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Geostatistical Modeling of Uncertainty for the Risk Analysis of a Contaminated Site

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ABSTRACT
This work is a study of multivariate simulations of pollutants to assess the sampling uncertainty for the risk analysis of a contaminated site. The study started from data collected for a remediation project of a steel-works in northern Italy. The soil samples were taken from boreholes excavated a few years ago and analyzed by a chemical laboratory. The data set comprises concentrations of several pollutants, from which a subset of ten organic and inorganic compounds were selected. The first part of study is a univariate and bivariate sta- tistical analysis of the data. All data were spatially analyzed and transformed to the Gaussian space so as to reduce the effects of extreme high values due to contaminant hot spots and the requirements of Gaussian simulation procedures. The variography analysis quantified spatial correlation and cross-correlations, which led to a hypothesized linear model of coregionalization for all variables. Geostatistical simulation methods were applied to assess the uncertainty. Two types of simulations were performed: correlation correction of univariate sequential Gaussian simulations (SGS), and sequential Gaussian co-simulations (SGCOS). The outputs from the correlation correction simulations and SGCOS were analyzed and grade-tonnage curves were produced to assess basic environmental risk.

KEYWORDS
Uncertainty Modeling, Multivariate Geostatistical Simulations, Risk Analysis, Environmental Pollution, Remediation Project

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