Using Data Management and 3-Dimensional Data Visualization to Generate More Complete Conceptual Site Models and Streamline Site Closure

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Background/Objectives. Incomplete conceptual site models (CSM) are often a result of a combination of inadequate data density, poor data management, and/or a failure to visualize and evaluate complex 3-dimensional (3-D) data sets. Business-based decisions based upon these incomplete CSMs often lead to repeated site characterization events, failed remedy implementations, and poor communication of site conditions to stakeholders. Developing an accurate CSM that leverages data stored in a relational database integrated into 3-D visualization and volumetric analysis is a best management practice (BMP) that provides the ability to evaluate complex data sets and environmental systems.

Approach/Activities. A comprehensive data management solution and visual CSM was completed for multiple Industrial Sites in the United States and Brazil that aided in optimizing remedy implementation and long-term monitoring strategies. For each site, historical groundwater and soil analytical data, geologic information, and water level gauging data were gathered and imported into a geographic information system (GIS) and EQuIS database. In addition, CAD base maps, historical aerial imagery, and DEM were also evaluated and incorporated into the GIS. These data sets were processed and exported for analysis in Ctech's Earth Volumetric Studio (Studio). A geologic framework was developed and a 3-D geologic model was created, water table surfaces and selected analytical data sets were kriged using as time sequences to evaluate temporal changes in groundwater plumes. An initial 3-D CSM was presented to the project technical team to evaluate past and current Site conditions. Based upon feedback from the technical team, revisions to the 3-D CSM were completed and further focused data analysis was conducted to assist the technical team in evaluating data gaps, remediation design strategies, lifecycle cost savings, additional remedial alternatives, and/or determine varied site strategies based on client's business needs. The final 2-D/3-D CSM was then used as a tool to assist the project team in the generation of engineering documents including plan view maps, cross-sections, volumetric analysis, plume maps, in addition to 3-D deliverables.

Results/Lessons Learned. Creation of the data visualization 2-D/3-D CSM ultimately assisted in the identification of additional source areas, defined residual contaminated mass, refined the groundwater plume architecture, provided intimate visual depiction of contaminant distribution over time, identified and closed data gaps, and provided for targeted site investigation and remediation design strategies. Leveraging innovation through technology supports improvements with infield site data collection, data quality assurance, field work efficiencies, a centralized data management process and data visualization facilitates a "Best-In-Class" approach for enhancing insights into environmental liability systems for more informed business decisions. Integrating technology innovation as a standard practice into the daily Environmental Liability Management process provides for more informed business decisions reducing liability lifecycles and cost. The 2-D/3-D data visualization also provides a valuable mechanism to evaluate offsite property management issues, identify cost saving opportunities, promotes better tactical risk management strategies and provides an enhanced visual data set that can be routinely updated during a site's lifecycle.