INFORMATION SHEET: NON TRADITIONAL IN-SITU VITRIFICATION

ER2002-0640

Aerial view of the NTISV hot test

LOS ALAMOS NATIONAL LABORATORY

Los Alamos National Laboratory (the Laboratory) is a multidisciplinary research facility owned by the Department of Energy (DOE) and managed by the University of California. The Laboratory is located in north-central New Mexico approximately 20 miles northwest of Santa Fe. The Laboratory covers 43 square miles of the Pajarito Plateau; the Plateau consists of a series of finger-like mesas that are separated by deep canyons containing perennial and intermittent streams running from west to east.

RISK REDUCTION AND ENVIRONMENTAL STEWARDSHIP ENVIRONMENTAL RESTORATION PROJECT

The Laboratory's Environmental Restoration (ER) Project (implemented by the Risk Reduction and Environmental Stewardship [RRES] Division) is a part of a DOE nationwide program. DOE's environmental restoration efforts began in 1989. The ER Project investigates whether hazardous chemicals and/or radioactive wastes are present as a result of past Laboratory operations and cleans up and restores such sites as needed.

NON TRADITIONAL IN-SITU VITRIFICATION DESCRIPTION

Non Traditional In-Situ Vitrification (NTISV) technology uses electrical current to melt contaminated soil and rock into an inert, glass-like monolith. This technology traps the contamination in its original location underground. In November 1999, a team effort to demonstrate NTISV technology was initiated between the Laboratory, DOE, MSE Technology Applications, Inc., and Geosafe Corporation. This demonstration involved two phases: a "cold" test (conducted in an uncontaminated area), followed by a "hot" test (conducted in a radioactively contaminated area). Both phases of the demonstration took place at Technical Area (TA) 21.

PROCESS

The NTISV process involves placement of large electrodes within contaminated material at a specific depth. Vertical planes of highly conductive graphite starter material are injected in the subsurface between pairs of electrodes. Running electricity through the electrodes and the starter planes results in heating and subsequent melting of the contaminated material. In both phases of the NTISV demonstration, four electrodes were configured in two pairs with two starter planes running between them. Thus, two vertically-oriented melts were formed in the subsurface. These planes then melted in a downward and outward progression until they merged at the target depth. Contaminated materials located above the melt were incorporated into the melt as volume reduction resulted in subsidence of overlying materials.

COLD DEMONSTRATION

The cold test (melt without contaminants) was completed April 1999. Although the site was not contaminated with radioactive constituents, the test involved the placement of "surrogate" chemicals to simulate radioactive contamination. The estimated area of the vitrified material after completion of the cold demonstration was 23 feet by 25 feet.

1940s The Laboratory was founded in 1943 as part of the Manhattan Project. Processes used to carry out the Laboratory's past and present missions involve the use of hazardous and radioactive materials.

1950s During and after World War II, materials were disposed of on the Laboratory site or otherwise released into the environment.

1960s Congress enacted basic legislation to protect the environment. The Department of Energy's predecessor, the Atomic Energy Commission, and the Laboratory began to conduct surveys and to clean up areas where spills and disposal had occurred.

1970s Congress enacted the Resource Conservation and Recovery Act (RCRA) that governs the day-to-day operations of hazardous waste generation, treatment, storage, and disposal facilities (sites).

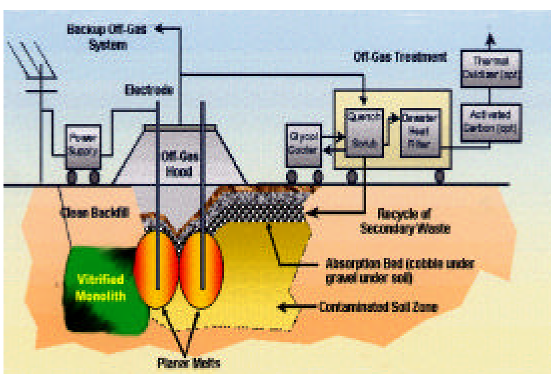
1980s Congress amended RCRA by passing the Hazardous and Solid Waste Amendments (HSWA). HSWA prescribes a corrective action process that focuses primarily on the investigation and cleanup, if required, of inactive sites.

1989 Environmental restoration began at the Laboratory to clean up sites that were formerly involved in weapons research and production.

1990s Present The ER Project investigates and cleans up sites that have the potential to affect human health or the environment, in accordance with the Laboratory's RCRA permit.

Drill rig used to obtain samples of melt material

Workers removing core samples



Geosafe Diagram of NTISV process

What is Non Traditional In-Situ Vitrification (NTISV)?

What is Traditional In-Situ Vitrification (ISV)?

The top of the glass is located 11 feet below ground surface and extends to a depth of 22 feet. The project team collected samples of the glassy material to determine the quality of the glass and to verify that the surrogate compounds were distributed and immobilized within the glass. Analytical results from the glass samples indicated that the surrogates were immobilized within the glass. Two analytical tests to evaluate glass durability did not detect the surrogate compounds. These results suggest that the glass is durable and resistant to leaching.

HOT DEMONSTRATION

The hot test (melt with contaminants) began in April 2000, and involved melting a portion of absorption bed 1 at Material Disposal Area (MDA) V. Absorption bed 1 contains soil, cobbles, and gravel contaminated with low levels of radionuclides and inorganics. To vitrify the mass of cobbles, gravel, and soil, four electrodes were inserted into a section of the absorption bed. Electricity was applied until the material around the electrodes reached temperatures of 2000 degrees Celsius.

As the vitrification occurred, certain contaminates were volatilized (converted to gas). These volatile contaminants were captured and treated by the off-gas filtration system and thermal oxidizer. Only treated air was discharged from the demonstration site. After the molten material cooled, contaminants that were not volatilized remained entombed in a huge, solid, glass-like black formed from the process. The glass resembles obsidian, which is a natural volcanic glass. The team sampled the glassy material during FY02 to determine the quality of the melt and to determine whether the glass successfully immobilized the contaminants. Not all analytical results have been received, but those available indicate that the contaminants have been distributed and inorganic contaminants have been immobilized within the melt.

OUTCOME

The NTISV demonstration verified the potential of NTISV to extend the capabilities of in situ vitrification beyond those of conventional systems, thereby broadening the DOE's options for cost effective remediation of buried wastes. The demonstration showed that the technology could treat both the contaminated bed contents and underlying contaminated soil to a depth of 22 feet. Approximately 300 tons of contaminated soil and absorption bed materials were treated by the cold demonstration. The hot demonstration involved a larger melt, treating an estimated 500 tons of contaminated absorption bed material at MDA-V. The melting process resulted in the destruction and removal of all organic contaminants within the target treatment zone, and immobilization of heavy metals and radionuclides with a high integrity vitrified (glassy rock-like) monolith. The process produced an environmentally benign product.

OPPORTUNITIES FOR PUBLIC INVOLVEMENT

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