HIGH-SPECIFIC-ACTIVITY WASTE HANDLING FOR GREATER CONFINEMENT DISPOSAL

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ABSTRACT

In 1980 the DOE's National Low-Level Waste Management Program began to review alternatives to the shallow land burial of low-level radioactive wastes. Although the majority of low-level waste is routinely and safely disposed in shallow land burial, a portion was considered unsuitable for shallow land burial because of its high specific activity or potential for migration into biopathways.

In 1981, the Greater Confinement Disposal Test (GCDT) was started at the DOE's Nevada Test Site to demonstrate the feasibility of "greater depth" burial in alluvial sediments. The project is designed to demonstrate the disposal of DOE low-level wastes at a depth sufficient to minimize or eliminate natural environmental intrusion processes into the waste zone. One of the primary goals of the GCDT is to develop equipment and operational procedures for handling and disposal of high-specific-activity wastes.

This paper discusses the waste loading of the GCDT and presents information on the radiological aspects of handling high-specific-activity wastes.

GCDT DISPOSAL OPERATIONS

Waste Loading Operations

In December 1983, waste loading operations commenced with the remote transfer and disposal of a 345-kilocurie Sr-90 source. The Sr-90 was contained in four 2- x 30-centimeter stainless steel capsules. The GCDT remote waste handling system was used to extract the capsules from the shielded shipping container and "free-air" transfer them down the GCDT borehole. A specially constructed 120- x 120-centimeter "bucket" filled with metal turnings had been placed at the bottom of the borehole. This bucket will serve to evenly distribute heat generated by the encapsulated waste sources. The skin temperature of the Sr-90 capsules was approximately 600°C and each capsule generated about 900 watts of thermal energy.

The next sources to be disposed were a 20.5-kilocurie Cs-137 capsule, two Co-60 capsules totaling 500 curies, and a 110-kilocurie Sr-90 source. At the completion of the remote waste disposal operations, a lid was placed on the bucket and soil backfil added.

Subsequent wastes loaded were contact-handled and included over 690 kilocuries of tritium contained in 80 208-liter drums, and over 40 kilocuries of Sr-90 contained in decommissioned radioactive thermoelectric generators.

Wastes were layered with soil backfill to distribute compressive loads and fill void spaces. Wastes were loaded to within 20 meters of the surface and the remaining volume was backfilled with soil. Figure 1 illustrates the waste distribution within the borehole.

Radiological Safety During Waste Loading Operations

In performing remote waste loading operations, radiological safety is of primary importance. Detailed operating procedures and contingency plans were developed for each remote-handled source. Time, distance, and shielding calculations were performed to assure that personnel exposures would be as low as reasonably achievable.

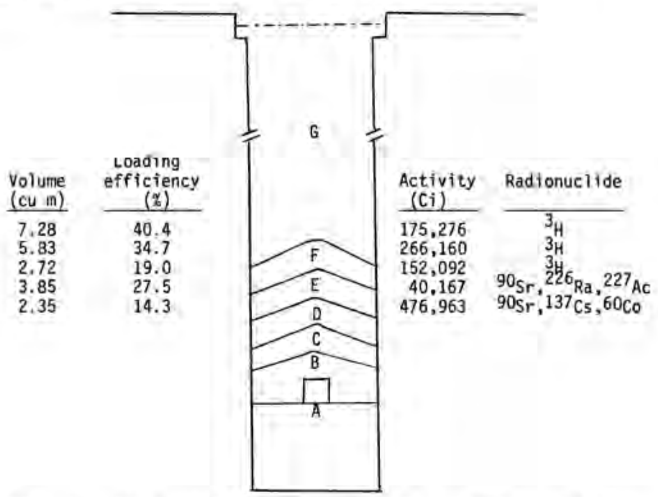

Fig. 1. GCDT waste distribution by nuclide, volume, loading efficiency, and activity.

A 4-meter-high soil berm was located approximately 15 meters from the GCDT to provide shielding for the operating personnel who were located behind the berm at a distance of approximately 120 meters from the borehole. While the shielding berm eliminated all direct radiation, the distance between the source and the operations control center was necessary to reduce the scattered radiation to acceptable levels.

Figure 2 shows the estimated and actual recorded radiation exposure levels for the transfer of the 345-kilocurie Sr-90 source. The exposure rates were approximately 35 roentgens/hour at 10 meters and 225 milliroentgens/hour at 100 meters. Figure 3 presents the estimated and recorded exposure rates behind the shielding berm. At the operations control center, the radiation exposure levels peaked at approximately 50 milliroentgens/hour during the source transfer.

The time required to perform the transfer operation is a critical factor in determining the safety of personnel. Prior to each operation, all procedures were practiced and every effort made to reduce the time required to perform the free-air transfer. The average

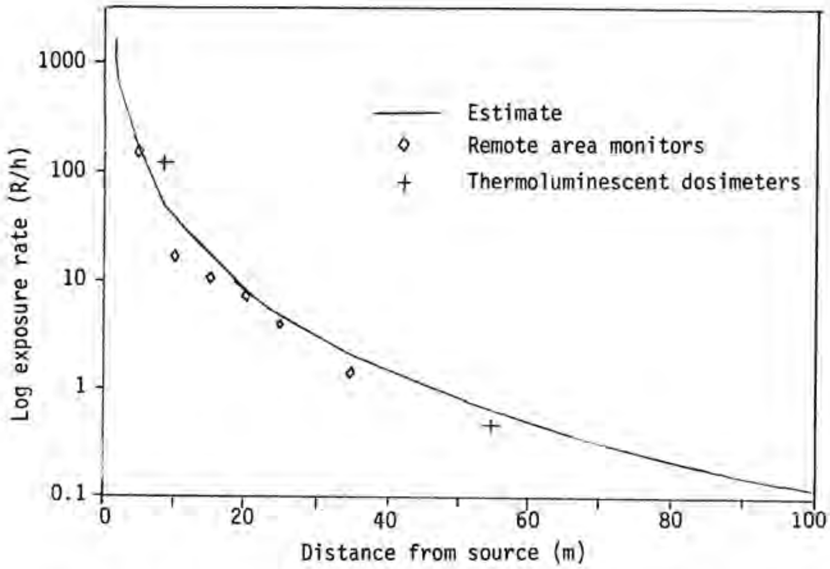

Fig. 2. Actual and estimated unshielded direct exposure rate data for the free-air transfer of a 345-kilocurie Sr-90 source. TLD integrated dose data has been converted to exposure rate.

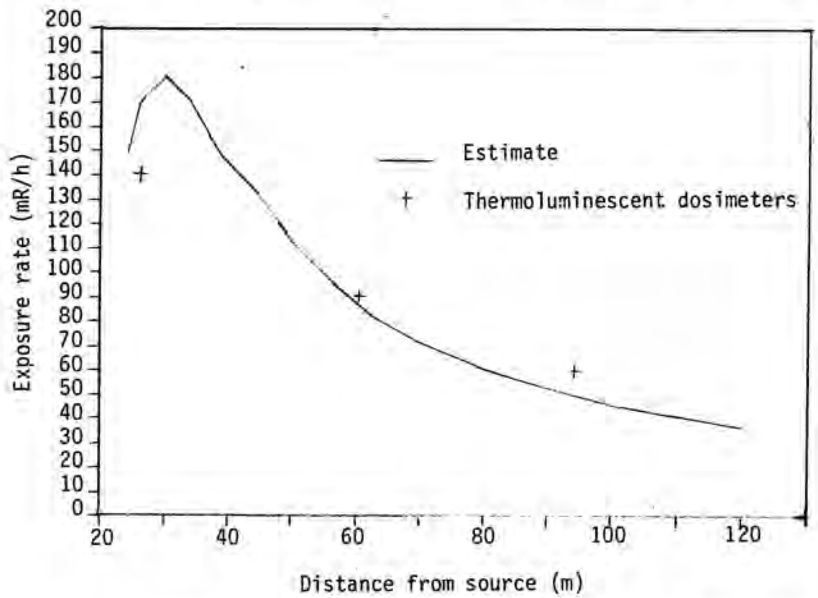

Fig. 3. Actual and estimated scattered exposure rate data from behind the shielding berm for the free-air transfer of a 345-kilocurie Sr-90 source. TLD integrated dose data has been converted to exposure rate.

time required to perform the transfers of the five remote-handled sources was under two minutes. As a result, personnel did not receive any recordable exposures from any of the waste disposal operations. This fact was a notable accomplishment and demonstrated the feasibility of safely disposing of high-specific-activity wastes without the need to sacrifice expensive shielding containers or expose personnel.