# HYDROGEOLOGY OF THE UPPER GLACIAL AQUIFER BROOKHAVEN NATIONAL LABORATORY, UPTON, NEW YORK

Douglas E. Paquette
Safety and Environmental Protection Division
Brookhaven National Laboratory, Upton, New York 11973

ABSTRACT- At Brookhaven National Laboratory, accidental chemical spills and past waste handling and disposal practices have resulted in low level volatile organic compound and radionuclide contamination of the Upper Pleistocene deposits (upper glacial aquifer). In a effort to better understand site-wide contaminant migration pathways, Brookhaven National Laboratory has undertaken a multi-year hydrogeologic characterization project. The characterization effort consists of soil borings, geophysical logging, the installation of piezometers, and ground-water modeling. Initial results of this study indicate complex depositional and erosional patterns within the upper glacial and underlying units, and complex ground-water flow patterns due to ground-water pumpage and recharge.

The upper glacial aquifer deposits range from 130 to 200 feet in thickness, and are typically characterized by highly permeable, brown, medium to coarse-grained sand and gravel. In the central area of the site, however, the basal 50 feet of the upper glacial aquifer is composed of less permeable light green, fine to medium-grained sand and sandy clay. The glacial deposits lie unconformably upon either the Gardiners Clay (Upper Pleistocene) or the Magothy aquifer (Late Cretaceous). The Gardiners Clay, a dark gray, silty and sandy clay ranging from 10 to 15 feet in thickness, appears to be restricted to the central, southwestern and southeastern areas of the site where it acts as a confining unit between the upper glacial and Magothy aquifers. The Gardiners Clay has not been encountered in the south central and northern areas of the site, where Gardiners may have been removed during a period of erosion which formed channels into the Magothy aquifer of up to 50 feet in depth.

Natural ground-water flow directions across the site vary between being eastward along the Peconic River, southeastward toward the Forge River, and southward toward the Carmans River. However, ground-water flow in the central area of the site is strongly influenced by pumpage of water supply wells and recharge basins, which cause considerable, and variable, deviations in natural ground-water flow directions and velocities. Aquifer pumping tests indicate that the hydraulic conductivity of the upper glacial aquifer is approximately 175 feet per day and a specific yield of 0.24. The hydraulic gradient is typically 0.001 feet per feet. Calculated ground-water flow velocities range from 0.6 to 0.75 feet per day. Water-level measurements taken from paired piezometers near the northern site boundary (near the regional ground-water divide) indicate deep-flow recharge, with downward vertical hydraulic gradients of up to 0.006 feet per feet. Head differences become negligible in paired wells located in the central and southern areas of the site, indicating that ground-water flow is almost horizontal in these areas.