TECHNOLOGY @ ROCKY FLATS

Demonstration & Deployment Summary

Horizontal Directional Drilling (HDD) and Environmental Measurement while Drilling (EMWD)

Summary

Rocky Flats has 31 sites that must be characterized to determine potential requirements for remediation of Under Building Contamination (UBC). In 2000, a new technology was put into use at Rocky Flats to assist with this. The technology is called Horizontal Directional Drilling (HDD) and Environmental Measurement While Drilling (EMWD) and was developed by Sandia National Laboratories. It combines existing and new technologies to create an innovative system for detecting soil contamination levels.

Horizontal drilling has been in use in the mining and telephone industries for some time. However, the new system includes the addition of a location sensor and a gamma ray spectrometer (GRS) to detect and analyze radiological contamination. Information about any contamination encountered is sent to a computer on the surface in "real time" mode.

HDD/EMWD allows remote characterization of the soil. The system provides testing for suspected underground contamination from a distance. It also provides the immediate production of data on what contamination there may be and where it may be found. Conventional vertical drilling methods used previously required workers to stand directly above the borehole. Potentially contaminated soil was brought to the surface where it could become a hazard to workers and the environment.

The Need

Traditional methods can be used for horizontal drilling but require sufficient fluids (drilling "mud") to fill the entire borehole plus an additional 50% for reserve. The waste volume that results is high because the soil and fluids removed from the borehole must be disposed of as contaminated waste. The new HDD/EWMD technology involves pushing casings with a drill bit into the soil. Excess soils are pushed to the side instead of being removed from the borehole by pumping out the fluids.

When compared to traditional methods, the advantages of using HDD/EWMD to reduce the amount of contaminated drilling waste is dramatic. At Hanford, an estimated 10,000 to 15,000 gallons of drilling fluid were lost to the surface and subsurface soils during the drilling of a 70 foot horizontal borehole using traditional methods. Using the Hanford experience as a model, it is estimated that 50,000 to 80,000 gallons of drilling fluid would be needed for five holes under the B123 Slab and B886. It is expected that this would produce 125 drums of waste and the associated environmental and worker risks. On the other hand, the only waste products from the HDD/EWMD process come from soil samples retrieved with a split spoon sampler. Those fill only one to two drums per bore hole.

The Technology

The foundation of the technology is a steerable drill head that is inserted into the ground at a predetermined angle and can be steered toward the area to be characterized. Once the target depth of five to six feet is reached, the drill head can be steered to follow a pre-planned path. The system's primary equipment consists of a hammer drill that pushes casing containing a drill bit through the soil.

Preparing to begin drilling and sampling operations

The HDD/EWMD mechanism employs a 900-lb pneumatic hammer mounted on a 20-foot steel frame to simultaneously drive the drill bit and a 4-inch exterior steel casing to create the borehole. A "Digitrak" receiver is used to keep track of the location and depth of the borehole. There are no drilling fluids/muds

used/produced. As noted previously, excess soil is pushed to the side rather than be removed from the borehole. Sample measurements are taken at 15 feet intervals. The drill bit is removed from the casing, a sampling tube is hammered into the soil ahead of the casing, and measurements are collected at 1 foot increments. The sample tube is retrieved, the drill bit reinserted, and forward progress is resumed.

Entry area for the horizontal drill under a slab

The Project

HDD/EMWD was employed at Rocky Flats to provide characterization for suspected UBC at a decommissioned building (B123 Slab) and at an existing building (B886) that are typical of the locations where UBC characterization is required.

The potential UBC was from suspected leaks from both the process waste lines and other building operations. There were four HDD/EWMD boreholes drilled along the process waste line route under the B123 Slab. No contamination was found. There was one HDD/EWMD bore hole drilled under the area where a Highly Enriched Uranyl Nitrate solution spill occurred. Contamination was found in the building slab but not in the soils under the building.

The Benefits and Results

The biggest benefits of HDD/EWMD are its contribution to increased worker protection and significant reduction of contaminated drilling process by-products. The HDD/EWMD process also minimizes the spread of contaminated material to uncontaminated portions of the borehole because soils movement is almost nonexistent and there is no fluid flow. Conventional horizontal drilling has been used at other DOE sites with its attendant significantly high drilling mud and borehole material wastes. The HDD/EWMD technology used at Rocky Flats virtually eliminates these problems.

The cost savings due to employment of the HDD/EWMD technology at the B123 Slab and B886 sites are significant. Using the Hanford model, 50,000 to 80,000 gallons of waste totaling 190 to 300 cubic meters in volume would have been produced had traditional drilling methods been used. Because HDD/EWMD was used instead of traditional methods, the 190 to 300 cubic meters of waste was not produced. With disposal costs at $1,537 per cubic meter, the resulting cost savings are estimated to be $290K to $460K.

The bottom line is that deployment of HDD/EMWD has resulted in a significant increase in personnel safety, a significant decrease in environmental hazards and cost savings of some $150K to over $200K for each building with a footprint in the 10,000—20,000 square foot range.

Environmental sampling at the drill site

Technology Supporting Paths to Closure

For more information about Technology at Rocky Flats, contact Dave Maloney, Kaiser-Hill Company, (303) 966-7566, or Dave Hicks, DOE, Rocky Flats Field Office, (303) 966-3122

KAISER•HILL COMPANY