

Nevada Test Site Environmental Remediation Progress Toward Closure of Contaminated Sites – 10325

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ABSTRACT

The Environmental Restoration Project at the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Site Office is charged with assessing the environmental impacts that resulted from atmospheric and underground nuclear tests conducted from 1951 to 1992 on the Nevada Test Site and Nevada Test and Training Range (which includes the Tonopah Test Range). The goal of the project is to protect public health and the environment through investigations and corrective actions.

The *Federal Facility Agreement and Consent Order* (FFACO), established in 1996 between the State of Nevada Division of Environmental Protection (NDEP), DOE, and the U.S. Department of Defense, serves as the cleanup agreement for the Environmental Restoration Project and provides the framework for identifying, prioritizing, investigating, remediating, and monitoring contaminated sites. This agreement satisfies the corrective action requirements of the *Resource Conservation and Recovery Act*. To ensure efficiency in managing these corrective actions, the sites are grouped according to location, physical and geological characteristics, and contaminants. These groups, called corrective action units, are prioritized based on potential risk to workers and the public, available technology, future land use, agency and stakeholder concerns, and other criteria. The Environmental Restoration Project contains three subprojects: Industrial Sites, Soils, and Underground Test Area. A fourth subproject, Offsites, has been transferred to the DOE Office of Legacy Management.

Nearly 14 years have passed since the FFACO was implemented and during this time, more than 3,000 sites have been identified as requiring investigation or corrective actions. To date, more than 1,930 sites have been investigated and closed through no further action, clean closure, or closure in place. Another 960 sites are currently being investigated or are in the remediation phase, leaving approximately 120 contaminated sites yet to be addressed.

A majority of the closed sites were accomplished under the Industrial Sites and Offsites Subprojects. As these subprojects are completed, emphasis will be placed on the Underground Test Area and Soils Subprojects.

INTRODUCTION

The Environmental Management (EM) Program was established in 1989 at U.S. Department of Energy (DOE) offices around the country to address the environmental liabilities associated with more than 50 years of nuclear weapons production and testing. More than 18 years later, EM is the world's largest environmental cleanup effort. As part of that effort, the DOE, National

Nuclear Security Administration Nevada Sites Office (NNSA/NSO) is responsible for remediating portions of the Nevada Test Site and the Tonopah Test Range.

The Nevada Test Site and the Tonopah Test Range played important roles in advancing the nation's nuclear testing program. Some of the facilities and land were used in direct support of nuclear testing, resulting in environmental contamination and subsequent hazardous and radioactive waste generation. Cleanup activities include identifying the nature and extent of contamination, determining its potential risk to the public and environment, and performing the necessary corrective actions in compliance with guidelines and requirements.

ENVIRONMENTAL RESTORATION

The *Federal Facility Agreement and Consent Order* (FFACO), established in 1996 between the State of Nevada Division of Environmental Protection (NDEP), DOE, and the U.S. Department of Defense, outlines the cleanup and monitoring commitments for sites and requires State of Nevada approval for the remediation activities selected to achieve closure [1]. Once the State has approved closure, a public notice of completion is issued to mark the end of the closure process. Individual releases or sites that have been identified as potentially needing remediation are referred to as corrective action sites (CASs). More than 3,000 CASs have been identified as requiring investigation or corrective actions since the FFACO was established.

To facilitate the implementation of the corrective action program, the Environmental Restoration Project is divided into three subprojects:

- Industrial Sites
- Soils
- Underground Test Area (UGTA)

INDUSTRIAL SITES SUBPROJECT

The Industrial Sites Subproject addresses industrial sites at the Nevada Test Site and Nevada Test and Training Range facilities – such as gas stations, motor pools, worker housing, and research buildings – used in direct support of nuclear testing. Activities conducted at these facilities resulted in some environmental contamination and subsequent hazardous and radioactive waste generation. Other miscellaneous areas include disposal wells, inactive tanks, contaminate waste sites, inactive ponds, muck piles, spill sites, drains and sumps, and ordnance sites. The contamination of concern may include hazardous chemicals, unexploded ordnance, and low-level radionuclides.

Over the past few years, the focus of the Industrial Sites Subproject has included the Decontamination and decommissioning of facilities with no active mission and in which contamination exists. The goal of decontamination is to reduce risks to site workers, the public and the environment, and limit the long-term cost of surveillance and maintenance. Decommissioning simply means to remove from service, which, in most cases at means to demolish the facilities and properly dispose of the generated waste.

Nearly 1,900 Industrial Sites have been identified, verified, and inventoried for characterization, closure and/or restoration. Of these, more than 1,750 sites have been formally closed. The remaining sites are grouped according to the source of contamination, location, and other technical characteristics.

SOILS SUBPROJECT

The Soils Subproject includes land areas where atmospheric nuclear tests, nuclear safety experiments, and evaluation tests for peaceful uses of nuclear explosives (i.e., Plowshare Program) conducted at the Nevada Test Site, Nevada Test and Training Range, and Tonopah Test Range resulted in the radioactive contamination of surface soils.

The NNSA/NSO performs characterization activities at each corrective action site managed under the Soils Subproject to establish the nature and extent of contamination, and determine potential risk to the public and environment. Information obtained through these activities is used to select corrective action strategies, such as removal of soil or closure in place with restricted access controls. Corrective actions performed must comply with the guidelines and requirements of the FFACO [1].

There are a total of 107 Soils Subproject corrective action sites, all of which have undergone preliminary characterizations. Two sites on the Nevada Test and Training Range have undergone interim remediation, and 16 sites on the Nevada Test Site were formally closed in 2009. Sites will continue to undergo further characterization and will be cleaned, fenced, posted, and /or monitored as deemed necessary. For sites where contamination is left in place, use restrictions will be maintained. These sites will continue to be managed by NNSA/NSO according to all applicable requirements.

UNDERGROUND TEST AREA (UGTA) SUBPROJECT

From 1951 to 1992, the U.S. government conducted 828 underground nuclear tests at the Nevada Test Site at depths ranging from approximately 60 to 4,800 feet below ground surface. About one-third of these tests occurred near, below, or in the water table, resulting in some radioactive contamination of the area's groundwater.

Faced with the reality that no proven, feasible method existed then, or now, for remediating deep, groundwater contamination, the UGTA Subproject team set out to develop an effective, long-term monitoring system. This network is designed to identify radiological risks to help ensure the safety of offsite populations. Scientists continue to develop and refine computer models to effectively position future monitoring wells within the monitoring network.

The complex geology and hydrology of the Nevada Test Site presents unusual challenges in understanding speed, volume, and direction of groundwater flow and the movement of contaminants. To meet these challenges, the UGTA Subproject team has developed a process that incorporates various research components, including estimating the releasable source term, drilling and sampling of wells, contaminant characterization, and computer model development.

With these components in mind, the team designed a phased approach. A regional evaluation exploring the groundwater pathways over the entire Nevada Test Site has been completed.

Currently, the process of determining contaminant movement and boundaries unique to each of the underground test areas is taking place. The objective is to establish a comprehensive monitoring network using both new and existing wells.

A key component of the strategy is the continuing development of contaminant transport models. These models are three-dimensional, computerized predictions of where and how quickly radioactive contamination is moving in the groundwater. The models use data collected from drilling related to past underground nuclear testing and the sampling of groundwater wells. The NNSA/NSO expects to complete these groundwater models by 2025 with an additional two years to close the sites.

Once NNSA/NSO and the State of Nevada find the results acceptable, the State will approve completion of UGTA characterization activities. The DOE will then implement a long-term monitoring program using existing wells and, if necessary, drilling new wells.

ENVIRONMENTAL MANAGEMENT BOTTOM LINE

The NNSA/NSO is committed to accelerating cleanup and reducing risk to workers, the public, and the environment with a timely, cost-effective approach for the sites under Nevada control and is committed to working cooperatively with regulators and keeping the public informed of its activities

REFERENCES

1. FEDERAL FACILITY AGREEMENT AND CONSENT ORDER, Agreed to by the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management (1996; as amended February 2008).

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