**Section 817.416 Groundwater Quality Standards**

a) Applicable groundwater quality standards:

1) Groundwater quality shall be maintained at each constituent's applicable groundwater quality standard at or beyond the zone of attenuation. The applicable groundwater quality standard established for any constituent shall be:

A) The Board established standard; or

B) The Board established standard adjusted by the Board in accordance with the justification procedure of subsection (b) of this Section; or

C) For those constituents where no Board established standard exists, the background concentration.

2) Any statistically significant increase above an applicable groundwater quality standard established pursuant to subsection (a)(1) that is attributable to the facility and which occurs at or beyond the zone of attenuation within 100 years after closure of the last unit accepting waste within such a facility shall constitute a violation.

3) For the purposes of this Part:

A) "Background concentration" means that concentration of a constitutent that is established as the background in accordance with subsection (d).

B) "Board-established standard" is the concentration of a constituent adopted by the Board as a groundwater quality standard under 35 Ill. Adm. Code 620.

b) Justification for adjusted groundwater quality standards:

1) An operator may petition the Board for an adjusted groundwater quality standard in accordance with the procedures specified in Section 28.1 of the Act and 35 Ill. Adm. Code 106.410 through 106.416.

2) For groundwater which contains naturally occurring constituents which do not meet the standards of 35 Ill. Adm. Code 620, the Board will specify adjusted groundwater quality standards, upon a demonstration by the operator that:

A) The groundwater does not presently serve as a source of drinking water;

B) The change in standards will not interfere with, or become injurious to, any present or potential beneficial uses for such waters;

C) The change in standards is necessary for economic or social development, by providing information including, but not limited to, the impacts of the standards on the regional economy, social disbenefits such as loss of jobs or closing of landfills, and economic analysis contrasting the health and environmental benefits with costs likely to be incurred in meeting the standards; and

D) The groundwater cannot presently, and will not in the future, serve as a source of drinking water because:

i) It is impossible to remove water in usable quantities;

ii) the groundwater is situated at a depth or location such that recovery of water for drinking purposes is not technologically feasible or economically reasonable;

iii) The groundwater is so contaminated that it would be economically or technologically impractical to render that water fit for human consumption;

iv) The total dissolved solids content of the groundwater is more than 3,000 mg/l and the water will not be used to serve a public water supply system; or

v) The total dissolved solids content of the groundwater exceeds 10,000 mg/l.

c) Determination of the zone of attenuation.

1) The zone of attenuation, within which concentrations of constituents in leachate discharged from the unit may exceed the applicable groundwater quality standard of this Section, is a volume bounded by a vertical plane at the property boundary or 100 feet from the edge of the unit, whichever is less, extending from the ground surface to the bottom of the uppermost aquifer and excluding the volume occupied by the waste.

2) Zones of attenuation shall not extend to the annual high water mark of navigable surface waters.

3) Overlapping zones of attenuation from units within a single facility may be combined into a single zone for the purposes of establishing a monitoring network.

d) Establishment of background concentrations:

1) The initial monitoring to determine background concentrations shall commence during the hydrogeological assessment required by Section 817.411. The background concentrations for those parameters identified in Sections 817.411(e)(1)(G) and 817.415(a)(2) and (a)(3) shall be established based on quarterly sampling of wells for one year, monitored in accordance with the requirements of subsections (d)(2), (d)(3), and (d)(4) of this Section, which may be adjusted during the operation of a facility. Statistical tests and procedures shall be employed, in accordance with subsection (e) below, depending on the number, type and frequency of samples collected from the wells, to establish the background concentrations. Adjustments to the background concentrations shall be made only if changes in the concentrations of constituents observed in upgradient wells over time are determined, in accordance with subsection (d)(3) below, to be statistically significant. Background concentrations determined in accordance with this subsection shall be used for the purposes of establishing groundwater quality standards, in accordance with subsection (a) above. The operator shall prepare a list of background concentrations established in accordance with this subsection. The operator shall maintain such a list at the facility, shall submit a copy of the list to the Agency for establishing standards in accordance with subsection (a), and shall provide updates to the list within ten days after any change to the list.

2) A network of monitoring wells shall be established upgradient from the unit, with respect to groundwater flow, in accordance with the following standards, in order to determine the background concentrations of constituents in the groundwater:

A) The wells shall be located at such a distance that discharges of contaminants from the unit will not be detectable but will be representative of groundwater immediately upgradient of the unit;

B) The wells shall be sampled at the same frequency as other monitoring points to provide continuous background concentration data, throughout the monitoring period; and

C) The wells shall be located at several depths to provide data on the spatial variability.

3) A determination of background concentrations may include the sampling of wells that are not hydraulically upgradient of the waste unit where:

A) Hydrogeologic conditions do not allow the owner or operator to determine what wells are hydraulically upgradient of the waste; and

B) Sampling at other wells will provide an indication of background concentrations that is representative of that which would have been provided by upgradient wells.

4) If background concentrations cannot be determined on site, then alternative background concentrations may be determined from actual monitoring data from the aquifer of concern, obtained from sample points located as close as is reasonably possible to the site.

e) Statistical analysis of groundwater monitoring data:

1) Statistical tests shall be used to analyze groundwater monitoring data. One or more of the normal theory statistical tests listed in subsection (e)(4) below shall be chosen first for analyzing the data set or transformation of the data set. Where such normal theory tests are demonstrated to be inappropriate, tests listed in subsection (e)(5) or a test in accordance with subsection (e)(6) shall be used. For any statistical test chosen from subsections (e)(4) or (e)(5), the level of significance (Type 1 error level) shall be no less than 0.01, for individual well comparisons, and no less than 0.05, for multiple well comparisons. The statistical analysis shall include, but not be limited to, the accounting of data below, the detection limit of the analytical method used, the establishment of background concentrations and the determination of whether statistically significant changes have occurred in:

A) The concentration of any chemical constituent with respect to the background concentration or MAPC; and

B) The established background concentration of any chemical constituents over time.

2) The statistical test or tests used shall be based upon the sampling and collection protocol of Sections 817.414 and 817.415.

3) Monitored data that are below the level of detection shall be reported as not detected (ND). The level of detection for each constituent shall be the minimum concentration of that constituent which can be measured and reported with 99 percent confidence that the true value is greater than zero, which is defined as the method detection limit (MDL). The following procedures shall be used to analyze such data, unless an alternative procedure in accordance with subsection (e)(6) is shown to be applicable:

A) Where the percentage of nondetects in the data base used is less than 15 percent, the operator shall replace NDs with the MDL divided by two, then proceed with the use of one or more of the Normal Theory statistical tests listed in subsection (e)(4);

B) Where the percentage of nondetects in the data base or data transformations used is between 15 and 50 percent, and the data are normally distributed, the operator shall use Cohen's adjustment to the sample mean and standard deviation, followed by one or more of the tests listed in subsection (e)(4)(C) of this Section. However, where data are not normally distributed, the operator shall use an applicable nonparametric test from subsection (e)(5);

C) Where the percentage of nondetects in the data base used is above 50 percent, then the owner or operator shall use the test of proportions listed in subsection (e)(4).

4) Normal theory statistical tests:

A) Student t-test including, but not limited to, Cochran's Approximation to the Behren-Fisher (CABF) t-test and Averaged Replicate (AR) t-test.

B) Parametric analysis of variance (ANOVA) followed by one or more of the multiple comparison procedures including, but not limited to, Fisher's Least Significant Difference (LSD), Student Newman-Kuel procedure, Duncan's New Multiple Range Test and Tukey's W procedure.

C) Control Charts, Prediction Intervals and Tolerance Intervals, for which the type I error levels shall be specified by the Agency in accordance with the requirements of 35 Ill. Adm. Code 724.197(i).

5) Nonparametric statistical tests shall include: Mann-Whitney U-test, Kruskal-Wallis test, a nonparametric analysis of variance (ANOVA) for multiple comparisons or the Wilcoxon Rank Sum test.

6) Any other statistical test based on the distribution of the sampling data may be used, if it is demonstrated to meet the requirements of 35 Ill. Adm. Code 724.197(i).