

Groundwater Plume Analytics® Tools for Environmental Site Assessments

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Converting numerical groundwater environmental data into unique, but easy to understand, visual graphics using statistics and mathematics is what we call “Groundwater Plume Analytics®”. Groundwater Plume Analytics® is an innovative evaluation technique to reliably and effectively communicate meaningful patterns in groundwater data and relies primarily on graphical displays to communicate valuable insight into groundwater plume behavior which leads to better site management decisions, from both a technical and financial perspective.

The Ricker Method® is an example of a unique Plume Analytics® method of evaluating plume stability that overcomes limitations posed by conventional well-by-well analysis techniques. Outputs from the Ricker Method® can be used as a basis for primary analysis and other plume diagnostic tools that allow the user to further evaluate and communicate groundwater plume dynamics. Some of these innovative tools include: Remediation System Benefit Analysis (RSBA®), Spatial Change Indicator™ (SCI) analysis, and Well Sufficiency Analysis™.

RSBA® is an interpretation of the relative benefit of a remediation system based on graphical data outputs created from the Ricker Method® evaluation and additional data inputs. In effect, what RSBA® does is evaluate the efficiency of an active groundwater remediation system that removes contaminant mass from groundwater (e.g., pump and treat). The tool evaluates whether an active system may be considered efficient or inefficient based on an evaluation of contaminant mass removed via the system and the relative stability of a groundwater plume.

The Spatial Change Indicator™ evaluation shows relative changes in the plume over time. For this analysis, each plume map in a particular time period is compared to the first plume map in the series. The current plume is subtracted from the original plume to create a new isopleth map that shows areas of the plume that decreased in concentration (indicated by blue or green shading) or increased in concentration (indicated by red shading). The visual aspect of this analysis allows the viewer to observe patterns of plume behavior over time.

The Ricker Method® Well Sufficiency Analysis™ is a statistical method to determine if a monitoring well network can be reduced while maintaining confidence in the ability of the network to monitor plume behavior. The analysis uses the plume stability characteristics of area, average concentration and mass indicator from the entire network as a baseline to

compare the respective plume stability characteristics from a reduced, or optimized, network. These comparisons are made for each of the plume stability characteristics using Mann-Kendall trend, linear regression trend, average relative percent difference and correlation coefficient. The optimized network is then assigned an overall strength based on the results of the comparisons made in each of the plume stability characteristics.

These tools have been successfully used as a basis for the cessation of remediation systems, evaluation of remediation progress, evaluating commingled plumes, reduction of monitoring well networks, reduction in monitoring frequency, providing additional lines of evidence for natural attenuation; and site closures. Several site examples demonstrating the use of these tools will be presented.

Joe A Ricker

For more than 26 years, Mr. Ricker has helped clients optimize a wide range of remediation solutions associated with past and present environmental liabilities under various regulatory programs in more than 30 states, as well as multiple remediation sites in Canada and Brazil. Mr. Ricker is a licensed Professional Engineer in 28 states. He received a B.S. in Civil Engineering from Rose-Hulman Institute of Technology and a M.S. in Civil Engineering from the University of Memphis.