



## Nevada Offsites

### Shoal, Nevada, Site

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

#### Site Description and History

The Shoal site is situated on 2,560 acres of withdrawn federal lands within the north-central portion of the Sand Springs Range in Churchill County, Nevada. The town of Fallon is the largest populated area in the region and is about 30 miles northwest of the site. The region around the Shoal site is sparsely populated; military installations, recreation, ranching, and mining provide the dominant commercial interests.

The Project Shoal underground nuclear test was part of the Vela Uniform program sponsored jointly by the U.S. Department of Defense and U.S. Atomic Energy Commission (AEC), a predecessor agency of the U.S. Department of Energy (DOE). Vela Uniform was a research and development program directed toward locating, detecting, and identifying underground detonations. The objective of Project Shoal was to detonate a nuclear device underground, in an active seismic area, to improve the United States' ability to detect, identify, and locate underground nuclear detonations.

Performed on October 26, 1963, the Project Shoal test consisted of detonating a 12-kiloton nuclear device in granitic rock at a depth of approximately 1,211 feet below ground surface. The device was put into place via a shaft located approximately 1,000 feet west of Surface Ground Zero. The shaft was mined to a depth of approximately 1,315 feet below ground surface. At that depth, a drift (a nearly horizontal tunnel) was mined approximately 300 feet west and 1,050 feet east, ending in a 30-foot vertical "buttonhook" where the nuclear device was emplaced. Re-entry drilling directly over the blast cavity indicated that the Shoal device detonated as predicted, and a rubble chimney about 171 feet in diameter and 356 feet high formed above the explosion shot point. No radiation escaped to the



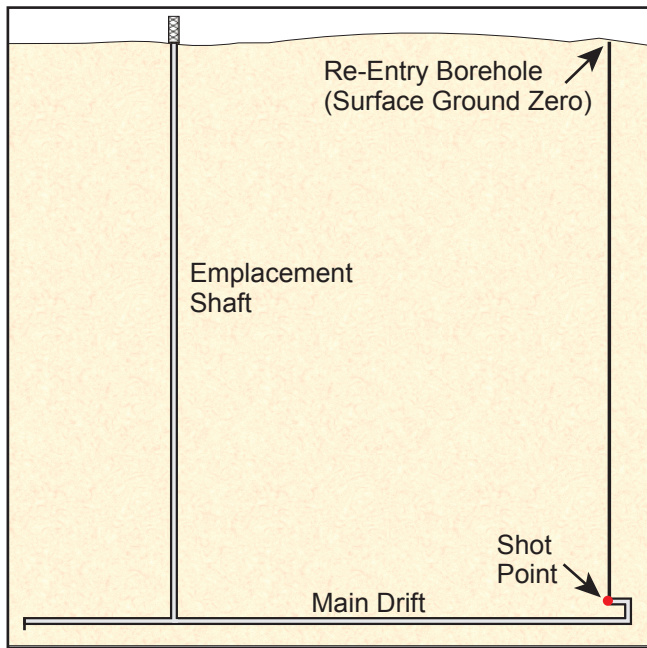
*Location of the Shoal, Nevada, Site*

surface during the underground nuclear test, and no further underground nuclear testing was conducted at the site.

Groundwater is present beneath the site at depths of approximately 965 to 1,375 feet below ground surface. Groundwater moves primarily through fractures in the granite and it is recharged by infiltration of precipitation in the Sand Springs Range; regional discharge occurs in the valleys.

#### Surface Conditions

Surface contamination at the Shoal site resulted from pretest activities and posttest re-entry drilling. Contamination at the



*Subsurface Layout of the Shoal Site  
Underground Nuclear Test*

surface was identified as Corrective Action Unit (CAU) 416 and was comprised of three corrective action sites; a mud pit, a muckpile, and housekeeping area. The mud pit consisted of drilling mud that was contaminated with total petroleum hydrocarbons in excess of the state action level. Remediation of this location included excavating and transporting the hydrocarbon-contaminated material to the Nevada National Security Site (then known as the Nevada Test Site). The muckpile consisted of broken granite removed while the emplacement shaft and drifts were being mined in 1963. In 1996, a portion of muckpile material was used to backfill the emplacement shaft. Analytical results obtained from the remaining muckpile indicated that no contaminants of concern were detected above regulatory limits, so the pile was left "as is" at the site because it posed the least environmental impact. The housekeeping area consisted of approximately 20 rusted and empty 1-quart oil cans. Remediation activities included removal, disposal, and preparation of Housekeeping Closure Verification documentation. Surface restoration was completed in 1998 and remediation activities were

summarized in the *Closure Report for CAU No. 416, Project Shoal Area*. The Nevada Division of Environmental Protection (NDEP) approved the closure report on February 13, 1998, stating that no post-closure monitoring is required and no land-use restrictions apply at CAU 416.

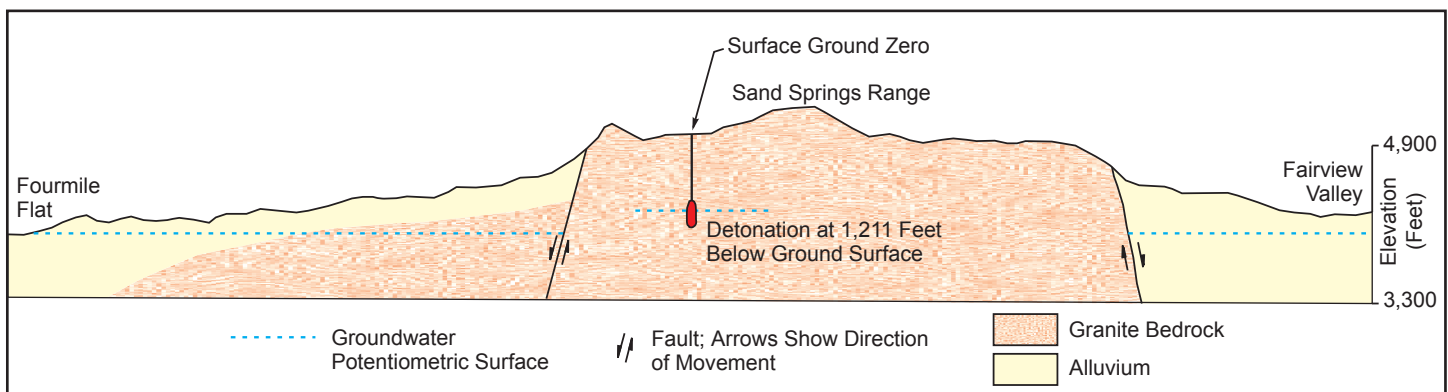
## Subsurface Conditions

Subsurface contamination at the Shoal site resulted from the underground nuclear test and is identified as CAU 447. This CAU consists of the test cavity and the emplacement shaft. The original corrective action strategy for the subsurface used a groundwater flow and transport model to help evaluate data and select a corrective action alternative. Model results were used to determine a contaminant boundary, or restricted region, surrounding the nuclear detonation. The contaminant boundary is a probabilistic, model-forecasted perimeter that represents the maximum extent that groundwater contaminated with test-related radionuclides exceeding Safe Drinking Water Act standards is estimated to travel in 1,000 years. Through agreement with NDEP, the contaminant boundary serves as the Shoal site compliance boundary.

Originally, the corrective action strategy for CAU 447 required installation of three wells for the dual purpose of monitoring and validation of the groundwater flow and transport model. Monitoring data and modeling results were compared as part of the validation process. Based on the evaluation, it was concluded that the model did not accurately predict water levels or a prevailing lateral flow direction. This indicated that the model could not be validated. As a result, a new corrective action strategy is being developed for the site and will be negotiated with NDEP.

## Long-Term Hydrologic Monitoring Program

The U.S. Environmental Protection Agency monitored groundwater quality at and near the site annually from 1972 until 2008 as part of its Long-Term Hydrologic Monitoring Program. Samples were historically collected from 11 onsite monitoring wells and six offsite sample locations (three wells, two windmills, and one spring). Since the program's inception, results obtained using conventional analytical methods have detected no radionuclides related to the underground nuclear



*Schematic Geologic Cross Section of the Shoal Site Area*



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test in any of the samples collected from the offsite locations. In support of these data, DOE has developed a more refined monitoring network for the site that focuses on monitoring the onsite wells. The onsite wells are sampled annually and results are provided to the NDEP in an annual groundwater monitoring report for the site.

## Land Use

The Shoal site was withdrawn from the Bureau of Land Management (BLM) in September 1962 for all forms of appropriation—including mining and mineral exploration—and was reserved to the AEC for the Project Shoal experiment. In Title XXX of the National Defense Authorization Act of 2000, the surface of the Shoal site, along with the surrounding area, was reserved to the U.S. Navy for tactical maneuvering and air support testing and training. Under this same act, DOE retained responsibility and liability for subsurface interests.

The region around the Shoal site is sparsely populated; military installations, recreation, ranching, and mining are the dominant activities in the region. No residences or habitable structures are on the site.

## Institutional Controls

No institutional controls are required for the surface of the Shoal site.

A monument near a borehole that is directly over the test cavity (now known as Surface Ground Zero) gives notice of restrictions associated with the subsurface of the Shoal site. The monument defines restrictions for excavation, drilling, and removal of material between elevations of 5,050 feet and 3,530 feet above mean sea level, and extending to a horizontal distance of 3,300 feet in any direction from Surface Ground Zero. The Navy land withdrawal in 1999 included restrictions to prevent drilling on the property, a notification requirement for drilling on adjacent BLM property, and restricted-access postings to discourage incidental intrusion. The subsurface will require long-term surveillance and monitoring because of radiological contamination in the test cavity.

## Regulatory Setting

Environmental restoration at the site is regulated by Federal Facility Agreement and Consent Order (FFACO 1996, as amended) requirements. FFACO is a three-party compliance agreement for sites within Nevada, between DOE, the State of Nevada, and the U.S. Department of Defense. NDEP has regulatory oversight of cleanup operations. Through FFACO, the DOE Office of Environmental Management was responsible for cleanup of the site and maintaining it in a manner that is protective of human health and the environment.

## Legacy Management Activities

On October 1, 2006, the DOE Office of Legacy Management (LM) assumed responsibility for (1) completing groundwater monitoring and modeling, (2) developing and implementing a Long-Term Surveillance and Maintenance Plan for the site, (3) accepting the transfer of records and real property, (4) managing site records, (5) implementing and managing existing agreements and programs with regulatory agencies, (6) determining future access controls and administering the DOE land withdrawals, and (7) responding to stakeholder inquiries.

## Contacts

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

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

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Office of Legacy Management  
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(877) 695-5322 (toll-free)