

These assessments addressed the health risks posed by both the radiological and nonradiological contaminants associated with tailings. The primary tailings-related radiological contaminants of concern were gamma radiation and radon gas. The highest risk tailings-related nonradiological contaminants of concern included arsenic, copper, lead, molybdenum, selenium, uranium, vanadium, and zinc.

The FS evaluated alternatives for remediation of the Site for each of OUs I, II, and III. The analytical data collected for the RI were used in the development and evaluation of these alternatives. The remedial alternatives evaluated for OUs I and II ranged from no action to removal of tailings contamination to a licensed off-site facility. The remedial alternatives evaluated for OU III ranged from no action to active ground and surface water collection, treatment, and discharge.

Record of Decision Findings

A Record of Decision (ROD) for the Site was signed by UDEQ and EPA on August 21 and 22, 1990, respectively. The ROD identified the selected remedy for remediation of OUs I and II. Because the selected remedy for remediation of OU III was dependent on the implementation of the selected remedy for OUs I and II and its effect on ground and surface water contamination, it was determined that a separate ROD would be issued for OU III at a later date. A ROD for an Interim Remedial Action at OU III was signed by EPA and UDEQ in September 1998. The interim selected remedy was to allow for passive treatment of contaminated ground water through natural flushing and to implement institutional controls that would limit access to ground water pending the collection of sufficient data to develop a final OU III ROD. Contamination in surface water was expected to diminish as a result of the removal of the source (tailings contamination) from OUs I and II and natural flushing of the ground water.

The selected remedy for remediation of OUs I and II of the Site, including the OU II Non-Surface and Ground-Water Impacted Peripheral Properties, was to remove radioactive materials to meet specific cleanup standards, modify existing structures to isolate radon sources from inhabitants, and restore with clean materials. Cleanup activities required excavation and, in some cases, demolition of structures and other property improvements. All affected structures and other improvements were reconstructed or the owner was compensated based on their current

value. The selected remedy also allowed for the implementation of supplemental standards and institutional controls such that tailings contamination exceeding the cleanup standards was permitted to remain on certain properties where cleanup would cause excessive risk of injury to workers or the public, where cleanup would cause excessive environmental damage, and/or where cleanup costs would be excessive relative to the benefits. Excavated materials were disposed of in a repository that was built approximately one mile south of the Millsite.

The ROD stipulated numerous applicable or relevant and appropriate requirements (ARARs) to govern remedial actions on OUs I and II. The following ARARs, used for the remediation of the OU II Non-Surface and Ground-Water Impacted Peripheral Properties, established contaminant-specific limits for the cleanup of radiologically contaminated soils and sediments:

- 40 CFR part 192—Sets forth contaminant-specific numerical cleanup standards for Ra-226, radon decay products, and gamma radiation at 40 CFR 192.12. Criteria for using supplemental standards in lieu of the numerical cleanup standards set forth at 40 CFR 192.12 are provided at 40 CFR 192.21.

- DOE's Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites (FUSRAP/SFMP)—Provides additional guidelines for cleanup of radiological contamination that exceeds the numerical standards of 40 CFR 192.12 that is located in an area of a given size (DOE "hot spot" criteria).

- Resource Conservation and Recovery Act (RCRA)—Identified as a potential ARAR with regard to the management of any hazardous wastes encountered during remediation that were not governed by the cleanup standards set forth at 40 CFR part 192.

- DOE Order 5400.5 "Radiation Protection of the Public and Environment"—This was not an ARAR identified in the ROD but was implemented to guide the cleanup of uranium materials on property MP-00211-VL, one of the OU II Non-Surface and Ground-Water Impacted Peripheral Properties.

- EPA Region III Risk-Based Concentration Table (First Quarter 1995)—This was not an ARAR identified in the ROD but was implemented to guide the cleanup of certain nonradiological hazardous

substances associated with uranium yellow cake, which was discovered during the remediation of property MP-00211-VL.

- State of Utah Underground Storage Tank Rules—This was not an ARAR identified in the ROD but was implemented to guide the excavation and disposal of underground storage tanks and associated wastes that were discovered during the remediation of certain Site properties.

The ROD stipulated that design components for the repository built south of the Millsite would be based on standards specified in 40 CFR 192.02, the Uranium Mill Tailings Radiation Control Act of 1978, the Uranium Mill Tailings Remedial Action (UMTRA) Program, and on standards that would enable the repository to meet the requirements for a RCRA Subtitle C hazardous waste disposal facility.

Characterization of Risk

The RI/FS identified gamma radiation and radon gas as the primary radiological contaminants of concern associated with uranium and vanadium mill tailings. Health risk assessments identified exposure to gamma radiation and inhalation of radon and radon daughters as the two most significant potential direct exposure pathways to these radiological contaminants. Gamma radiation emanates from tailings and delivers a radioactive dose to the entire body. Radon-222 and daughter products, which decay from Ra-226 contained in the tailings and migrate into the atmosphere, emit alpha radiation that affects the lungs when inhaled.

The RI/FS also identified the following eight elements as the highest tailings-related nonradiological contaminants of concern due to their potential chemical toxicity: arsenic, copper, lead, molybdenum, selenium, uranium, vanadium, and zinc (uranium was considered to be a higher risk due to chemical toxicity rather than radioactivity). The RI/FS health risk assessments determined that the two most significant potential exposure pathways to these nonradiological contaminants were ingestion of contaminated vegetables and ingestion of contaminated beef. These were considered to be indirect exposure pathways resulting from contaminated surface water being used to irrigate fields and water livestock, thereby introducing the nonradiological contaminants into the food chain. Direct exposures to the nonradiological contaminants through contact with contaminated soil, water, or air were determined to be negligible health risks.