U.S. DEPARTMENT OF ENERGY | Legacy Management

Rulison, Colorado, Site

FACT SHEET

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 located 8,154 feet above sea level on the north flank of Battlement Mesa in western Colorado, about 12 miles southwest of the town of Rifle and 8 miles southeast of the town of Parachute.

On September 10, 1969, the U.S. Atomic Energy Commission (AEC), a predecessor agency of the U.S. Department of Energy (DOE), detonated a 43-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. 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 objective of the Project Rulison detonation was to stimulate flow of natural gas through fractures created by the blast and use the chimney as a collection chamber. The detonation created a roughly spherical cavity estimated to be 152 feet in diameter and containing melted and vaporized rock. The blast also fractured the surrounding rock to an estimated radius of 263 feet from the detonation point. As the cavity cooled, the melted and vaporized rock collected in a puddle at the bottom. Most of the radionuclides were trapped in this puddle as it cooled and formed into a glassy solid. Shortly after the detonation, gravity caused the roof of the cavity to collapse into the cavity chamber. This progressively upward collapsing of fractured rock into the cavity chamber formed a chimney of broken rock to an estimated height of about 274 feet above the point of detonation.

Following the detonation, a reentry well was drilled into the top of the chimney to collect data on gas production by burning or “flaring” the natural gas. Four gas-flaring events were conducted as part of the production testing and data evaluation that took place between October 1970 and April 1971. The first flaring event lasted three days. The U.S. Public Health Service used this test to calibrate its network of off-site equipment to monitor potential health effects of the production testing. Following the initial production test, three intermittent gas-flaring tests followed. These tests showed that production of natural gas stimulated by the detonation was less than anticipated. Although approximately 455 million cubic feet of natural gas was produced, elevated levels of radioactivity in the gas made it unacceptable for use at that time.

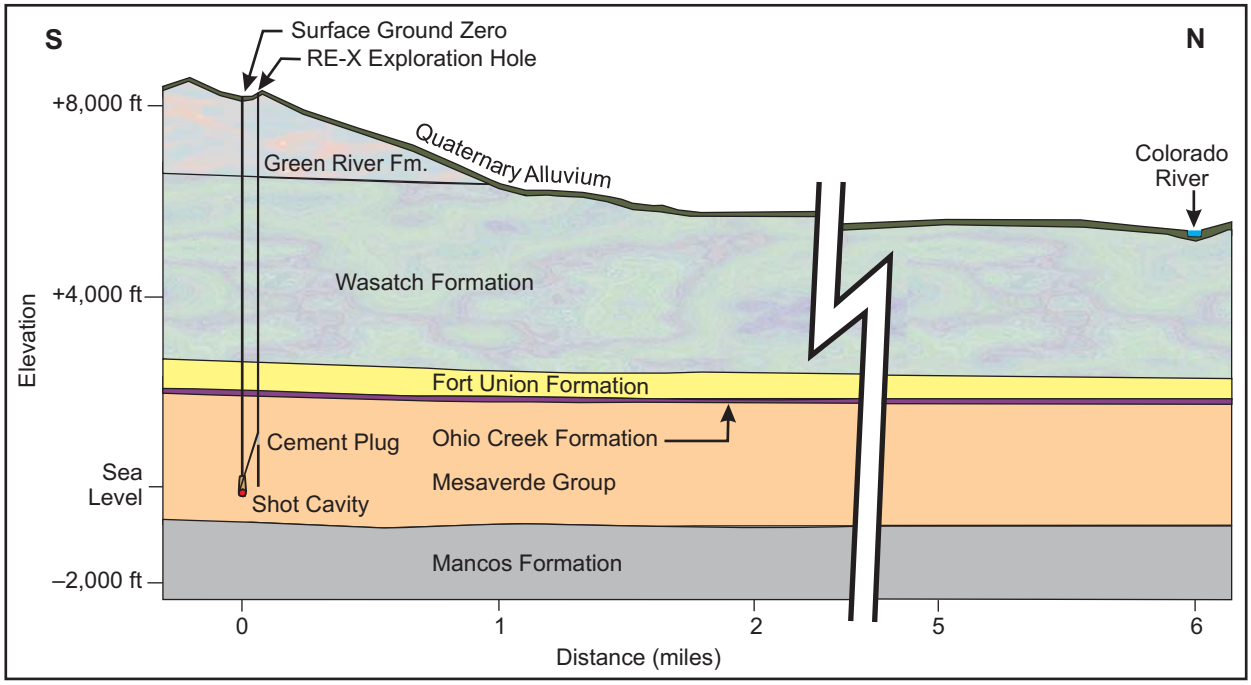
Location of the Rulison, Colorado, Site

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 a 40-acre area surrounding the device emplacement well, known as surface ground zero. DOE's Office of Legacy Management has responsibility for long-term management of the Rulison Site. Regulatory oversight for the site involves collaboration with the Colorado Department of Public Health and Environment (CDPHE) and the Colorado Oil and Gas Conservation Commission (COGCC).

Surface Cleanup at the Rulison Site

In July 1972, equipment that was no longer needed at the site was decontaminated and removed from the site. Following the decontamination and removal of



Cross Section of the Rulison, Colorado, Site

equipment, the site was left in standby condition until 1976, when the remaining equipment and surface facilities were dismantled, inspected, surveyed for radiation, decontaminated if necessary, and removed to an off-site location.

Power poles and power lines were left at the site at the landowner's request. Drilling fluid in the effluent pond was removed, and the impoundment structure was left at the request of the landowner.

Sediment and soil samples collected from the former effluent pond and areas near the reentry well contained organic drilling additives in the form of petroleum hydrocarbons. The corrective action consisted of draining the pond and removing sediments that contained petroleum hydrocarbons in concentrations exceeding the state regulatory limit. A pond liner was installed before the pond 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 reentry well area. After eight consecutive quarters of sampling, 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 the Colorado regulators with a Surface Closure Report and recommended closure of the Rulison Site surface with no further action. CDPHE agreed and approved the closure activities.

Subsurface Conditions

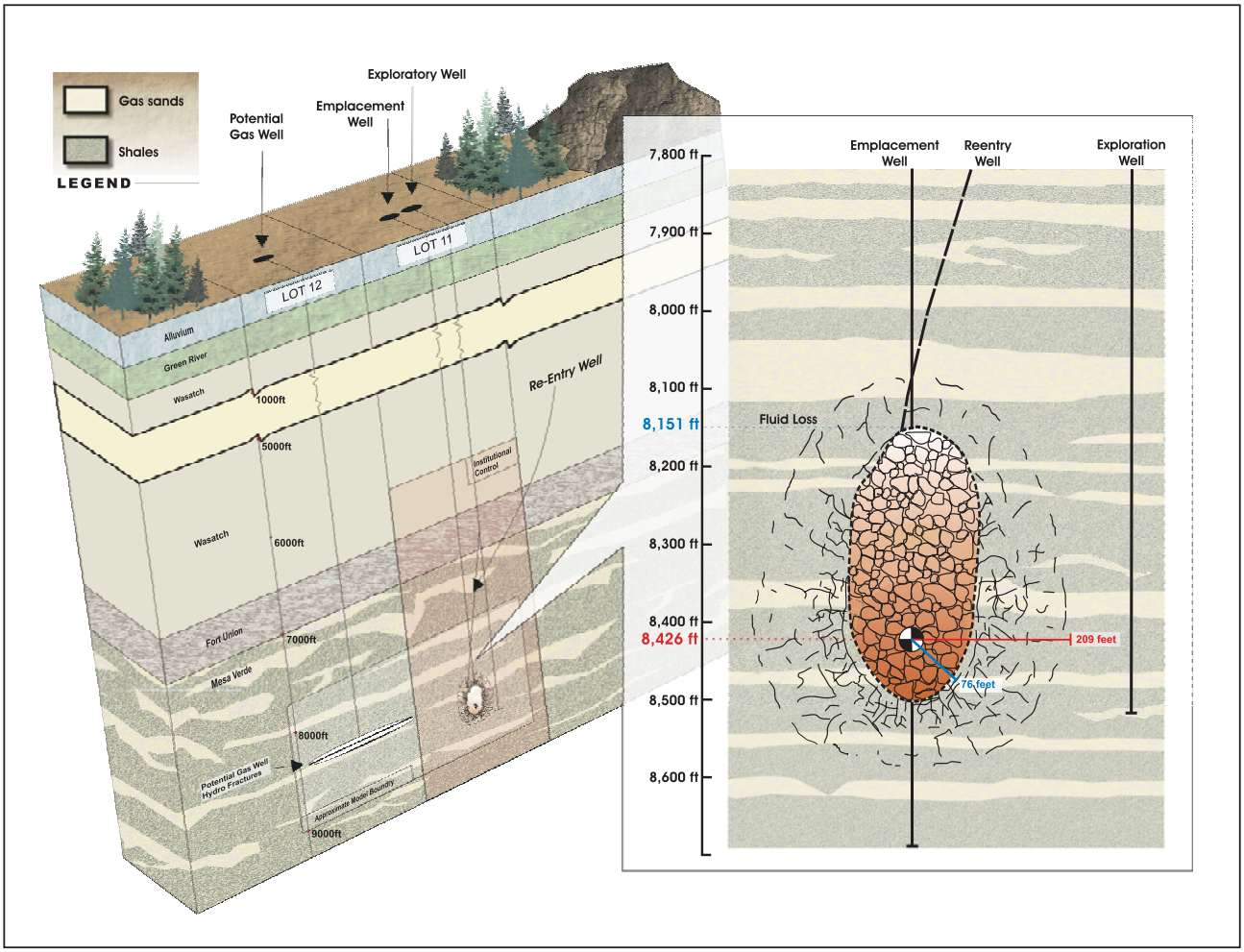
DOE does not plan to remove the radioactive contamination in or around the test cavity in the deep subsurface because no feasible technology currently exists. The detonation occurred in low-permeability natural-gas-bearing sedimentary rock that extends several thousand feet above and below the test cavity. Aquifers used for drinking water and irrigation in the surrounding area are in alluvium and terrace materials that are 6,000 to 9,000 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, if any, water.

The nuclear test created a wide variety of radionuclides. Most of these were incased in the glass melt puddle that formed at the base of the cavity shortly after detonation, greatly reducing their mobility. Some radionuclides that were in the gas phase or in water vapor were removed during production testing of the natural gas. The primary contaminant of concern remaining in the deep subsurface is tritium, a mobile radioisotope of hydrogen. Tritium has a half-life of 12.3 years and decays to nonradioactive helium. DOE 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.

Long-Term Hydrologic Monitoring Program

Since 1972, the U.S. Environmental Protection Agency has monitored groundwater annually at and near the Rulison Site as part of a 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.

DOE has been working with the natural gas industry, State regulators, and stakeholders in the development of a long-term monitoring plan for gas wells drilled near the Rulison Site. DOE is committed to long-term monitoring of wells for potential contaminates and to protect human health and the environment.



Rulison Post-Detonation Cross Section

Institutional Controls

The federal government prohibits drilling and extracting below 6,000 feet within a 40-acre zone surrounding surface ground zero. DOE is conducting subsurface modeling studies to assess the adequacy of this exclusion boundary. The modeling simulates subsurface conditions of the test cavity, applies hypothetical gas production stresses to the formation (such as fracturing the rock at target depths to release natural gas), and defines a probable contaminant boundary. Subsurface use restrictions within the Rulison Site boundary will remain in place in perpetuity. A permanent monument at surface ground zero bears a plaque with an inscription denoting 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.

COGCC established two wider boundaries around the site. When a company applies for a permit to drill within a three-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 one-half mile requires a full hearing before the commission.

Legacy Management Activities

The DOE Office of Legacy Management manages the Rulison Site to ensure that conditions at the site continue to be protective of human health and the environment. DOE will conduct annual site inspections to verify that no drilling has taken place within the exclusion boundary and will conduct long-term monitoring of surface water, groundwater, and natural gas.

Contacts

Documents related to the Rulison Site are available on the DOE Office of Legacy Management website at http://www.LM.doe.gov/land/sites/co/rulison/rulison.htm.

For more information about DOE Office of Legacy Management activities at the Rulison Site, contact

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