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DEFENSE WASTE MANAGEMENT OPERATIONS AT THE NEVADA TEST SITE

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I. INTRODUCTION

Waste management activities were initiated at the Nevada Test Site (NTS) to dispose of low-level wastes (LLW) produced by the Department of Energy's (DOE's) weapons testing program. Disposal activities have expanded from the burial of atmospheric weapons testing debris to demonstration facilities for greater-than-Class C (GTCC) waste, transuranic (TRU) waste storage and certification, and the development of a mixed waste (MW) facility. Site specific operational research projects support technology development required for the various disposal facilities. The annual cost of managing the facilities is about $6 million depending on waste volumes and types.

II. SITE SELECTION

The Radioactive Waste Management Site (RWMS) is located in southern Nevada approximately 75 miles from Las Vegas. Investigations of geography, geology, and hydrogeologic conditions at the NTS have been in progress by the U.S. Geological Survey (USGS) and numerous contracted organizations since 1951. The site provides a superior physiogeographic, geologic, and hydrogeologic environment for effective waste containment. Other favorable conditions include buffer zones around the NTS, limited public access, and low population density in the surrounding communities. Annual rainfall is approximately 10 to 13 centimeters and surface water runoff occurs only during unusually intense or persistent storms. The site is a considerable distance from surface springs, and disposal excavations are in a 245-meter-thick vadose (unsaturated) zone. Consequently, transport of contaminants will probably be dominated by unsaturated porous media flow phenomena.

III. ESTABLISHMENT OF THE RWMP

In January of 1961, the first trench was opened to dispose of accumulated test debris at the NTS. Generated onsite, waste consisted mainly of contaminated wood, metal, paper, laboratory glassware, filters, and metal pipe fittings. Six trenches were excavated over a 13-year period, with the last closing in 1979. Early trenches averaged 3.6 m in depth and width and 220 m long. Records indicating curie activity, disposal locations, and waste generation sites are maintained.

In 1974, the NTS began to accept offsite TRU wastes; and in 1978, the DOE expanded waste management activities to include the disposal of LLW produced at other DOE facilities. Reynolds Electrical & Engineering Co., Inc. (REECo), as a prime contractor to DOE, established the Radioactive Waste Management Project (RWMP) to operate the disposal facilities. Seventeen offsite DOE affiliated laboratories are currently authorized to send LLW to the NTS.

IV. SPECIFIC OPERATIONS

Currently, RWMP provides management of five distinct types of defense radioactive waste: (1) packaged LLW disposed by shallow land burial (SLB), (2) TRU waste retrievably stored aboveground, (3) bulk waste disposed in expended weapons test craters, (4) greater confinement burial in augered shafts for high-specific-activity (HSA) or concentrated tritium waste, and (5) development of a SLB MW facility. All RWMP facilities are operated under DOE/Nevada Operations Office (NV) guidance and meet the applicable DOE Orders, DOE/NV's NVO-185, Operational Radioactive Defense Waste Management Plan, and NVO-232, Radiation Safety Manual for the Nevada Test Site. Comprehensive environmental monitoring is performed by the REECo Environmental Sciences Department for all NTS activities.

A. LLW Operations

A majority of packaged LLW is received from offsite generators. Generators must obtain written approval from the DOE/NV Manager and must provide three-year waste forecasts, waste certification quality assurance plans, and evidence that all waste meets the waste acceptance criteria (WAC) of NVO-185. Approval for disposal of bulk

DISCLAIMER

and greater confinement disposal (GCD) waste is on a case-by-case basis. Waste cannot contain liquids, dispersible fines, and/or hazardous materials as defined in Title 40, Part 261, of the Code of Federal Regulations (CFR). Contact radiation levels cannot exceed 200 millirem per hour. Audits of the generator's waste processing, packaging, certification, and shipping methods are conducted by DOE/NV and RWMP personnel. Upon receipt, waste shipment packages and documentation are inspected, and radiological surveys are conducted.

Shallow land burial is conducted in excavated trenches and pits located on the 37.2 hectare RWMS. Trenches have a nominal width and depth of 3.7 m and typical pits are 7 m deep, 45 m wide, and 220 m long. Packages are stacked, marked and located by Nevada state grid coordinates, and positioned to utilize the entire pit capacity and provide maximum stability. All trenches and pits are permanently marked with cement monuments which are placed immediately upon closure of each excavation. Diversion channels and earth dikes are constructed around the site perimeter to prevent surface water flooding from storms.

The Bulk Waste Management Facility (BWMF) is located in Yucca Flat, an alluvial basin used extensively for the underground weapons testing program. Disposal is conducted in the subsidences that result from surface cratering subsequent to an underground test. A majority of the waste disposed at the BWMF is debris from early atmospheric weapons testing. The RWMP NTS Consolidation Project addresses cleanup, relocation, and disposal of debris stored at 24 NTS locations. At the end of 1987, 21 consolidation storage sites had been completed.

B. TRU Waste Storage

In 1974, the NTS began to accept TRU wastes, defined by the DOE as having TRU radionuclides in excess of ten nanocuries-per-gram. These wastes were separated from LLW and placed in retrievable storage for eventual shipment to the DOE Waste Isolation Pilot Plant (WIPP) geologic repository. In August of 1982, the limit of concern for TRU radionuclides was increased to 100 nanocuries-per-gram and approximately 100 cubic meters were then eligible for SLB. By 1985, the TRU waste generators were required to certify their TRU waste to the WIPP requirements prior to shipment to the NTS. The waste received before that date has been certified at the NTS. The certification process included nondestructive assay and real-time radiography techniques using mobile systems developed by the Los Alamos National Laboratory (LANL). Currently, over 600 cubic meters of TRU waste are in certified storage. Waste records are now being reexamined for determination of the hazardous constituents. Shipment of the NTS TRU waste to WIPP is expected to begin in 1990.

C. GCD Operations

Greater confinement disposal methods are for LLW considered unsuitable for SLB. These wastes can be classified as HSA or operationally difficult waste to handle, and environmentally mobile wastes which demonstrate significant potential for migration into biopathways, and/or are considered to be above the Nuclear Regulatory Commission definition of class "C" (GTCC) wastes. In 1987, the DOE committed to Congress to accept and provide management for commercial GTCC LLW in response to Public Law 99-240, which assigned that responsibility to the Federal Government under the "Low-Level Radioactive Waste Policy Amendments Act of 1985."

In 1981, the National Low-Level Waste Management Program funded the Greater Confinement Disposal Test (GCDT) at the NTS. Primary goals for GCDT were to develop equipment and operational procedures for remote handling of waste and to monitor, measure, and predict the performance of augered shaft disposal. The GCDT facility consists of a central emplacement shaft 3 m in diameter and 36 m deep in the alluvial sediments of the RWMS. Nine monitoring shafts, 0.6 m in diameter, are orbitally staggered at radii of 3, 4.9, and 6.7 m. Instrumentation included soil-atmosphere samplers, thermocouples, thermocouple psychrometers, and neutron access tubes. Encapsulated strontium-90, cesium-137, and cobalt-60 sources, totaling 517 kilocuries, and 210-liter drums of tritium wastes, totaling 593.5 kilocuries, were disposed. Research efforts continued for 3.5 years and climaxed with the release and measurement of organic tracers to determine various geophysical soil parameters. Monitoring and research on the potential migration of tritium continues.

The GCDT has successfully completed most of its primary goals. A remote waste handling system, consisting of an 18-ton all-terrain crane with a variety of manipulator tools and closed-circuit television cameras, was operated for diverse disposal situations. Personnel operating or observing the free-air remote waste operations received no measurable radiation dose. The GCDT operations were demonstrated to be economically comparable, if not preferable, to viable GCD methods at sites in humid regions. Cost estimates are further reduced with consideration of the 100 to 300-year period of necessary institutional control. The final goal to achieve is completion of a probabilistic risk assessment to determine the performance of the GCDT. It is anticipated final reports will be completed in 1988. Operational greater confinement or augered shaft disposal has been employed for two waste types at the RWMS. In 1987, activated stainless steel (scrap fuel cladding) and HSA tritium (greater than 10,000 curies/drum) were disposed in independent 36-meter-deep augered shafts.

D. Mixed Waste Management Facility (MWMF) Development

The principal task in establishing a MWMF at the NTS is to obtain a Resource Conservation and Recovery Act (RCRA) Part B permit. A RCRA permit is normally granted by the applicable state if the state is authorized by the U.S. Environmental Protection Agency (EPA). The state of Nevada has adopted the federal regulations concerning MW (1984 Hazardous and Solid Waste Amendments) but is currently authorized, by the EPA, to regulate only the pre-1984 portion of RCRA. Under this regulatory "limbo," a permit granted by the state will not have complete EPA concurrence until the state receives RCRA authorization from the EPA. The state is planning to apply for authorization by April 1988, and it is assumed EPA will take up to one year to review the application.

A RCRA Part B permit was originally submitted to the EPA, Region IX, in November 1985 and to the state of Nevada 13 months later assuming that the state would eventually become the regulatory agency for the NTS MWMF. The permit application is currently being updated and revised into a modular format so that in the future additional NTS facilities can be appended in the original permit. Interim status for receipt of MW at the NTS RWMS was received from the state of Nevada on September 17, 1987. Under interim status, DOE/NV must comply with the state-adopted 40 CFR, Part 265, Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, prior to obtaining a permit. The state has accepted the waiver request for pit liners and groundwater wells based on the low potential for migration of hazardous constituents during the interim status phase. However, the state will require an approved alternative monitoring system for permitted operations. RWMP personnel have designed a subsurface monitoring system. The system is a combination of neutron moisture probe access tubes, soil air samplers, and access tubes for gamma spectroscopy. This system will be installed prior to receipt of any MW and will be used to gather data to support the systems use as an alternative method.

Critical tasks currently being performed include an Environmental Assessment, Quality Assurance Program Plan, Land Use and Conceptual Operating Plan, and development of a Waste Examination Facility (WEF). The WEF will include nondestructive assay and radiography, and package breaching capability. Waste examination is a quality assurance measure to provide verification of performance of waste generator certification programs. Audits of waste generator programs will serve as the primary verification mechanism for the waste acceptance criteria. An NTS Environmental Laboratory, which will provide sample analysis capability for all NTS RCRA programs is near completion.

E. Operational Research

Various operational research projects, other than GCDT, have been conducted in association with RWMP activities. Beginning in 1978, studies have been conducted by the University of California Los Angeles on tritium migration and revegetation. Tritium migration studies have examined plant root uptake, and migration through trench caps and the deep unsaturated vadose zone. Revegetation studies have been conducted on the trench caps, flood dikes, and cleaned up Consolidation Project storage sites.

In 1986, the In-Situ Monitoring of Organics (ISMO) project began to demonstrate the use of a subsurface sampling system to characterize and monitor volatile organic pollutant releases from RWMP disposal facilities. A subcontract to the University of Arizona was funded to develop a method for determining the sorption coefficients of various organic compounds to NTS soils. The results of this work are being submitted to the American Society for Testing and Materials for consideration as a standard method.