

DECLUSTERING AND STOCHASTIC SIMULATION OF
GROUND-WATER TRITIUM CONCENTRATIONS AT
HANFORD, WASHINGTON

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Declustering and Stochastic Simulation of Ground-Water Tritium Concentrations at Hanford, Washington

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Monitoring and characterization of radionuclides and hazardous chemicals in ground water are ongoing activities at the U.S. Department of Energy's (DOE) Hanford Site in south-central Washington State. These activities are conducted to assess the impacts of Site operations on public health and the environment, to comply with the Resource Conservation and Recovery Act (RCRA), and for characterization of sites under the Comprehensive Environmental Resource Compensation and Liability Act (CERCLA). Periodic measurement and sampling of approximately 720 wells provides site-specific information about hydraulic head and contaminant concentrations. These data are then used to infer ground-water flow directions and gradients for the interpretation of contaminant transport.

Tritium, a by-product of nuclear materials production, is the most widespread radionuclide contaminant on site. Identification of tritium concentrations above the Drinking Water Standard (DWS) of 20,000 pCi/L are of particular concern. However, due to preferential location of monitoring wells near historical production sites, a disproportionately large number of samples originate in higher concentration areas. Consequently, univariate as well as bivariate (spatial) statistics like the variogram need to be adjusted to account for the preferential sampling. Such "declustering" of the samples is necessary to appraise the actual proportions above or below any cutoff (e.g., the DWS) and to accurately map or simulate tritium at unsampled locations.

Ground-water tritium concentrations from 1993 are used as a case study to demonstrate the importance of declustering. Clustered data effects are

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quantified and interpreted for both univariate and bivariate statistical measures. Then, using the declustered data, the results of a stochastic simulation of the contaminant are presented. By providing multiple, equally probable renditions of contaminant concentration that all honor the sample values and their statistics, stochastic simulations are used to identify areas where site-wide characterization and monitoring could benefit from additional wells. Alternatively, stochastic simulations are used also to appraise possible redundancy of information for locations (i.e., clusters) where wells are more plentiful.