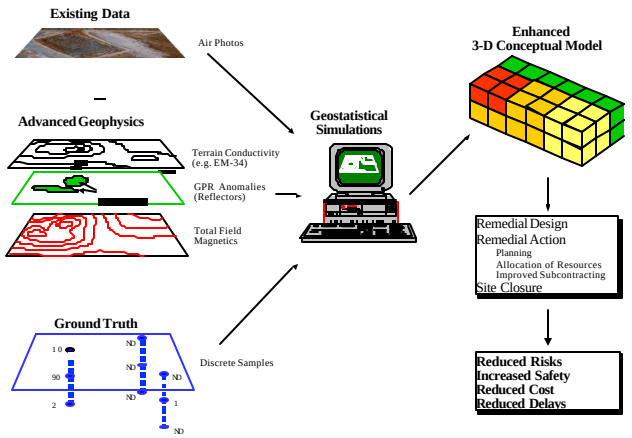
Enhanced Site Characterization System (ESCS)



SUMMARY

The Enhanced Site Characterization System (ESCS) combines advanced geophysical data and interpretation techniques with existing information, traditional characterization, and "ground truth" data for type matching of geophysical and chemical signatures to various waste types. The system uses geostatistics to integrate multiple data sets and produce a more detailed map of the subsurface contents than is possible using individual characterization technologies.

Deployment of the ESCS was initiated in February 1999 to characterize an unexcavated portion of the 618-4 Burial Ground.

INNOVATIVE TECHNOLOGY DESCRIPTION

ESCS is an advanced characterization system that can utilize information from a variety of geophysical, chemical, and radiological survey techniques to produce detailed maps of the subsurface.

Examples of advanced geophysical methods include:

- Electromagnetic offset logging
- Induced polarization
- Cs-vapor magnetometer
- Time-domain electromagnetics.

Data from these advanced methods complement existing data sets from traditional methods, which include the following:

- Historical records and photographs
- Conventional geophysical surveys
- Soil gas surveys
- Radiation surveys
- Trench and borehole sampling.

Geostatistical techniques are used to integrate the multiple data sets to model the spatial distribution of the data and provide estimates of uncertainty. The integration is accomplished using a combination of multivariate statistics and geostatistical conditional simulations, and closes the data gaps normally found when each data type is interpreted separately. The product of the system is an integrated three-dimensional conceptual model of the distribution of various waste types in a burial ground. This model can be used for planning future excavation at the site; reducing economic, health, and safety risks during excavation; and reducing remediation costs.

BASELINE DESCRIPTION

The baseline characterization includes review of historical documents and aerial photographs, performance of conventional surface geophysics and soil gas surveys on a limited basis, and collection of soil and waste samples from boreholes or trenches.

DEPLOYMENT DESCRIPTION

The ESCS was deployed to characterize an unexcavated portion of the 618-4 Burial Ground. Excavation in the burial ground was halted upon discovery and partial excavation of a cache of drums containing depleted uranium waste. Additional characterization of the remaining area of the burial ground was needed to plan for continued excavation in the area of the drummed waste.

All previous geophysical and sampling data for the 618-4 Burial Ground, as well as "ground truth" data from the excavated portions of the burial ground, were compiled and processed to produce an initial integrated set of pre-excavation maps for the burial ground. These initial pre-excavation maps were completed on April 15, 1999. Interim results from this activity found that the available geophysical data and ground truth data were of poor resolution and would not support precise location and volume definition of a targeted cache of drums discovered in the burial ground, nor would these data support accurate spatial correlations.

Acquisition of supplemental geophysical (electromagnetic offset logging [EOL]) data targeted at the cache of drums was initiated in May 1999. Access boreholes were installed for collecting samples and EOL data. Geophysical data acquisition was conducted in early to mid-June. A specialized resistivity cell was developed to measure the resistivity of the soils and its relationship to soil moisture. These data provide background soil resistivity data that help improve the geophysical analysis of the EOL data.

Existing ground penetrating radar and magnetic data were reprocessed/reinterpreted to develop geostatistical correlagrams for these data sets. Geostatistical simulations and preparation of the pre-excavation map of the 618-4 Burial Ground were completed in September 1999.

DETAILS OF BENEFITS

The ESCS is capable of delineating waste boundaries and locating various categories of wastes, including high-risk wastes. This system is an improvement over the current baseline practice in that it can support excavation planning and waste handling decisions. Thus, the technology helps reduce the risk of costly delays and inappropriate mobilization of remedial resources, improves remedial alternative selection and design, and enhances pre-planning and prioritization of equipment and resources needed for remedial actions.

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