Fact Sheet

U.S. DEPARTMENT OF ENERGY | Legacy Management

Rifle, Colorado, Disposal and Processing Sites

UMTRCA Title I sites

This fact sheet provides information about the **Rifle disposal and processing sites**. These sites are 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

Two former uranium and vanadium processing sites are located near the city of Rifle, Colorado. The Old Rifle site is approximately 0.3 mile east of the city of Rifle; the New Rifle site is approximately 2 miles southwest of Rifle. The Colorado River defines the southern boundary of each site. The ore-processing operations created radioactive tailings, a predominantly sandy material.

The state of Colorado acquired these sites in 1988 and transferred ownership of both to the city of Rifle; the city acquired the Old Rifle site in 2000 and the New Rifle site in 2004.

Surface remediation of the Rifle sites began in spring 1992 and was completed in October 1996. Tailings and tailings-contaminated materials from both former processing sites were relocated to the Rifle disposal site approximately 6 miles north of the city of Rifle.

Regulatory Setting

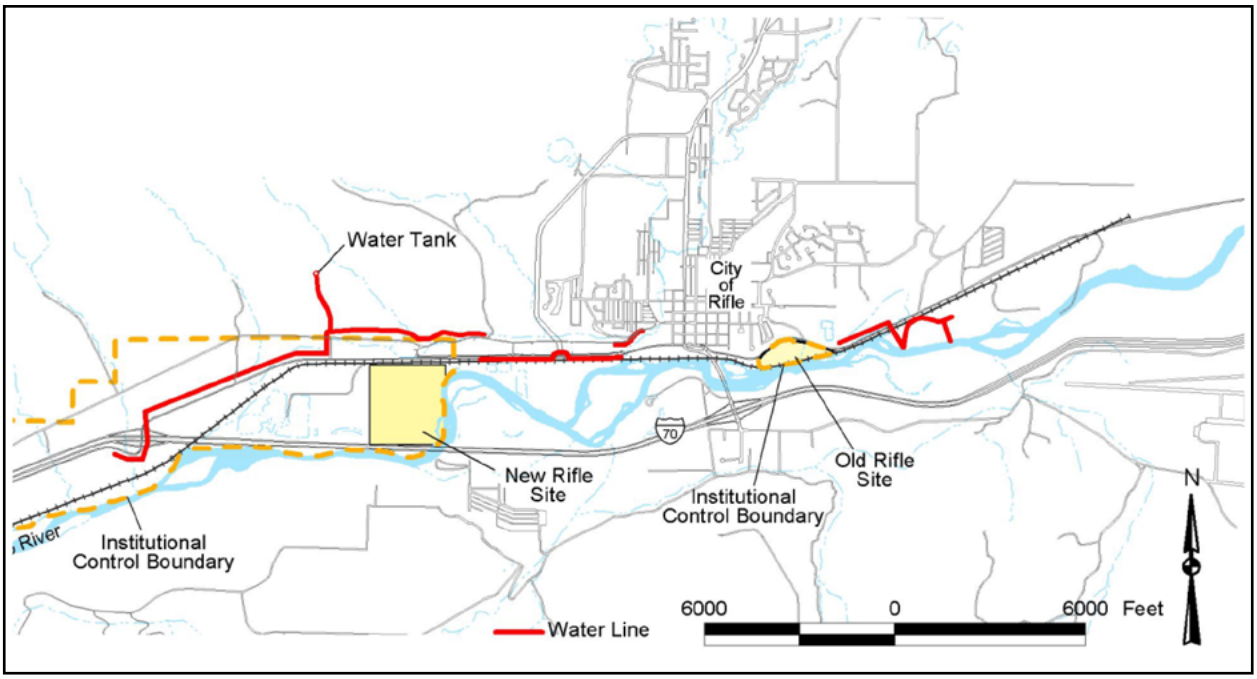
Congress passed the Uranium Mill Tailings Radiation Control Act (UMTRCA) in 1978 (Public Law 95-604), and the U.S. Department of Energy (DOE) remediated 22 inactive uranium-ore processing sites under the Uranium Mill Tailings Remedial Action (UMTRA) Project in accordance with standards promulgated by the U.S. Environmental Protection Agency in Title 40 *Code of Federal Regulations* (CFR), Part 192. Subpart B of 40 CFR 192 regulated cleanup of contaminated groundwater at the processing sites. The radioactive materials were encapsulated in U.S. Nuclear Regulatory Commission (NRC)-approved disposal cells. The NRC general license for UMTRCA Title I sites is established in 10 CFR 40.27. The Rifle disposal site was included under the general license in 1998.

Processing Sites

Both Rifle processing sites are underlain by 20 to 30 feet of Colorado River alluvium. Beneath the alluvium, semiconfined groundwater occurs in interlayered sandstone, siltstone, and claystone beds in the Wasatch Formation. In general, groundwater in the alluvium and in the Wasatch Formation flows southwest. The alluvial aquifer is contaminated by seepage from the former mill tailings piles and raffinate ponds at both sites. Because of the large dilution by the river (at least a factor of 30,000), contaminants in alluvial groundwater discharging to the river are quickly diluted to background concentrations, and no mill-related contamination has been detected in samples of Colorado River water collected at or downstream from the sites.

Old Rifle: Union Carbide Corporation and its predecessor, the United States Vanadium Corporation, owned the Old Rifle mill and operated it from 1924 to 1932 and from 1942 to 1958; the mill was idle from 1932 to 1942. It processed vanadium ore during both operating periods and uranium ore during the later operating period. Ore was shipped to the mill by truck and rail from eastern Utah and from mines located near Meeker and Rifle, Colorado. After 1958, most of the mill tailings at the Old Rifle site were reprocessed and deposited at the New Rifle site.

Contaminants of concern in alluvial groundwater at the Old Rifle site are selenium, uranium, and vanadium. Tailings seepage has not contaminated the Wasatch Formation.



Institutional Control Features at the Rifle Sites.

Current Site Reuse

The city of Rifle constructed an operations and maintenance facility on the east end of the property in 2007. On the west end of the site, the DOE Office of Science is currently conducting biogeochemical research on uranium and other constituents.

New Rifle: The New Rifle mill replaced the Old Rifle mill in 1958 and was also owned and operated by Union Carbide Corporation. The mill was constructed as part of a multisite complex that included the upgrading facilities at Slick Rock, Colorado, and Green River, Utah. Ore and upgrade products from those sites were shipped to the New Rifle mill by truck and rail. From 1958 to 1973, the mill produced uranium and vanadium concentrates. The New Rifle mill processed tailings from the Old Rifle mill, uranium ore, and refined upgrade products. From 1973 to 1984, part of the mill was used to produce vanadium concentrate; this operation involved processing vanadium solutions and did not produce tailings.

Contaminants of concern in groundwater at the New Rifle site are arsenic, molybdenum, nitrate, selenium, uranium, and vanadium. Most of the higher concentrations of contaminants are within the site boundary and immediately west of the site, but some uranium contamination in the alluvial aquifer extends further west of the site.

Current Site Reuse

The city of Rifle constructed a wastewater treatment facility on the east side of the site between 2008 and 2010. One hundred percent of the facility's power is provided by two arrays of solar panels.

The city of Rifle has constructed other solar arrays at the former processing site that provide additional power to the community.

New Rifle Processing Site in 1974 (above) and 2008 (below).

Compliance Strategy

In 2002, NRC concurred on a groundwater compliance strategy of natural flushing with institutional controls (ICs) for the Old Rifle site. Natural flushing is a process in which natural geochemical and biological processes and groundwater movement decrease contaminant concentrations in the aquifer. The goal is to decrease concentrations to established limits, background concentrations, or alternate concentration limits. Alternate concentration limits may be adopted within specified areas when an established maximum concentration is unattainable or when no drinking water standard exists. However, the alternate concentration limits must not pose a risk to human health or the environment. Selenium and vanadium have alternate concentration limits, and uranium must not exceed a background concentration in groundwater at the Old Rifle site. A new proposed compliance strategy for Old Rifle is being revised based on comments received from NRC.

The proposed groundwater compliance strategy for the New Rifle site has been natural flushing, application of ICs, and alternate concentration limits for vanadium and selenium. This strategy is similar to that for Old Rifle; however, NRC has never concurred in this strategy for the New Rifle site, and DOE is revising a new proposed compliance strategy based on comments received from NRC.

Old Rifle: To track the progress of natural flushing, groundwater samples are collected for analysis a minimum of twice per year. Analytical results of groundwater samples collected from 1998 through 2015 indicated that concentrations of site-related contaminants are generally not decreasing over time. Groundwater modeling results had predicted that contaminant levels at the Old Rifle site would decrease through natural flushing to background levels, maximum concentration limits, or alternate concentration limits within 100 years. An evaluation of monitoring results does not support this conclusion, and the site conceptual model and compliance strategy have been revised.

A new proposed compliance strategy of no remediation with the application of ACLs was submitted to NRC in 2017 through an updated draft Groundwater Compliance Action Plan (GCAP). DOE is currently addressing NRC comments on the draft GCAP

New Rifle: The six contaminants of concern are monitored twice a year. Groundwater modeling results at the New Rifle site had predicted that contaminants would decrease to background levels, maximum concentration limits, or alternate concentration limits within 100 years. As at the Old Rifle site, concentrations at the New Rifle site are not decreasing as predicted, and the site conceptual model and compliance strategy have been revised.

A new proposed compliance strategy of no remediation with the application of ACLs was submitted to NRC in 2017 through an updated GCAP. DOE is currently addressing NRC comments regarding the updated GCAP.

Old Rifle Processing Site in 1957 (above) and 2008 (below).

Institutional Controls

ICs are restrictions that protect public health and the environment by limiting access to contaminated alluvial groundwater at the Rifle sites. DOE encouraged public participation in the creation of ICs at the sites and held numerous meetings with citizens and representatives of the city of Rifle and Garfield County to provide information and discuss the extent of the ICs.

ICs for the Old Rifle site consist of deed restrictions on the land transfer to the city of Rifle, an environmental covenant between the Colorado Department of Public Health and Environment (CDPHE) and the city of Rifle, and an UMTRA Overlay Zone District that do not allow access to groundwater without express written permission from the state of Colorado and DOE.

At the New Rifle site, the ICs are legal administrative actions consisting of a deed restriction covering the former mill site property and city and county ordinances restricting the use of contaminated groundwater. Garfield County requires owners of property within the New Rifle site institutional controls boundary to provide proof of a source of potable water to develop the property. The county also established a drinking water constraint zone within the boundary in which any source of water intended for human consumption must

Rifle Disposal Cell, 2010.

meet applicable standards. The city of Rifle requires residents within the ICs boundary to tap into the municipal water system if the property is annexed to the city. To compensate property owners for limiting the beneficial uses of the groundwater, DOE funded two water line extensions to the current municipal system to ensure the availability of potable water to properties affected by site-related contamination. Because the second water line extension does not provide services within the full extent of the ICs boundary, DOE provided reverse osmosis systems for users within the boundary but beyond the reach of the water line. Energy-related economic growth in the Rifle area during the past decade prompted the city to extend water lines within the ICs boundary and all users are currently serviced by municipal water.

Elevated concentrations of molybdenum, selenium, ammonia, nitrate, vanadium, and uranium in alluvial groundwater have migrated downgradient from the New Rifle site to property owned by Umetco Minerals Corporation. The Umetco property contains two ponds that remain from a former gravel-mining operation. Because the ponds receive inflow from alluvial groundwater, and concentrations of molybdenum, nitrate, and uranium in the ponds sometimes exceed standards in 40 CFR 192, the pond water represents an exposure pathway. To prevent inappropriate use of the contaminated water, an environmental covenant was adopted in 2009 between Umetco and CDPHE. The covenant prohibits unauthorized access to the ponds and requires the use of appropriate measures such as fencing to prevent livestock from accessing the ponds. It also limits access to groundwater without permission of the state of Colorado and DOE.

Disposal Site

In August 1991, the Bureau of Land Management permanently transferred administration of 205 acres in Estes Gulch, about 6 miles north of the city of Rifle, to DOE for use as the Rifle disposal site. The predominant land use in the area is grazing; the surrounding region is sparsely populated. Warning signs mark the site perimeter, which is partially fenced.

The Wasatch Formation underlies the disposal site. The Wasatch Formation is considered an aquitard and does not contain significant quantities of groundwater. Groundwater in this formation is characterized as limited use, which means the groundwater is not a current or future source of potable water because of naturally poor water quality and low yield.

Disposal Cell Design

The Rifle disposal cell is located at the head of a small drainage basin on a dissected pediment and alluvial fan surface. The ground slopes southwest. The cell is roughly triangular and measures approximately 3,000 feet on each side; the cover encompasses an area of 71 acres on the 205-acre site. About 3.5 million cubic yards of contaminated materials with a total activity of 2,738 curies of radium-226 are encapsulated in the cell.

The cell cover is a multicomponent system designed to encapsulate and isolate the contaminated materials. The cover consists of (1) a low-permeability radon barrier (first layer placed over compacted tailings), (2) a sand filter/drainage layer, (3) a frost protection/rooting-medium layer, (4) an upper filter layer, and (5) riprap on the top and side slopes to protect against wind and water erosion. The cell design promotes rapid runoff of precipitation to minimize infiltration. A riprap apron and ditch at the toe of the disposal cell carry water away from the cell. An unlined interceptor ditch abuts the upslope portion of the disposal cell to divert surface flow away from the cell. A leachate collection system was emplaced at the toe of the cell during cell construction and was to be decommissioned after transient drainage of pore water had ceased; however, pore water continues to accumulate in the disposal cell, despite continuous dewatering operations. DOE is actively investigating potential sources to the leachate collection system and mitigation strategies. Native vegetation is being reestablished in the disturbed areas at the site.

Legacy Management Activities

The DOE Office of Legacy Management (LM) is responsible for ensuring that the selected groundwater compliance strategies at the New and Old Rifle sites continue to be protective of human health and the environment. LM will also monitor the effectiveness of ICs and the progress of natural flushing.

LM manages the disposal site according to a site-specific Long-Term Surveillance Plan to ensure that the disposal cell system continues 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, and performs site maintenance as necessary to verify the 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 Rifle disposal site will last indefinitely.

CONTACT INFORMATION

IN CASE OF AN EMERGENCY AT THE SITE, CONTACT 911

LM TOLL-FREE EMERGENCY HOTLINE: (877) 695-5322

Site-specific documents related to the **Rifle, Colorado, Disposal Site and Processing Sites** are available on the LM website at **www.energy.gov/lm/rifle-colorado-disposal-site-and-processing-sites**

For more information about LM activities at the **Rifle, Colorado, Disposal Site and Processing Sites**, contact:

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