Geosyntec consultants

Certification for Selected Statistical Methods

CCR Unit: Peg's Hill Landfill, Maysville, Kentucky

Certification:

I, **Scott Graves**, a qualified professional engineer registered in the Commonwealth of Kentucky, have reviewed the available information on the Peg's Hill Landfill groundwater monitoring system and baseline groundwater monitoring data and, based on my review, and in my professional opinion, certify that the selected statistical methods presented in the narrative description that accompanies this certification are appropriate for evaluating groundwater monitoring data for this CCR unit as described in 40 CFR §257.93(f) and (g). This certification and the underlying evaluation to select appropriate statistical procedures were conducted under my direction or supervision according to a system designed to assure that qualified personnel selected the statistical procedure pursuant to 40 CFR Part 257.93. This certification is, to the best of my knowledge, accurate and complete.

Printed Name: Scott Graves

PE License Number: 21274 State: Kentucky

09/22/2023

Seal and Signature Date

NARRATIVE DESCRIPTION OF STATISTICAL METHODS

Introduction

The Peg's Hill Landfill is a coal ash residuals (CCR) landfill located in Maysville, Kentucky. The landfill's groundwater monitoring system has been designed and constructed to meet the requirements of 40 CFR Part 257.91. The baseline groundwater quality data collected, and the available statistical methods listed in 257.93(f) and (g), were evaluated to select and certify the appropriate statistical method to be used for the Detection Monitoring program. This narrative summarizes the certified statistical methods that were selected, and that will be used, to derive background concentrations for each Appendix III and Appendix IV constituent at each downgradient compliance well.

Upper Tolerance Intervals (Upper Tolerance Limits, UTL)

Upper tolerance limits (UTLs) are statistical ranges calculated using the background dataset. They are developed to specify a threshold background concentration that contains a certain percentile of the range of background values at a certain probability level. For example, a 95/95 UPL will contain 95 percent of the background concentration range at a 95 percent confidence level. By definition, a small percent of the background population will exceed the UTL. Future compliance well sample results that exceed the UTL are considered to be a statistically significant increase (SSI) above background. UTLs account for the variation in background concentrations, the size of the background dataset, and the frequency of non-detect results. Parametric UTLs are used when the background data follow a normal distribution or can be transformed to a normal distribution. Non-parametric UTLs are used when the background data do not follow a known statistical distribution model. If the background data are all non-detect values, the laboratory reporting limit (RL) may serve as the UTL, or the Double Quantification Rule (DQR) can be used wherein two successive detections in a downgradient, compliance wells constitute an SSI above background. UTLs were calculated for both Appendix III and Appendix IV constituents. Consistent with USEPA's Unified Guidance, UTLs will be used for Appendix IV background concentrations when comparing to drinking water maximum contaminant levels to set the ground water protection standard (GWPS).

Upper Prediction Intervals (Upper Prediction Limits, UPL)

Upper prediction limits (UPLs) are statistical ranges calculated using the background dataset. They are an estimate of the upper end of the estimated background concentration range designed to predict the value of one or more future independent sample(s), within a certain probability. For a UPL at 95% confidence level, the probability that a future independently sampled groundwater concentrations will be less than or equal to the UPL is 95%. UPLs can be calculated using parametric (normally or lognormally distributed data) or non-parametric methods. Parametric UPLs are used when the background data follow a normal distribution or can be transformed to a normal distribution. Non-parametric UPLs are used when the background data do not follow a known statistical distribution model. If the background data are all non-detect values, the laboratory reporting limit (RL) may serve as the UPL, or the Double Quantification Rule (DQR)

can be used wherein two successive detections in a downgradient, compliance wells constitute an SSI above background. UPLs were calculated for only Appendix III constituents.

Selected Statistical Methods

The following statistical methods were selected and certified as appropriate to calculate the background concentration and to be used during the Detection Monitoring program. As required by 40 CFR Part 257.93(g)(4), the confidence level and the percentage of the population that will be contained by the selected statistical method at least as effective as the other statistical methods listed in 40 CFR Part 257.93(f) and (g). The selected statistical methods will be used to calculate background concentrations for comparison to downgradient compliance well sample concentrations for Appendix III and Appendix IV constituents during the Detection Monitoring program.

Appendix III Analyte	Statistical Approach	Monitoring Well	Selected Test
Boron	Intra-well	PH-MW-03A	UPL
	Inter-well	PH-MW-04	UPL
	Inter-well	PH-MW-05	UPL
Calcium	Inter-well	All three*	UPL
Chloride	Intra-well	PH-MW-03A	UPL
	Inter-well	PH-MW-04	UPL
	Inter-well	PH-MW-05	UPL
Fluoride	Intra-well	PH-MW-03A	UPL
	Inter-well	PH-MW-04	UPL
	Inter-well	PH-MW-05	UPL
pH	Inter-well	All three*	UPL
Sulfate	Intra-well	PH-MW-03A	UPL
	Inter-well	PH-MW-04	UPL
	Inter-well	PH-MW-05	UPL
TDS	Inter-well	All three*	UPL

Appendix IV Analyte	Statistical Approach	Monitoring Well	Selected Test
Antimony	Inter-well	All three*	UTL
Arsenic	Inter-well	All three*	UTL
Barium	Intra-well	PH-MW-03A	UTL
	Intra-well	PH-MW-04	UTL
	Intra-well	PH-MW-05	UTL
Beryllium	Inter-well	All three*	UTL
Cadmium	Inter-well	All three*	UTL
Chromium	Inter-well	All three*	UTL
Cobalt	Inter-well	All three*	UTL
Fluoride	Intra-well	PH-MW-03A	UTL

	Inter-well	PH-MW-04	UTL
	Inter-well	PH-MW-05	UTL
Lead	Inter-well	All three*	UTL
Lithium	Intra-well	PH-MW-03A	UTL
	Inter-well	PH-MW-04	UTL
	Inter-well	PH-MW-05	UTL
Mercury	Inter-well	All three*	UTL
Molybdenum	Intra-well	PH-MW-03A	UTL
	Inter-well	PH-MW-04	UTL
	Inter-well	PH-MW-05	UTL
Radium 226/228 Combined	Inter-well	All three*	UTL
Selenium	Inter-well	All three*	UTL
Thallium	Inter-well	All three*	UTL

* All three compliance wells including PH-MW-03A, PH-MW-04, and PH-MW-05