

## FINAL

SUBJECT: Solid Waste Guidance: Statistical Evaluation Requirements at Individual Monitoring Wells [OAC Rules 3745-27-10(C)(8), 3745-29-10(C)(8) and 3745-30-08(C)(7)]

Number: GD0403.204  
Issued: 07/25/95  
Revised:  
Page 1 of 2

---

PURPOSE: To clarify Ohio EPA's position on the use of ANOVA for statistically evaluating ground water quality data at individual downgradient monitoring wells and the necessity for evaluation of data from upgradient monitoring wells.

BACKGROUND: OAC Rules 3745-27-10(C)(8), 3745-29-10(C)(8) and 3745-30-08(C)(7) specifically require the owner/operator of a municipal, industrial or residual solid waste landfill facility, (MIRSWLF), "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)(6) and (C)(7) ((C)(5) and (C)(6) of OAC Rule 3745-30-08) of this Rule." Since the statistical methodology of ANOVA compares the means of different groups of observations, there was a question as to whether the use of ANOVA was adequate given the way OAC Rules 3745-27-10(C)(8), 3745-29-10(C)(8) and 3745-30-08(C)(7) are written. This guidance addresses the issue of whether the use of ANOVA is appropriate for the required statistical evaluation.

In addition, OAC Rules 3745-27-10(C)(8), 3745-29-10(C)(8) and 3745-30-08(C)(7) require the owner/operator to "determine whether or not there is a statistically significant increase (or decrease in the case of pH) from background values for each parameter or constituent required in the Ground Water Monitoring Program." This wording has elicited questions as to whether ground water quality data from the upgradient monitoring well(s) are required to be statistically evaluated. This guidance addresses that question.

GUIDANCE: The U.S. EPA was contacted for an interpretive clarification of OAC Rules 3745-27-10(C)(8), 3745-29-10(C)(8) and 3745-30-08(C)(7) because OEPA rules were adopted from the federal rules. Regarding the use of ANOVA at downgradient monitoring wells, the U.S. EPA considers ANOVA an omnibus test, in that it is able to provide for many things at once. As stated in the U.S. EPA interim final guidance document Statistical Analysis of Ground Water Monitoring Data at RCRA Facilities, and the 1992 addendum to that document, ANOVA is used to compare the means of different groups of observations to determine whether there are any statistically significant differences among the groups. The ANOVA statistical procedure must be followed by individual contrast procedures to determine where the differences lie. These contrast procedures are considered part of the ANOVA test. This is true for both a parametric ANOVA and ANOVA based on ranks.

U.S. EPA stated that there have not been problems, at the federal level, with facilities or consultants challenging the use of ANOVA in light of the regulatory wording. Because ANOVA meets the statistical performance standards in OAC Rules 3745-27-10(C)(7), 3745-29-10(C)(7) and 3745-30-08(C)(6), no conflict exists between the use of ANOVA for the required statistical comparison and the OEPA rule requiring the comparison.

Also, OAC Rule 3745-27-10(C)(8) specifically requires owner/operators of an MIRS WLF "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." The rule states that a comparison of GW quality is to be made at each downgradient well to the background value of that parameter or constituent. The parameters from upgradient monitoring wells do not have to be statistically analyzed. Only downgradient wells are to be statistically evaluated. Upgradient, and downgradient, ground water monitoring wells are required to be sampled and analyzed according to the schedule in OAC Rule 3745-27-10(D).