Fact Sheet

U.S. DEPARTMENT OF ENERGY | Legacy Management

Shiprock, New Mexico, Disposal Site

An UMTRCA Title I site

This fact sheet provides information about the **Shiprock site**. This site is managed by the **U.S. Department of Energy Office of Legacy Management** under **Title I** of the **Uranium Mill Tailings Radiation Control Act of 1978**.

Site Information and History

The Shiprock site is the location of a former uranium- and vanadium-ore processing facility within the Navajo Nation in the northwest corner of New Mexico near the town of Shiprock, approximately 28 miles west of Farmington. Kerr-McGee built the mill and operated the facility from 1954 until 1963. Vanadium Corporation of America purchased the mill and operated it until it closed in 1968. The milling operations created process-related wastes and radioactive tailings, a predominantly sandy material. The mill, ore storage area, raffinate ponds (ponds that contain spent liquids from the milling process), and tailings piles occupied approximately 230 acres leased from the Navajo Nation.

In 1983, the U.S. Department of Energy (DOE) and the Navajo Nation entered into an agreement for site cleanup. By September 1986, all tailings and associated materials (including contaminated materials from offsite vicinity properties) were encapsulated in the disposal cell built on top of the existing tailings piles.

Regulatory Setting

Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA) in 1978 (Public Law 95-604) and DOE remediated 22 inactive uranium-ore processing sites under the Uranium Mill Tailings Remedial Action Project in accordance with standards promulgated by the U.S. Environmental Protection Agency in Title 40 *Code of Federal Regulations* (CFR), Part 192. The radioactive materials were encapsulated in U.S. Nuclear Regulatory Commission–approved disposal cells. The U.S. Nuclear Regulatory Commission general license for UMTRCA Title I sites is established in 10 CFR 40.27. The Shiprock disposal site was included under the general license in 1996.

Disposal Site

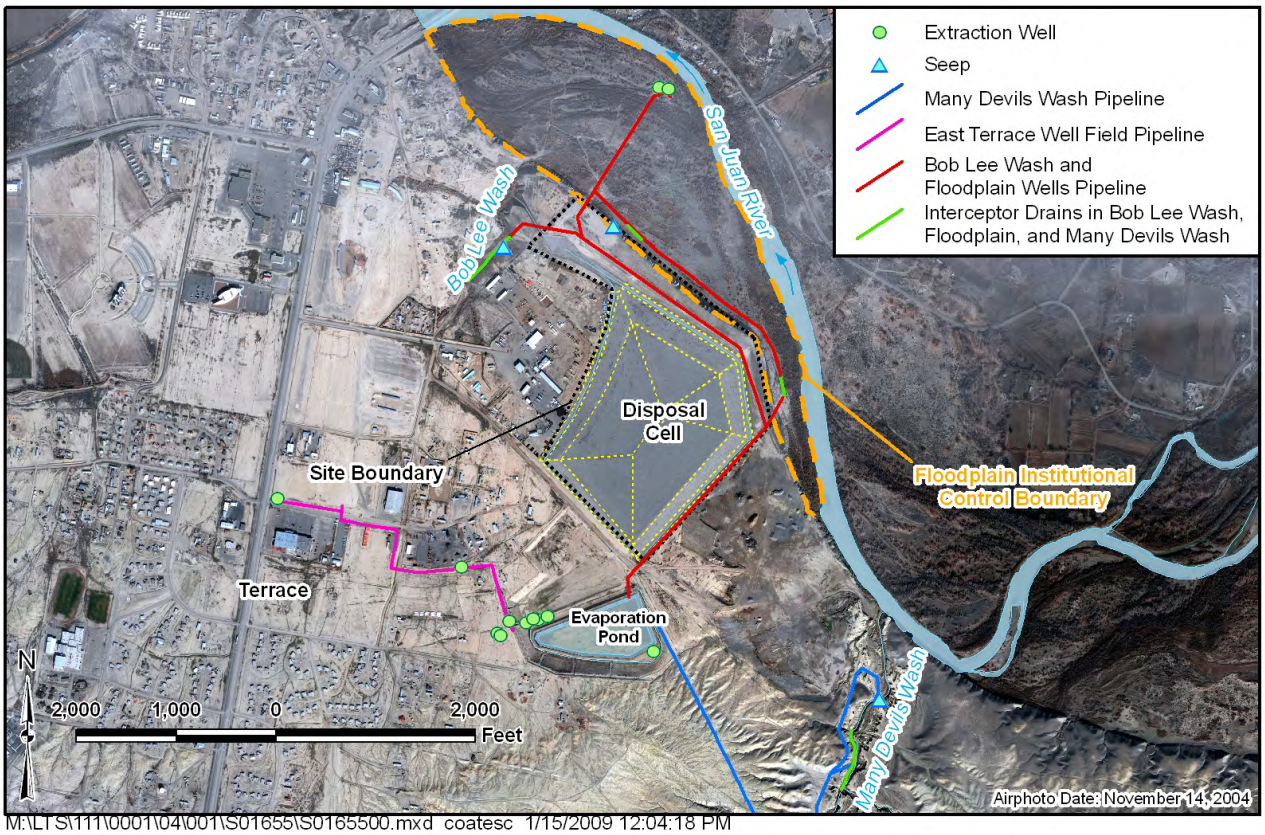
The disposal cell and adjacent former mill site are on a terrace that is trisected by two minor drainages, Bob Lee Wash and Many Devils Wash. At the northeast edge of the terrace, a steep escarpment 50 to 60 feet high forms the boundary between the San Juan River floodplain and the terrace area. The horizontal distance from the disposal cell to the San Juan River is about 600 feet.

Groundwater in the terrace area is thought to be a result of human activities. Past milling operations and irrigation in the terrace area are believed to have contributed most of the water in the terrace groundwater system.

The floodplain alluvial aquifer is north of the disposal cell in the floodplain area between the San Juan River and the base of the escarpment.

In 1961, a test hole was drilled on the terrace about one-half mile northwest of the disposal cell area. This hole, drilled to a depth of 1,850 feet, was not capped. Artesian flow from this hole, now known as site Well 0648, has continued since 1961 and is currently flowing at a rate of about 64 gallons per minute across the terrace into Bob Lee Wash, which drains to the floodplain and eventually to the San Juan River. Inflow from Well 0648 supplies more than half the volume of groundwater in the floodplain. The floodplain aquifer also receives inflow from the San Juan River and from the terrace groundwater system.

Past milling operations have left contaminants in the terrace groundwater system and in the floodplain alluvial aquifer. Contaminated groundwater from the terrace has infiltrated the



Features of the Shiprock Site

upper few feet of the underlying weathered Mancos Shale bedrock and has migrated into the alluvial aquifer on the floodplain. Terrace groundwater has also surfaced in several places as seeps at the edge of the escarpment and in Bob Lee Wash. The contaminants of concern are ammonia, manganese, nitrate, selenium, strontium, sulfate, and uranium.

Compliance Strategy

Three different compliance strategies have been selected at the Shiprock site: (1) active remediation in the eastern portion of the terrace; (2) supplemental standards in the western portion of the terrace; and (3) natural flushing in conjunction with active remediation for the floodplain. These divisions reflect the different amounts of contamination in each area and a different balance of groundwater recharge. Compliance strategies for all three areas include monitoring of groundwater and surface water. Monitoring frequency varies from semiannually to once every two years, depending on the location.

Terrace, Eastern Portion

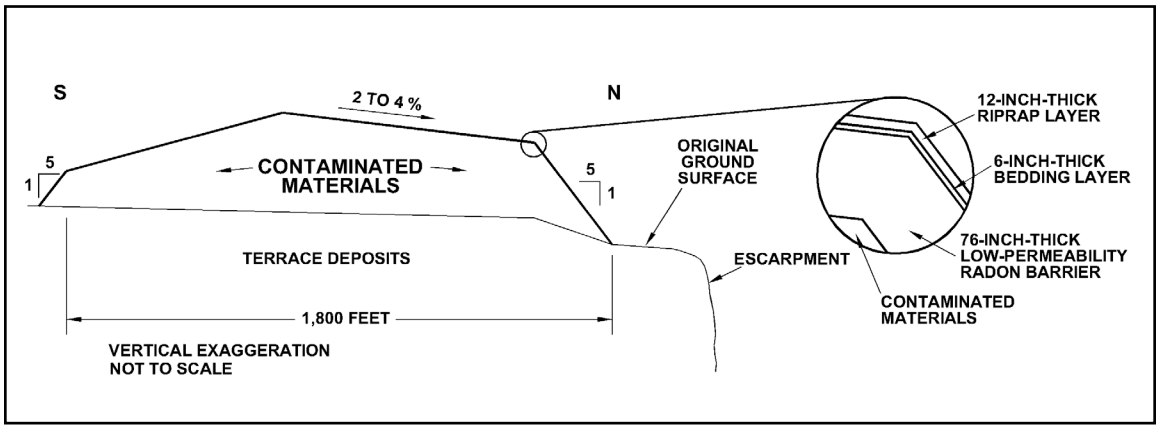
The proposed compliance strategy for the eastern terrace is active remediation and monitoring. Milling-related water from the groundwater system is pumped from extraction wells and collected in an interceptor drain at Bob Lee Wash. Collectively, the removal of water by the wells and interceptor drains will dry the seeps and curtail surface expression of groundwater in Bob Lee Wash. The extracted water is piped to an 11-acre evaporation pond on the terrace. Initial groundwater modeling predicted that about 7.5 years of extraction would be needed to reduce groundwater levels sufficiently to isolate contaminated groundwater from seeps in the washes and to create a separation between the eastern and western terrace groundwater systems, assuming an extraction rate of 7.5 gallons per minute from the terrace extraction wells. However, at present, the extraction rate is averaging 3.0 to 3.5 gallons per minute.

Terrace, Western Portion

The proposed compliance strategy for the western terrace groundwater system is application of supplemental standards with monitoring. Supplemental standards may be applied at locations where groundwater is classified as limited use (not a current or potential source of drinking water) because it meets any of several criteria. In the western portion of the terrace, groundwater is classified as limited use because of widespread ambient contamination not related to milling activities that cannot be cleaned up using treatment methods reasonably employed in public water systems (40 CFR 192.11[e][2]). It is highly probable that some constituents in the system — notably, selenium, sulfate, and uranium — are naturally occurring and are derived in part from leaching of Mancos Shale, and standards may never be achieved for this region.

Floodplain

The proposed compliance strategy for the floodplain aquifer is active remediation involving extraction of contaminated groundwater in conjunction with natural flushing, alternate



South-North Cross Section of the Shiprock Disposal Cell

concentration limits for selenium and sulfate, and monitoring. Alternate concentration limits may be adopted within specified areas if established maximum concentration limits are unattainable. Groundwater that infiltrates the floodplain from the eastern terrace system is collected in interceptor trenches and wells installed along the base of the escarpment. Approximately 1 million gallons of water is extracted from the floodplain contaminant plume each month and is piped to the evaporation pond on the terrace.

Groundwater Compliance Action Plan Process

The basis for selecting the compliance strategies for the Shiprock site was presented in a draft Groundwater Compliance Action Plan (GCAP) in 2002. In 2005, DOE revised the conceptual model of the site in an effort to assess the remediation design of the groundwater treatment system and to provide recommendations for improvement of the system. The recommendations were based on an observational approach that formed the technical approach used by the Uranium Mill Tailings Remedial Action (UMTRA) Ground Water Project for groundwater remediation. Included in the recommendations was a continued effort to evaluate the near term (three-year) and longer term (seven-year) progress toward the intended objectives of the selected compliance strategies.

Based on the evaluation efforts DOE will decide whether additional contingency methods are more likely to achieve extraction objectives or whether an alternative compliance strategy that is less dependent on active remediation or would require less rigorous cleanup goals (e.g., establishment of alternate concentration limits) should be selected.

Institutional Controls

Institutional controls on the floodplain to minimize the potential for risk to human health and the environment include (1) grazing restrictions, (2) control of access to the floodplain area, (3) a DOE-Navajo Nation agreement prohibiting use of groundwater in the floodplain, and (4) assurance from the Navajo Nation Water Code Administration that flowing artesian Well 0648 will be allowed to continue flowing into Bob Lee Wash and onto the floodplain.

Disposal Cell Design

The disposal cell is an asymmetrical pentagon with a maximum side length of 1,800 feet and a minimum side length of 800 feet. The cell occupies approximately 77 acres of the 105-acre site. A posted wire fence surrounds the cell. The cover of the Shiprock disposal cell is a multicomponent system designed to encapsulate and protect the contaminated materials. The disposal cell cover is composed of (1) a low-permeability radon barrier (first layer placed over compacted tailings) consisting of compacted sandy silty soils, (2) a layer of granular bedding material placed as a capillary break, and (3) a rock (riprap) erosion-protection layer. The use of these cover materials promotes rapid runoff of precipitation to minimize leachate. Rock-lined drainage ditches divert surface water runoff around and away from the disposal cell to a rock-lined energy dissipation area.

Legacy Management Activities

The DOE Office of Legacy Management (LM) is responsible for ensuring that the selected groundwater compliance strategy at the Shiprock disposal site continues to be protective of human health and the environment. LM will also monitor the effectiveness of institutional controls.

LM manages the disposal site according to a site-specific Long-Term Surveillance Plan to ensure that the disposal cell systems continue to prevent release of contaminants to the environment. Under provisions of this plan, LM conducts annual inspections of the site to evaluate the condition of surface features, performs site maintenance as necessary, and monitors groundwater to verify the continued integrity of the disposal cell.

In accordance with 40 CFR 192.02(a), the disposal cell is designed to be effective for 1,000 years, to the extent reasonably achievable, and, in any case, for at least 200 years. However, the general license has no expiration date, and LM's responsibility for the safety and integrity of the Shiprock disposal cell will last indefinitely.

CONTACT INFORMATION

IN CASE OF AN EMERGENCY AT THE SITE, CONTACT 911.

Site-specific documents related to the **Shiprock, New Mexico, Disposal Site** are available on the LM website at **www.energy.gov/lm/shiprock-new-mexico-disposal-site**

For more information about LM activities at the **Shiprock, New Mexico, Disposal Site**, contact:

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