Fact Sheet

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Rulison, Colorado | Site

A PLOWSHARE SITE/OFFSITE

This fact sheet provides information about the **Rulison site**. Long-term stewardship responsibilities for this site are managed by the **U.S. Department of Energy Office of Legacy Management**.

Site Information and History

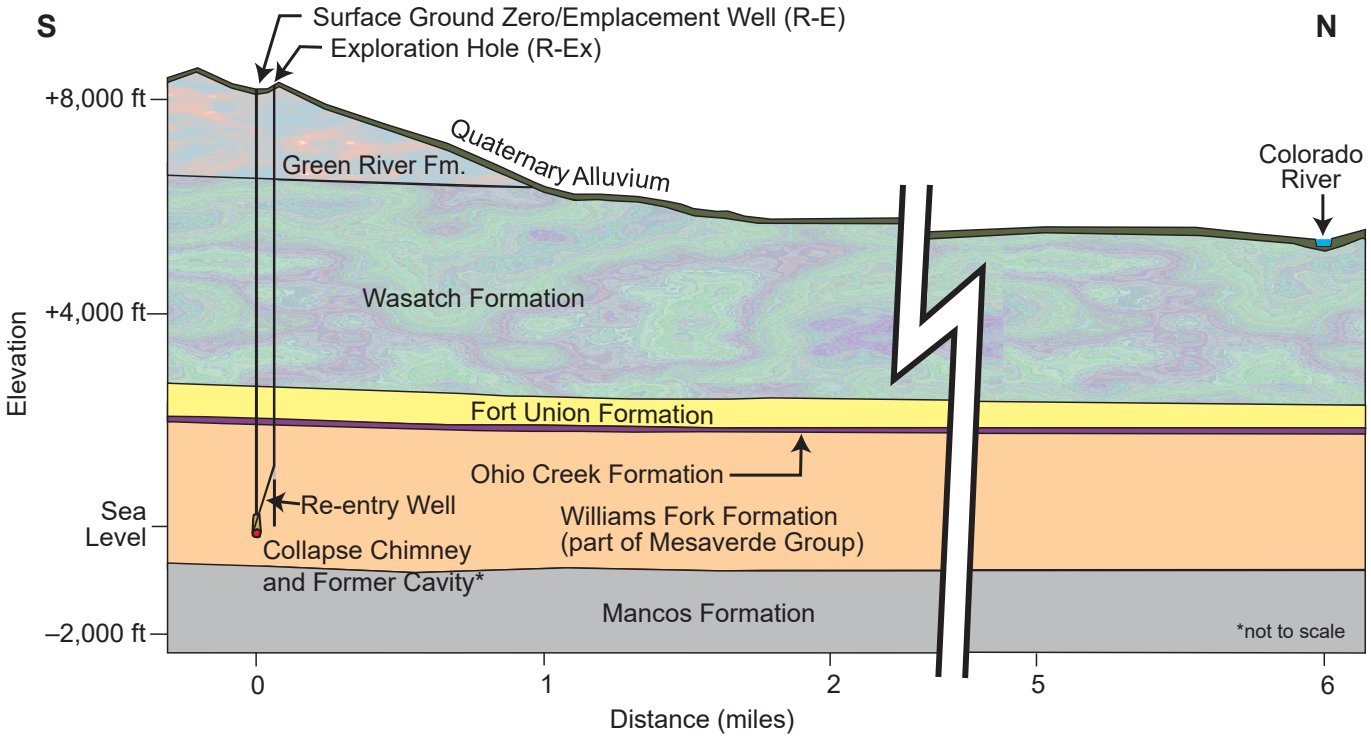
The Rulison, Colorado, Site is in the Piceance Basin of western Colorado at an elevation of 8,154 feet, about 40 miles northeast of Grand Junction and 12 miles southwest of Rifle. The Piceance Basin is a geologic structure that contains significant hydrocarbon reserves.

In the early 1960s the U.S. Atomic Energy Commission (AEC), a predecessor agency of the U.S. Department of Energy (DOE), investigated and developed alternative sites or "Offsites" to the Nevada National Security Site (formerly known as the Nevada Test Site) for underground nuclear testing. On Sept. 10, 1969, AEC, in partnership with Austral Oil Company of Houston, Texas, and the nuclear engineering firm CER Geonuclear Corporation of Las Vegas, Nevada, detonated a nuclear device at the Rulison site for the purpose of stimulating the flow of natural gas in the low-permeability geologic formation. This was the second natural-gas-reservoir stimulation experiment in the Plowshare Program, which was designed to develop peaceful uses for nuclear energy.

The detonation took place at 8,425 feet below ground surface, fracturing the low-permeability sandstone of the Williams Fork Formation of the Mesaverde Group in an attempt to release commercially marketable quantities of natural gas. The detonation produced extremely high temperatures that vaporized the surrounding rock, temporarily creating a cavity surrounded by a fractured area extending out from the detonation point (see post-detonation cross section). Shortly after the detonation, the overlying fractured rock collapsed into the cavity, creating a rubble-filled collapse chimney above the detonation point. As the former cavity cooled, the melted and vaporized rock collected and solidified at the cavity bottom (now the lower part of the collapse chimney). Most of the high-melting-point radionuclides were trapped in this solidified melt rock, which is often referred to as "melt glass" due to its glassy texture.

A sidetrack hole (re-entry well) was drilled off the exploration well (R-Ex) into the chimney and tested to determine how well the detonation improved gas production (see cross sections). The well produced 455 million cubic feet of natural gas in 107 days of testing over four periods from October

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Cross section of the Rulison, Colorado, Site.

1970 through April 1971. The produced gas was flared to the atmosphere and samples of the produced gas and water were analyzed to find out how radioactivity levels changed as testing progressed. The U.S. Environmental Protection Agency (EPA) National Environmental Respiratory Center and the Colorado Department of Public Health and Environment (CDPHE) monitored all releases during drilling and testing to protect workers at the site, the public, and the environment. The concentrations of radionuclides dropped throughout the production testing, but not completely, which made the produced gas unmarketable. AEC personnel closed the re-entry well after the final test in 1971, and it remained closed until it was plugged and abandoned in 1976.

Surface Conditions

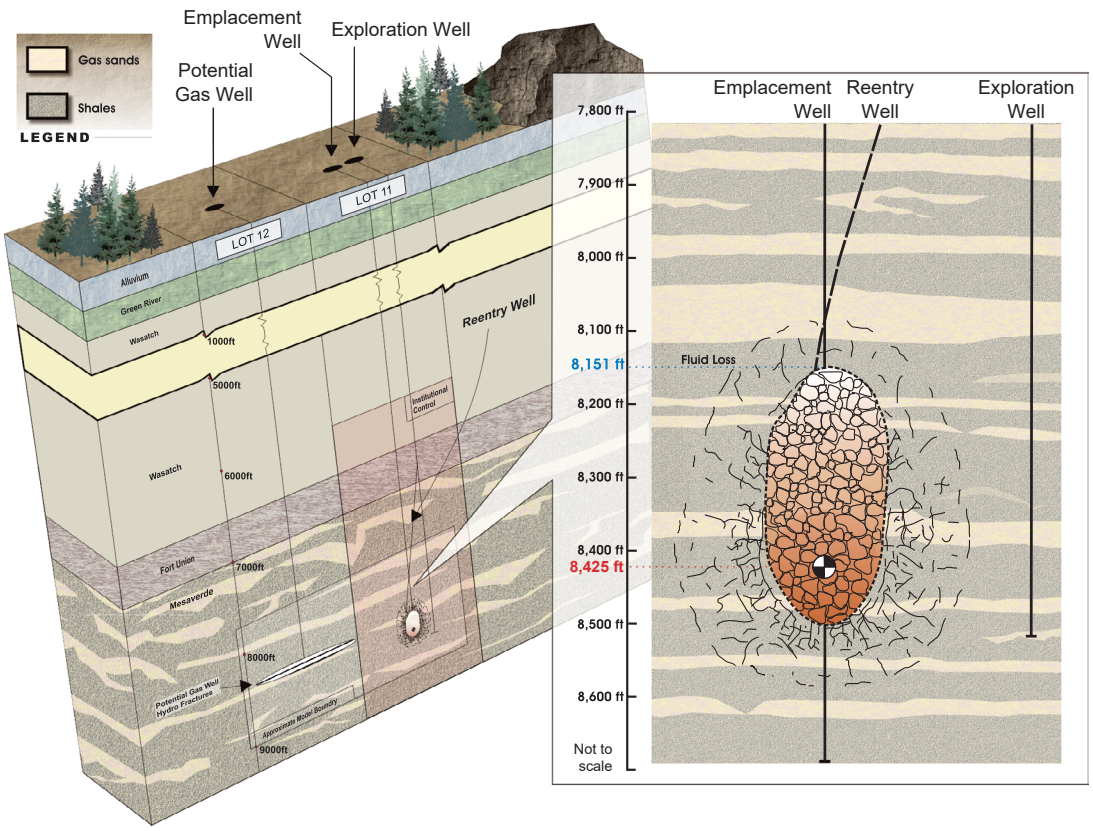
In July 1972, equipment no longer needed at the site was decontaminated and removed. The site was left in standby condition until 1976, when the remaining equipment and surface facilities were dismantled, inspected, and surveyed for radiation. Materials and equipment were decontaminated if necessary and removed to an off-site location. Drilling fluid in the effluent pond was removed and an impoundment structure was left as requested by the landowner. Power poles and power lines were also left at the request of the landowner.

Sediment and soil samples from the former pond and areas near the re-entry well collected in 1994 and 1995 contained organic drilling additives in the form of petroleum hydrocarbons. Remediation consisted of draining the pond and removing contaminated sediments that met the state of Colorado's regulatory criteria.

A liner was installed in the pond before it was refilled. Eight wells were installed to monitor groundwater quality and to verify that no contamination was moving into the groundwater from pond sediments below the liner or from soils around the re-entry well.

Water samples collected for eight consecutive quarters in 1996 and 1997 confirmed no migration of petroleum hydrocarbons above risk-based levels. DOE decommissioned the monitoring wells following Colorado well-abandonment regulations. In 1998, DOE provided Colorado regulators with the Rulison Site Surface Closure Report. CDPHE agreed no further action was required and approved closure of the site.

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Rulison post-detonation cross section.

Subsurface Conditions

The detonation was in the Williams Fork Formation of the Mesaverde Group, which is characterized as having very low permeability. Aquifers used for drinking water and irrigation in the surrounding area are shallow, more than 6,000 feet above the detonation point. The geologic formations between the near-surface aquifers and the deep subsurface detonation point are nearly impermeable and produce little or no water.

The nuclear test created a wide variety of radionuclides. Most of these were trapped in the solidified melt rock that formed at the base of the collapsed chimney shortly after detonation, greatly reducing their mobility. The natural gas production testing removed some radionuclides that were in gas. The primary contaminant in the deep subsurface is tritium, a radioisotope of hydrogen that can replace normal hydrogen in liquid water and water vapor. Tritium has a half-life of 12.3 years and decays to nonradioactive helium.

DOE routinely samples the producing natural gas wells nearest the site and results continue to confirm no migration of Rulison test-related radionuclides.

Long-Term Hydrologic Monitoring Program

EPA monitored shallow groundwater and surface water annually at and near the site from 1972 until 2008 as part of its Long-Term Hydrologic Monitoring Program. The DOE Office of Legacy Management (LM) took over the monitoring program in 2008. In 2020, LM refined the annual monitoring program, focusing on three shallow wells nearest the site. The monitoring results continue to confirm no migration of test-related contaminates. See monitoring results at https://gems.lm.doe.gov/#site=RUL.

Land Use

The Rulison site is located on private land in Lot 11, NE¼, SW¼, Section 25, Township 7 South, Range 95 West, 6th Principal Meridian. The area near the site is sparsely populated; there are a few scattered residences and ranches west, north, and northeast of the site, and there are two residences inside Lot 11. The area also supports some farming and ranching. Battlement Mesa is directly south of the site. Much of the area southwest, south, and southeast of the site is steep slopes rising to elevations of more than 9,600 feet above sea level.

The area around the site has undergone extensive drilling for natural gas in recent years. Technological advancements in hydrofracturing — pumping fluids and sand into the gas reservoirs at high pressure, creating fractures that extend out from the wellbore — have raised concerns that fractures might eventually extend into radioactive contamination from the detonation and bring contaminants to the surface through gas and water from the wells.

LM has been working with the Colorado Energy and Carbon Management Commission (ECMC), natural gas industry, state regulators, and stakeholders to monitor natural gas wells drilled near the Rulison site.

Institutional Controls

Following surface cleanup and CDPHE approval of the closure report, no institutional controls are required for the surface at the site.

A deed restriction was established for the site in 1976. It prohibits drilling and removing any material below 6,000 feet within the 40-acre boundary of Lot 11, unless authorized by the U.S. government. A monument at surface ground zero contains a plaque that provides the details of the nuclear test and states that excavation, drilling, and removing subsurface materials below a depth of 6,000 feet is prohibited without permission of the U.S. government.

ECMC established two wider boundaries around the site. When an exploration company applies for a permit to drill within a 3-mile radius of surface ground zero, ECMC notifies DOE. DOE reviews and comments on the application. ECMC also established a half-mile boundary around surface ground zero. An application for a permit to drill within half a mile requires a hearing before the commission.

Regulatory Setting

DOE is responsible for protectiveness of the environmental remedy and project-related contaminants at the Rulison site. The federal government has control of the subsurface rights beginning at a depth of 6,000 feet within the 40-acre boundary of Lot 11. LM is responsible for long-term management of the Rulison site and collaborates with ECMC and CDPHE for its long-term surveillance.

Legacy Management Activities

LM monitors the Rulison site to make sure conditions at the site remain protective of human health and the environment. Long-term surveillance activities include long-term monitoring of shallow groundwater wells and natural gas wells near the site.

Contact Information

In case of an emergency at the site contact 911.

Site-specific documents related to the **Rulison, Colorado, Site** are available on the LM website at **www.energy.gov/lm/rulison-colorado-site.**

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

U.S. Department of Energy
Office of Legacy Management
2597 Legacy Way
Grand Junction, CO 81503

Email:
public.affairs@lm.doe.gov

DOE Office of Legacy Management
(970) 248-6070

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