EXPEDITED SITE CHARACTERIZATION (ESC) STUDY AT CONTAMINATED SITE

Expedited Site Characterization (ESC) is a concept originally developed at the Argonne National Laboratory and was subsequently implemented to improve the cost- and time-effectiveness of pre-remedial environmental site characterizations. The motivation for developing the ESC process was the U.S. Department of Energy’s (DOE’s) need to streamline its immense environmental cleanups resulting primarily from nuclear weapons production.

The ESC process places emphasis on the use of multiple technologies for delineating and corroborating site features, rather than random, statistical approaches. Non-invasive or minimally invasive technologies are preferentially used, rather than the traditional approach of monitoring well installation and sampling. An ESC is a dynamic process, wherein a multi-disciplinary team with strong field experience works together to optimize the process of gathering and interpreting relevant data.

D’Appolonia participated in the DOE’s first test ESC, which was managed by the DOE’s Ames Laboratory in Iowa. The test site was the former Manufactured Gas Plant site in Marshalltown, Iowa. Activities at this site resulted in a wide range of contaminants over a period of more than 100 years.

The technologies applied for this ESC included a soil gas survey, immunoassay tests, passive sorbent sensors, high-speed micro-GC analyzer tests, GC/MS testing in a mobile laboratory, cone penetrometer tests (incorporating laser-induced fluorescence), and several geophysical surveys. D’Appolonia’s work consisted of conducting three-dimensional (3-D) and common mid-point profile ground penetrating radar (GPR) surveys, as well as geophysical well logging (conductivity, natural gamma, density, and neutron logs).

The 3-D GPR survey was conducted by compiling the data from 36 short profiles obtained with a 300-MHz antenna in a monostatic mode. Time slices of the trace amplitude of the radar signal allowed for the imaging of various depths into the ground in plan view. Numerous images to a depth of about 20 feet were derived, and it proved possible to distinguish various soil types and to map underground utilities.

A single profile using multiple offsets of a 100-MHz transmitter and receiver antennas was obtained across the site, and the data were processed in a manner similar to a seismic reflection profile. Coherent reflections defining the structure of soil and bedrock layers were obtained to a depth in excess of 75 feet. This depth of penetration was exceptional for the GPR technique.