

Development of a Statistical Approach to Determining Background Groundwater Conditions at Contaminated Sites in Alberta

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Determining background groundwater conditions is an essential step in the process of assessing, remediating, and achieving site closure at sites where groundwater impacts are present. Current regulatory guidelines in Alberta and British Columbia suggest possible strategies to determine background conditions, but do not provide regulated procedures or methodologies to conduct such investigations. The current regulatory guidelines also do not incorporate data quality control and verification methods.

A complete set of groundwater monitoring and groundwater sample analysis data collected during multiple sampling events was evaluated to determine whether background groundwater conditions could be characterized at the site in question. The site was potentially impacted by dissolved metals and showed exceedances in routine potability parameters related to a historical produced water release. Groundwater samples were collected over the course of 5 quarterly sampling events in order to account for possible seasonal variations in groundwater elevation, gradient, and flow orientation.

Several statistical methods were used to compare and evaluate the groundwater sample analysis data. The data quality of the analytical data was determined for each unique sampling event and a confidence interval was generated. Using an Analysis of Variance (ANOVA) process, the statistical variability among sampling events was compared for select parameter concentrations in samples collected from each individual monitoring well on site. The variability among select parameter concentrations in each of the wells on site was also determined for each sampling event. The results suggest that each quarterly data set was valid, and that a reasonable level of confidence in the reported results had been achieved on which to run the statistical program. The results of the program suggest that a statistical analysis-based methodology could be developed to characterize of background groundwater conditions at this site and other contaminated sites in Alberta.

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