

## **GENERAL ELECTRIC AIRCRAFT ENGINES**

*Albuquerque, New Mexico*

*Page One of Two*

### **Groundwater Modeling in Support of Remedial Design**

Alberto A. Gutiérrez served as principal in charge of this project while serving as President of GCL, predecessor to Geolex, Inc.

In support of groundwater remediation activities proposed for the Plant 83 Operable Unit of the South Valley Superfund site, GCL developed a conceptual model and database and a three-dimensional numerical model of groundwater flow and contaminant transport in an aquifer subject to seasonal variations and municipal pumping influences. This model was used to define the extent of volatile organic compound contamination and assist with the design of a pump-and-treat remediation system, the selected remedy for the site. GCL created a calibrated model that was reviewed and accepted for use in remedial design at this site by the U.S. Environmental Protection Agency (EPA) Region VI and the New Mexico Environment Department, and was peer-reviewed by General Electric Aircraft Engines, the U.S. Air Force, Canonie Environmental Services Corp., Tetra Tech, Inc., the U.S. Department of Energy, and Chem Nuclear Geotech.

The objectives of the groundwater flow model design and calibration were to produce a model consistent with the conceptual model of the aquifer; explain how model input values related to observed data and the conceptual model; compare water balances from the model with field data; and calibrate the model to transient flow conditions over short- and long-term evaluations. First, a conceptual hydrogeologic model of site hydrogeology and contaminant transport was developed. A single hydrostratigraphic unit comprised the aquifer beneath the site. The alluvial materials comprising the unit were heterogeneous in nature, with interlayering of fluvial and alluvial fan deposits. Major sources of recharge were infiltration from the Rio Grande and minor communication between the shallow zone and deep zone aquifers. Discharge was via pumpage and discharge on the east side of the model domain. Only dissolved phase contaminant transport was considered in the model, as no reported findings of immiscible phases were detected during the field program.

GCL selected the U.S. Geological Survey three-dimensional finite difference groundwater flow model, MODFLOW, coupled with the particle tracking program, PATH3D. The model domain was represented by a grid of 38 rows and 45 columns, with minimum grid spacings of 50 feet in the area of interest. The 1,000-foot section of the deep zone was simulated using nine layers to encompass the depth of municipal supply wells. Model layers were oriented horizontally to reflect the average orientation of bedding. All layers were capable of simulating confined or unconfined conditions. Individual model layer thicknesses were determined by vertical hydraulic gradients as measured in Westbay multi-level monitoring wells and lithologic and borehole geophysical logs. The model successfully reproduced the general flow field, the vertical hydraulic gradient distribution, and the general aquifer response to imposed pumping stresses. The model reproduced general variations in head in response to municipal pumping over a period of 15 months. Sensitivities occurred with respect to changes in municipal pumpage, the Rio Grande River as a boundary condition, and vertical to horizontal hydraulic conductivity ratios for all layers.

### **Major Project Elements:**

- Hydrology
- Groundwater modeling
- Program management/ QA/QC
- Database management
- CERCLA
- RI/FS
- Remedial design

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*Page Two of Two*

Results of the modeling work were used to locate and design additional multi-port Westbay monitoring wells and support remedial design of the Record of Decision-required pump-and-treat system. In addition, the model was used for inverse modeling to trace potential sources and evaluate potential co-mingling of multiple plumes of various origins. The model was subsequently used to evaluate the effectiveness of the pump-and-treat system and to assist with locating monitoring wells to monitor the progress of aquifer remediation.

