



Nevada Offsites

Rulison, Colorado, Site

*This fact sheet provides information about the Rulison, Colorado, Site.
This site is managed by the U.S. Department of Energy Office of Legacy Management.*

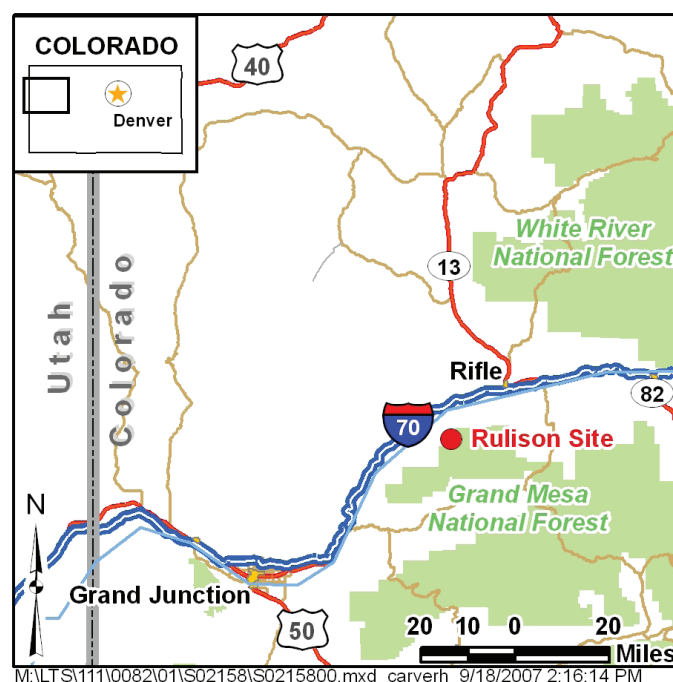
Site Description and History

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

On September 10, 1969, the U.S. Atomic Energy Commission (AEC), a predecessor agency of the U.S. Department of Energy (DOE), detonated a 40-kiloton nuclear device 8,426 feet below the ground surface in an attempt to release commercially marketable quantities of natural gas from the fine-grained, low-permeability sandstone of the Williams Fork Formation of the Mesaverde Group. This was the second natural gas reservoir stimulation experiment in the Plowshare Program, which was designed to develop peaceful uses for nuclear energy. Austral Oil Company of Houston, Texas, and the nuclear engineering firm CER Geonuclear Corporation of Las Vegas, Nevada, proposed the project. Those two firms and AEC jointly sponsored Project Rulison.

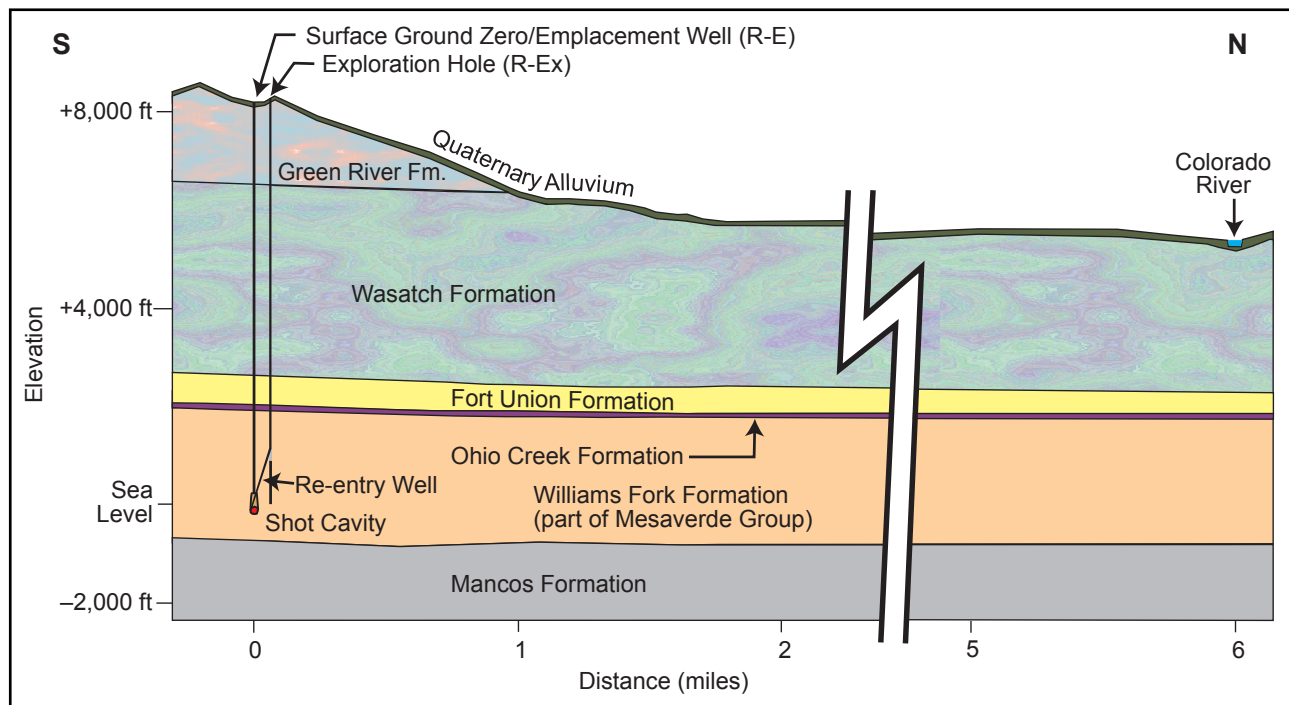
The detonation produced extremely high temperatures that vaporized a volume of rock, creating a somewhat spherical cavity with an estimated radius of 76 feet. The fractured rock surrounding the cavity extends outward an estimated 209 feet from the detonation point. The fractured rock above the roof of the cavity collapsed shortly after the detonation, forming a rubble-filled chimney that extends an estimated 274 feet above the detonation point. As the cavity cooled, the melted and vaporized rock collected and solidified at the bottom of the cavity. 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 the



Location of the Rulison, Colorado, Site

success of the detonation at improving gas production. The well produced 455 million cubic feet of natural gas in 107 days of testing that took place in four separate production tests from October 1970 through April 1971. The produced gas was flared to the atmosphere, and samples of the produced gas and water were analyzed to determine the degree to which radioactivity levels changed as testing progressed. All releases during drilling and testing were monitored by the U.S. Environmental Protection Agency National Environmental Respiratory Center and the Colorado Department of Public Health and Environment (CDPHE) to



Cross Section of the Rulison, Colorado, Site

protect workers at the site, the public, and the environment. The concentrations of radionuclides dropped throughout the production testing, but the remaining presence of radionuclides within the produced gas made it unmarketable. The re-entry well was shut in after the final test in 1971 and remained shut in 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 offsite location. Drilling fluid in the effluent pond was removed and the 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 effluent pond and areas near the re-entry well, collected in 1994 and 1995, contained organic drilling additives in the form of petroleum hydrocarbons. The corrective action consisted of draining the pond and removing sediments that contained the compound in concentrations exceeding the State of Colorado's regulatory limit. 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 and from soils in the re-entry well area.

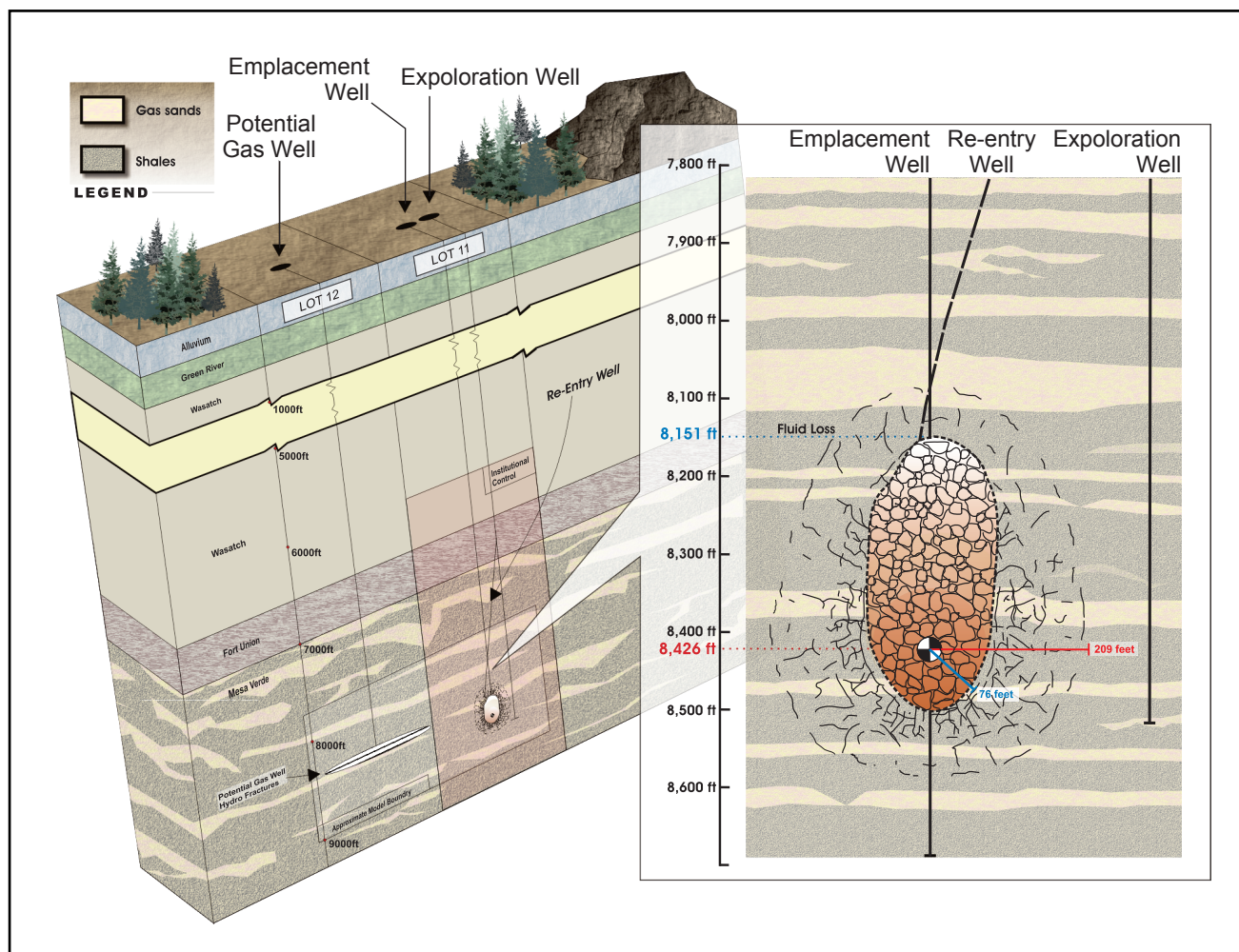
After eight consecutive quarters of sampling in 1996 and 1997, no migration of petroleum hydrocarbons above risk-

based trigger levels, was detected. The monitoring wells were decommissioned according to Colorado well abandonment regulations. In 1998, DOE provided Colorado regulators with the *Rulison Site Surface Closure Report* and recommended closure of the site surface with no further action. CDPHE agreed and approved the closure activities.

Subsurface Conditions

The detonation occurred 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 in alluvium and terrace materials that are 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 incorporated within the solidified melt rock that formed at the base of the cavity shortly after detonation, greatly reducing their mobility. Some radionuclides that were in the gas phase were removed during production testing of the natural gas. The primary contaminant of concern remaining in the deep subsurface is tritium, a radioisotope of hydrogen that can be present in liquid water and water vapor (substituting for normal hydrogen). Tritium has a half-life of 12.3 years and decays to nonradioactive helium. The DOE Office of Legacy Management (LM) monitors gas and water vapor from nearby gas production wells for tritium and other contaminants as a precaution. To date, no test-related radionuclides have been detected.



Rulison Post-Detonation Cross Section

Long-Term Hydrologic Monitoring Program

EPA monitored groundwater annually at and near the Rulison site from 1972 until 2008 as part of its Long-Term Hydrologic Monitoring Program. No radioactive contamination associated with the Rulison test has been detected in any samples taken from the nearby municipal drinking water supply springs, the water supply wells on five local ranches, or the spring and three wells on the test site. In 2008, LM assumed responsibility for the monitoring program at the Rulison site.

Land Use

The Rulison site is located on private land in Lot 11, NE $\frac{1}{4}$, SW $\frac{1}{4}$, Section 25, Township 7 South, Range 95 West, 6th Principal Meridian. The area near the site is sparsely populated; a few scattered residences and ranches are located west, north, and northeast of the site, and at least one residence is located inside Lot 11. The area also sustains some farming and ranching. Battlement Mesa is directly south of the site. Much of the topography southwest, south, and southeast of the site consists of 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 entrained with sand into the gas reservoirs at high pressure, creating fractures that extend outward from the wellbore—have raised concerns that fractures might eventually extend into radioactive contamination from the detonation and bring contaminants to the surface through produced gas and water from the wells.

LM has been working with the natural gas industry, state regulators, and stakeholders to develop a Long-Term Monitoring Plan for gas wells drilled near the Rulison site. LM is committed to long-term monitoring of wells for potential contaminants and the protection of human health and the environment.

Institutional Controls

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

The federal government prohibits drilling and removal of any material below 6,000 feet within the 40-acre boundary of Lot 11. A monument at Surface Ground Zero contains a plaque that documents the historical significance of the site.

and states that excavation, drilling, and removal of subsurface materials below a depth of 6,000 feet is prohibited without permission of the U.S. government.

The Colorado Oil and Gas Conservation Commission (COGCC) 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, COGCC notifies DOE. DOE reviews the application and provides comments. COGCC also established a half-mile boundary around Surface Ground Zero. An application for a permit to drill within 0.5 mile requires a hearing before the commission.

Regulatory Setting

The federal government holds title to, and DOE is responsible for, radioactive and other hazardous materials generated at the Rulison site. The federal government retains control of the subsurface rights beginning at a depth of 6,000 feet within the 40-acre boundary of Lot 11. LM has responsibility for long-term management of the Rulison site. Regulatory oversight for the site involves collaboration with COGCC and CDPHE.

Legacy Management Activities

LM manages the Rulison site to ensure conditions at the site continue to be protective of human health and the environment. LM conducts annual site inspections and long-term monitoring of surface water, groundwater, and natural gas.

Contacts

Documents related to the Rulison site are available on the LM website at <http://www.lm.doe.gov/rulison/Sites.aspx>.

For more information about LM activities at the Rulison site, contact:

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