



## Greater Confinement Disposal Project

### Background

From 1984 to 1989, intermediate depth disposal operations were conducted by the U.S. Department of Energy (DOE) at the Nevada Test Site (NTS). These operations emplaced high-specific-activity low-level radioactive wastes (LLW) and limited quantities of classified transuranic (TRU) wastes in Greater Confinement Disposal (GCD) boreholes. Of the 13 total boreholes, four boreholes contain TRU wastes.

In total, about 60,000kg (132,000lb) of classified TRU waste packages, containing less than 330 curies of Plutonium-239, are buried in the four boreholes. All of the TRU wastes emplaced in the GCD boreholes are classified for national security reasons and, therefore, do not meet the waste acceptance criteria for the Waste Isolation Pilot Plant (WIPP).

The GCD boreholes are about 3m (10ft) in diameter and 36m (120ft) deep. The bottom 15m (50ft) of each borehole was used for waste emplacement and the upper 21m (70ft) was backfilled with native alluvium. The picture to the right shows the placement of monitoring equipment in the first borehole. The bottom of each GCD borehole is almost 200m (650ft) above the water table. The NTS is one of the most arid portions of the United States and the boreholes are situated in a thick sequence of arid alluvium. These arid conditions result in a hydrologic system dominated by evapotranspiration.



*Placement of Monitoring Equipment in the First GCD Borehole*

In 1989, Sandia National Laboratories was asked by DOE to complete a performance assessment (PA) to help DOE determine whether or not the TRU wastes in the GCD boreholes will endanger human health. The requirements for protection of human health from TRU wastes are defined by the U.S. Environmental Protection Agency (EPA) 40 Code of Federal Regulations (CFR) Part 191 Subpart B requirements promulgated in 1985 [EPA, 1985].

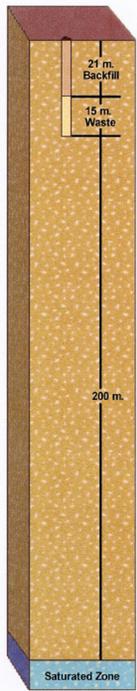
The regulations in 40 CFR 191 include four sets of requirements. The Containment Requirements set probabilistic limits on cumulative releases to the accessible environment for the next 10,000 years. The Groundwater Protection Requirements and Individual Protection Requirements set other quantitative limits on the disposal system. The fourth set of requirements in 40 CFR 191 is the Assurance Requirements, which are related to physical closure and long-term stewardship of the disposal system.



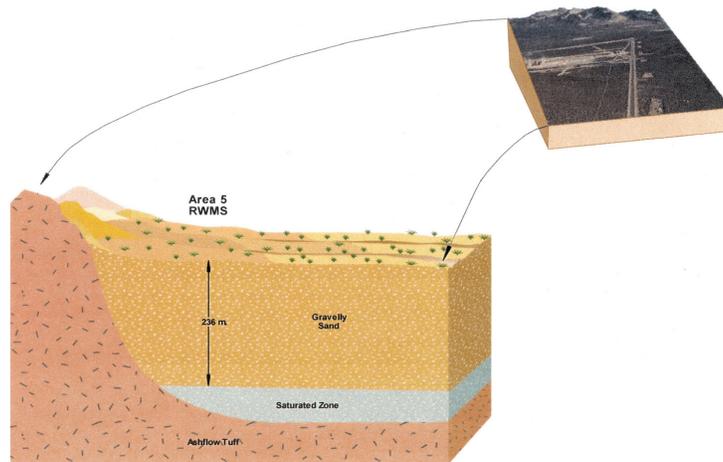
## Accomplishments

Sandia developed and used an iterative PA methodology, which focused work on uncertainty reduction in a cost-effective fashion that does not overestimate system performance and assured defensibility. Budget fluctuations and scope revisions did not allow completion in the original six-year time frame. However, the final PA was completed significantly under budget for a total DOE outlay of approximately \$12M.

The final “Compliance Assessment Document for the Transuranic Wastes in the Greater Confinement Disposal Boreholes at the Nevada Test Site,” was submitted in two volumes on March 31, 2000. Volume 2 documents the technical Performance Assessment, and Volume 4 documents Application of Assurance Requirements [Cochran et al., 2000 and Brosseau, 2000, respectively].



*Idealized Cross-Section Through a GCD Borehole, 200m (650ft) Above the Water Table*



*Nevada Test Site Cross-Section (in Arid Alluvium)*

## Results of Performance Assessment

The primary conclusions of the PA are that disposal of TRU wastes in intermediate depth GCD boreholes, in the arid NTS setting, is an ideal system for isolating such wastes and performs quite well in the overall objective of protecting human health. Potential doses to individuals under the Individual Protection Requirements over the 1,000-year regulatory time frame are almost insignificant. The GCD system in the arid NTS alluvial basins easily provides isolation of the TRU wastes such that cumulative release under the 10,000-year Containment Requirements fall well within the maximum release criteria spelled out in 40 CFR 191. The PA document provides a defensible basis, and a “reasonable expectation,” that compliance with regulatory requirements has been demonstrated.

## Capabilities

Successful completion of the GCD PA required the application or development of a number of capabilities:

- Regulatory analysis
- Iterative PA methodology, which focuses work on uncertainty reduction in a cost-effective fashion that does not overestimate system performance and assures defensibility
- Quality Assurance and software quality
- Analysis and screening of features, events, and processes; human intrusion
- Nuclear criticality assessment
- Geochemical studies, including sorption and solubility
- Vadose zone characterization, including moisture content, water balance, and advective flux
- Development of plant and animal bioturbation models
- Climate change studies
- Landfill subsidence analysis
- 10,000-year surface water flooding analysis under current and glacial climates
- Conceptual model development
- Flow and transport models and analysis
- Code development and consequence analysis

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