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Using Geostatistics to Improve Understanding of Contaminated Land Legacies –A Case Study at Sellafield

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Sellafield is the UK facility for Nuclear Fuel Reprocessing and Waste Management. It is a compact coastal site with an area of around 3 km2. It is currently operational and is expected to remain licensed until 2120.

Radioactive material has entered the sub-surface environment during operations following accidental leaks. This material is currently under active risk management prior to a final hazard reduction and site remediation phase. Sellafield Ltd has to understand and control the legacy of ground contamination to ensure protection of the workforce, the public and the environment. The main control exercised over this material is through an extensive monitoring and risk modelling programme. This work generates a quantity of important environmental data gathered at public cost. Features of the data that make its interpretation difficult include:
• Very large data sets
• Many different parameters
• Long time span (several decades)
• Variable quality (changes in analytical methods over time)
• Spot 3-D data (as opposed to continuous or 2-D plots)
To ensure that the best use is being made of appropriate methods for the gathering and understanding of these data, Sellafield Ltd has commissioned geostatistical analysis.

Soils and groundwater data are necessarily spatially correlated and require dedicated geostatistics data processing. Different spatial anisotropies are observed in the saturated and non-saturated zones and integrated in the model. Uncertainty quantification of contaminated volume estimates according to several radiological waste thresholds is addressed to improve risk analysis (remediation feasibility, costs, waste management⋯). Finally, a critical review of the sampling effort identifies under- or over-sampled areas based on the spatial auto-correlation description.

Improvements have been achieved in the following areas through this work:
• Inventory –better quantification of contaminated land volumes with an understanding of uncertainty
• Characterisation –greater resolution of contaminant distribution with an understanding of uncertainty
• Modelling - development of predictive transport models reflecting heterogeneous conditions
• Management –improved use of data visualisation to support communication, planning & risk management

The paper will address:
• The background to Sellafield land quality data interpretation challenges
• A description of the use of geostatistics to analyse Sellafield datasets
• A discussion on how results could be used in the future and on potential applications of geostatistics to other nuclear site challenges

Country or International Organization

Great Britain

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