To determine the rate of groundwater flow, the owner or operator shall provide data for hydraulic conductivity and porosity for the formation materials at each of the well locations.

(e) The owner or operator shall establish background groundwater quality in accordance with Rule .1631(a)(1) of this Section and Paragraphs (f) through (h) of this Rule for each of the monitoring parameters or constituents required in the particular groundwater monitoring program that applies to the MSWLF unit.

(f) The number of samples collected to establish groundwater quality data shall be consistent with the statistical procedures to be used, as provided for in Paragraph (g) of this Rule.

(g) Should the owner or operator choose to perform statistical analysis of groundwater quality data for the purpose of establishing background concentrations or to determine if there is an exceedance of the groundwater quality standards established in 15A NCAC 02L or the groundwater protection standards established in Rule .1634(b) of this Section, the owner or operator shall select one of the following statistical methods to be used in evaluating groundwater monitoring data for each constituent of concern. The statistical test chosen shall be conducted separately for each constituent of concern in each well.

- (1) A parametric analysis of variance (ANOVA) followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method shall include estimation and testing of the contrasts between each compliance well's mean and the background mean levels for each constituent.
- (2) A parametric analysis of variance (ANOVA) based on ranks followed by multiple comparisons procedures to identify statistically significant evidence of contamination. The method shall include estimation and testing of the contrasts between each compliance well's median and the background median levels for each constituent.
- (3) A tolerance or prediction interval procedure in which an interval for each constituent is established from the distribution of the background data, and the level of each constituent in each compliance well is compared to the upper tolerance or prediction limit.
- (4) A control chart approach that gives control limits for each constituent.
- (5) Another statistical test method that meets the performance standards of this Rule. The owner or operator shall submit a justification for an alternative test method to the Division for approval to determine compliance with this Rule. The justification shall demonstrate that the alternative statistical test method meets the performance standards of this Rule. If approved, the owner or operator shall place a copy of the justification for an alternative test method in the operating record.

(h) Any statistical method chosen to evaluate groundwater monitoring data shall comply with the following performance standards:

- (1) The statistical method used to evaluate groundwater monitoring data shall be appropriate for the distribution of chemical parameters or constituents of concern. If the distribution of the chemical parameters or constituents of concern is shown by the owner or operator, or by the Division, to be inappropriate for a normal theory test, then the data shall be transformed or a distribution-free theory test shall be used. If the distributions for the constituents differ, more than one statistical method shall be considered.
  - (2) If an individual well comparison procedure is used to compare an individual compliance well constituent concentration with background constituent concentrations or a groundwater protection standard, the test shall be done at a Type I error level no less than 0.01 for each testing period. If a multiple comparisons procedure is used, the Type I experiment wise error rate for each testing period shall be no less than 0.05; however, the Type I error of no less than 0.01 for individual well comparisons shall be maintained. This performance standard shall not apply to tolerance intervals, prediction intervals, or control charts.
  - (3) If a control chart approach is used to evaluate groundwater monitoring data, the specific type of control chart and its associated parameter values shall be protective of human health and the environment. The parameters shall be determined by the analyst 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.
  - (4) If a tolerance interval or a prediction interval is used to evaluate groundwater monitoring data, the levels of confidence and, for tolerance intervals, the percentage of the population that the interval shall contain, shall be protective of human health and the environment. These parameters shall be determined by the analyst after considering the number of samples in the background database, the data distribution, and the range of the concentration values for each constituent of concern.
  - (5) The statistical method shall account for data below the limit of detection with one or more statistical procedures that are protective of human health and the environment. Any practical quantitation limit (pql) that is used in the statistical method shall be the lowest concentration level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions that are available to the facility.
  - (6) If necessary, as provided for in 40 CFR 258, the statistical method shall include procedures to control or correct for seasonal and spatial variability as well as temporal correlation in the data.
- (i) Within 120 days from the date of sampling or as specified in the facility permit, whichever is less, the owner or operator shall submit to the Division a monitoring report in an electronic format that is accessible and viewable by the Division that includes information from the sampling event including field observations relating to the condition of the monitoring wells, field data, the laboratory analytical data report, statistical analysis (if utilized), field sampling methods and quality assurance and quality control data, information on groundwater flow direction, groundwater flow rate, and, for each well, any constituents that exceed groundwater quality standards set forth in 15A NCAC 02L .0202 or the groundwater protection standards established in Rule .1634(b) of this Section.

*History Note: Authority G.S. 130A-294;  
Eff. October 9, 1993;  
Amended Eff. April 1, 2011;  
Readopted Eff. September 16, 2021;  
Amended Eff. March 15, 2023.*