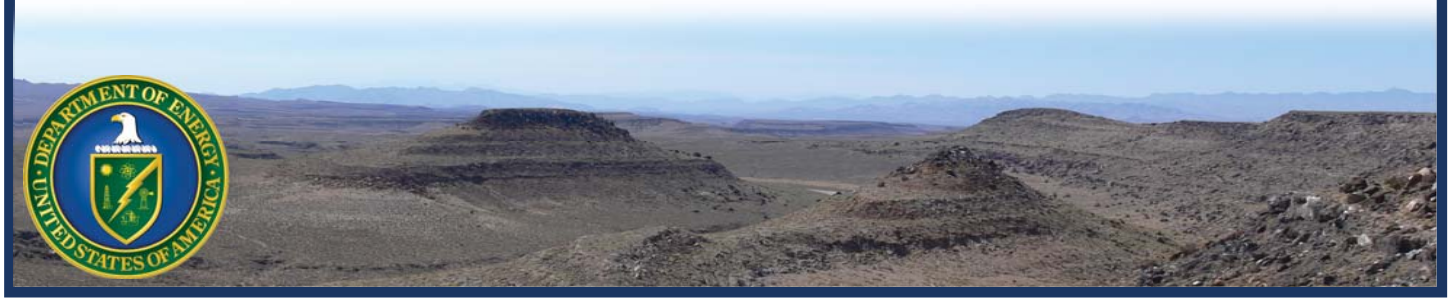
NEVADA NATIONAL
NNSS
SECURITY SITE

Nevada Field Office

Groundwater

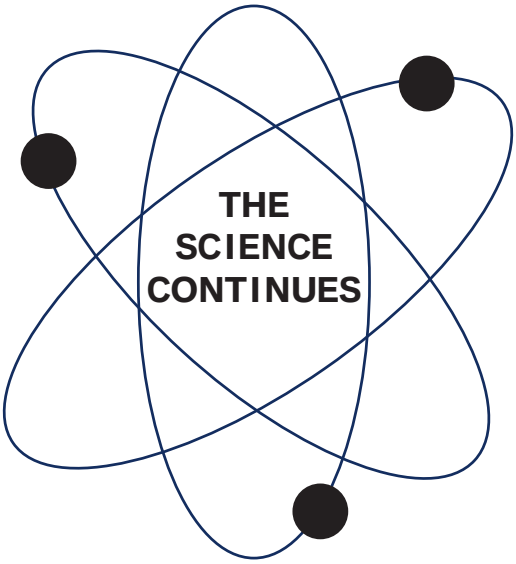
Questions & Answers



Groundwater at the Nevada National Security Site: What's Important to Know?

***Your Groundwater is Safe**: Public water supply is safe from the impacts of historic underground nuclear testing. Current research shows contaminated groundwater will not reach public water supplies.*

***The Science Continues**: As part of a long-term monitoring program, ongoing scientific studies will continue into the future to identify where contaminated groundwater is located, in which direction it flows and its rate of movement.*



***A Major Success**: After decades of analysis, the Department of Energy, along with numerous scientists across the nation, have determined that there is no risk to the public from contaminated groundwater in Frenchman Flat.*

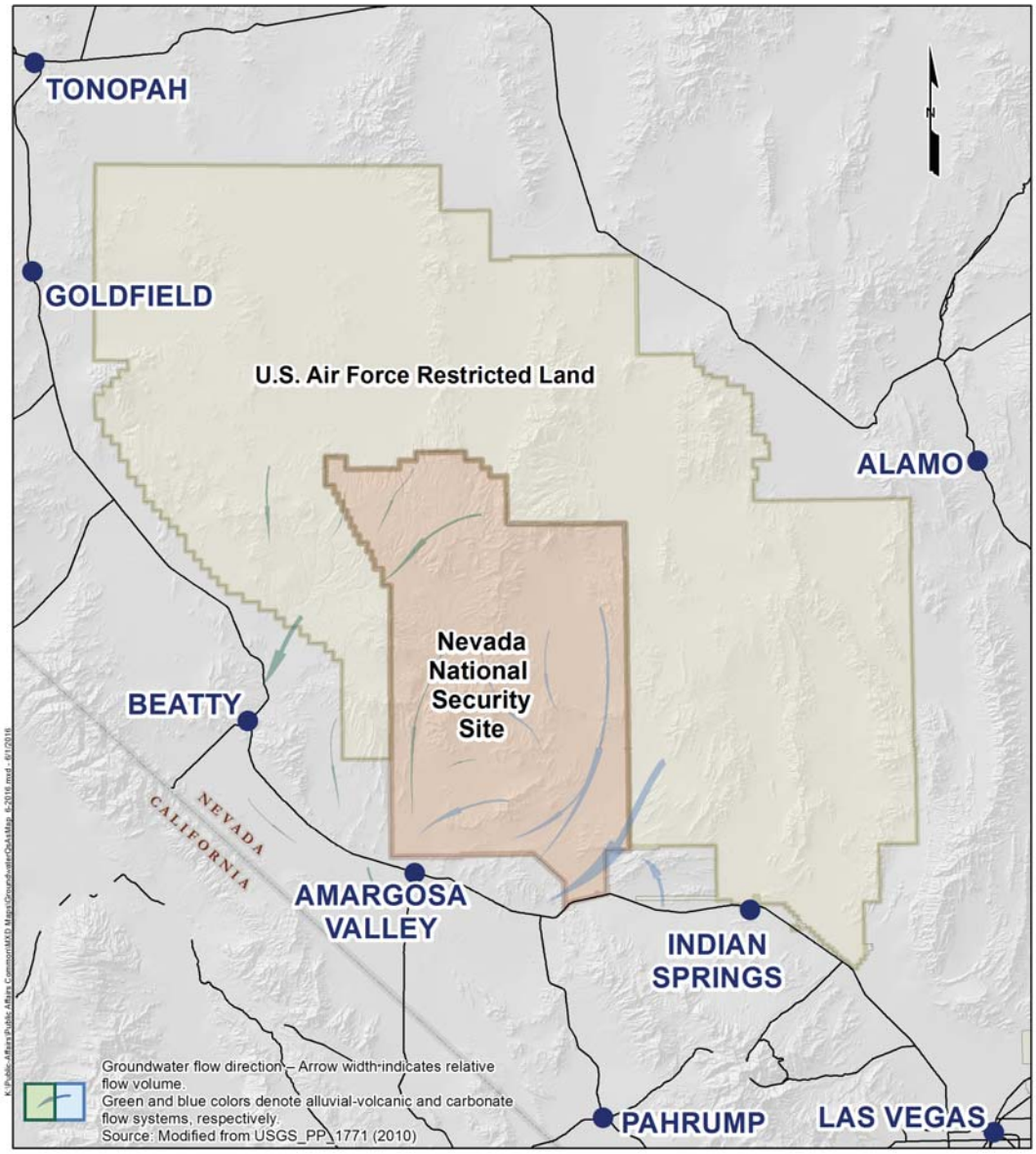
For more than 60 years, the Department of Energy has been studying groundwater at the Nevada National Security Site in order to understand the effects of historic underground nuclear testing. Today, the Department of Energy, National Nuclear Security Administration Nevada Field Office employs a comprehensive strategy focused on drilling wells and sampling, data interpretation, computer modeling, routine monitoring, and restricted access. The goal is to establish an effective, long-term monitoring network based upon collected data.

Current research shows the public water supply is safe from the impacts of historic underground nuclear testing.

Important Facts:

- 828 underground nuclear tests conducted at the NNSS from 1951 to 1992
- About one-third of tests occurred near, below, or within the water table
- Much of the contaminants are trapped in the test cavity
- Some contaminants were released into the groundwater
- Risks associated with contamination remain low due to slow groundwater movement, the immobility of some contaminants, and radioactive decay

The Nevada Field Office makes it a priority to keep the public informed about groundwater characterization activities. For the most up-to-date information, photos, and videos, visit nnss.gov/pages/programs/em/GroundwaterCharacterization.html.



How will the government protect the public from contaminated groundwater?

The most current scientific data available shows there is no risk to the public from groundwater contaminated by historical underground nuclear testing. For this reason, and since there is no proven, cost-effective technology to remove or stabilize the radiological contaminants, the strategy agreed to with the State of Nevada is to identify contaminant boundaries, restrict access to contaminated groundwater and implement a long-term monitoring program.

Are there any legal requirements in place that protect the public's interest?

Yes. The Federal Facility Agreement and Consent Order, an enforceable agreement between the U.S. Department of Energy and the State of Nevada Division of Environmental Protection, inherently addresses all applicable national environmental compliance laws and regulations that cover legacy contamination. In addition to this agreement, the Safe Drinking Water Act sets standards for public water systems that protect the public's interests.

How will you know if Nevada National Security Site contaminated groundwater is nearing a public water source?

There are more than 100 wells available for sampling on and off the Nevada National Security Site. Both groundwater and surface water sources are routinely sampled for a variety of contaminants. This network of monitoring wells will provide early detection of any contaminant movement. If contaminants are found in amounts that exceed Safe Drinking Water Act limits, the Nevada Field Office will immediately coordinate with the State of Nevada Division of Environmental Protection and implement protective actions to ensure public safety. In addition, computer models will be updated with the new information and corresponding changes, such as sampling frequency, will be made.

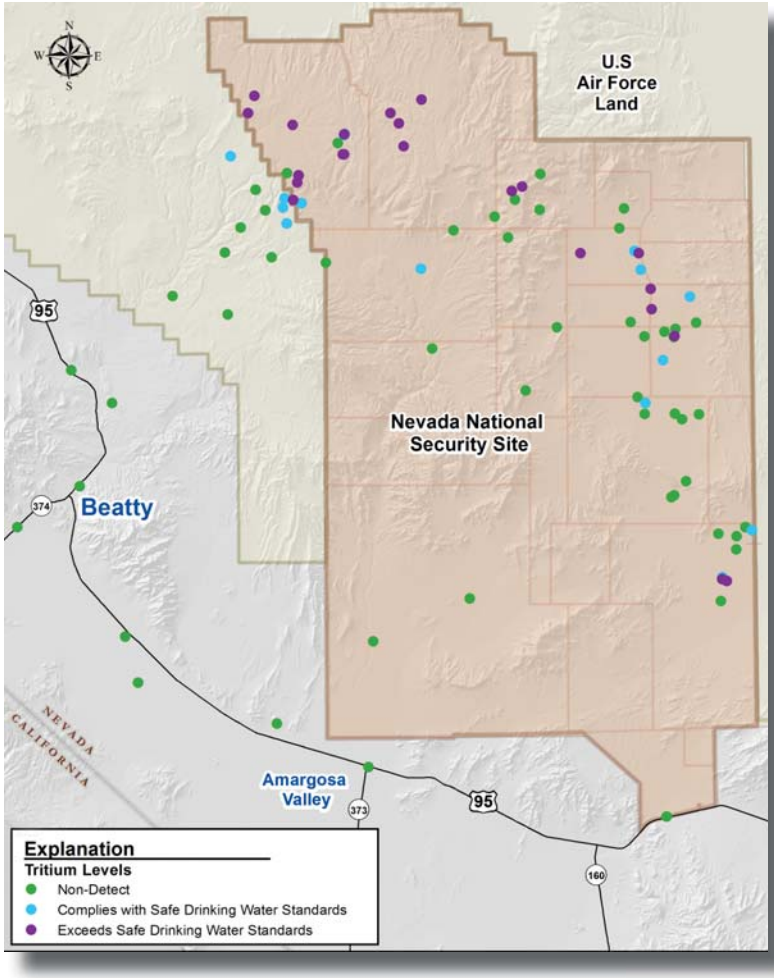
Did You Know?

Water sample results are available in the annual Nevada National Security Site Environmental Report at nnss.gov/pages/resources/library/NNSSER.html

Q Has contamination from historic underground nuclear tests been found in groundwater beyond the Nevada National Security Site boundary?

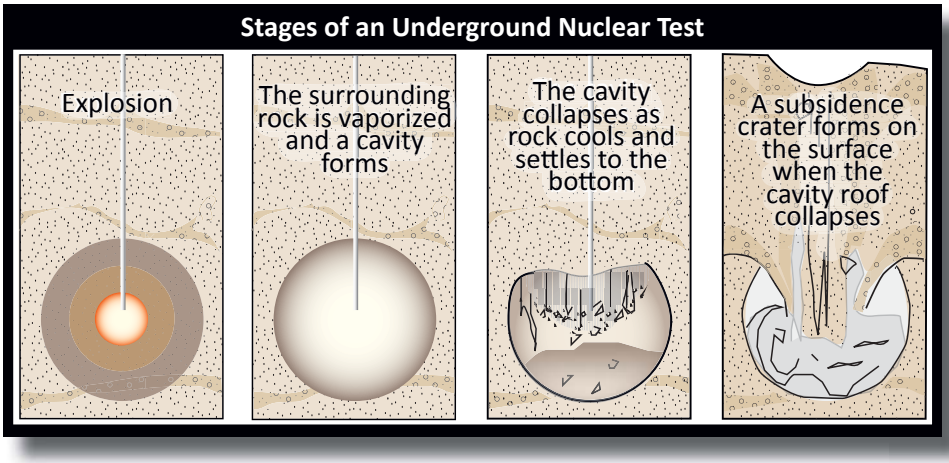
A Yes. As forecasted by computer models, detectable levels of tritium were found in wells located on the restricted U.S. Air Force land adjacent to the NNSS in October 2009. All tritium levels detected were in compliance with the U.S. Environmental Protection Agency Safe Drinking Water Act standard. Contamination from historic underground nuclear testing has not been found in any wells beyond the U.S. Air Force land surrounding the Nevada National Security Site, and contaminated groundwater at levels that exceed Safe Drinking Water Act standards is not expected to reach publicly accessible areas.

Contamination from historic underground nuclear testing has not been found in any wells beyond the U.S. Air Force land surrounding the Nevada National Security Site.



Q What radionuclides were released into groundwater during underground testing?

A Tritium (a radioactive form of hydrogen) is the most common radionuclide found in groundwater at the NNSS, and is the primary contaminant of study. This is because it is mobile in groundwater and an indicator that other contaminants may be present. Other contaminants released into groundwater include radioisotopes of carbon, iodine, chlorine, technetium, plutonium, cesium and strontium.



Did You Know? Much of the radionuclides released during underground nuclear testing are trapped in the melt glass of the nuclear test cavity and surrounding rock.

In what direction does Nevada National Security Site groundwater flow?

Analyses of data collected for more than 60 years indicate the groundwater in the eastern portion of the Nevada National Security Site eventually discharges to the Ash Meadows/ Devils Hole or Death Valley areas. The groundwater in the northwestern portion of the Nevada National Security Site locally discharges to springs in Oasis Valley.

How fast is the groundwater moving?

Estimated velocities (speed) range from a few feet per year up to 300 feet per year. Velocity of groundwater flow varies based on the geology, hydraulic properties (i.e., ability of water to flow through rock), and elevation of the water table.

Is the radioactive contamination moving in groundwater?

Yes. Some radionuclides, mostly tritium, move with the groundwater. The migration of radionuclides depends on the characteristics of each radionuclide and its surrounding environment. Much of the radionuclides are trapped in the melt glass of the nuclear test cavity and surrounding rock. Tritium decays rapidly and is not expected to be present when groundwater reaches publicly accessible wells.

Does contaminated groundwater at the Nevada National Security Site pose a health risk to the public?

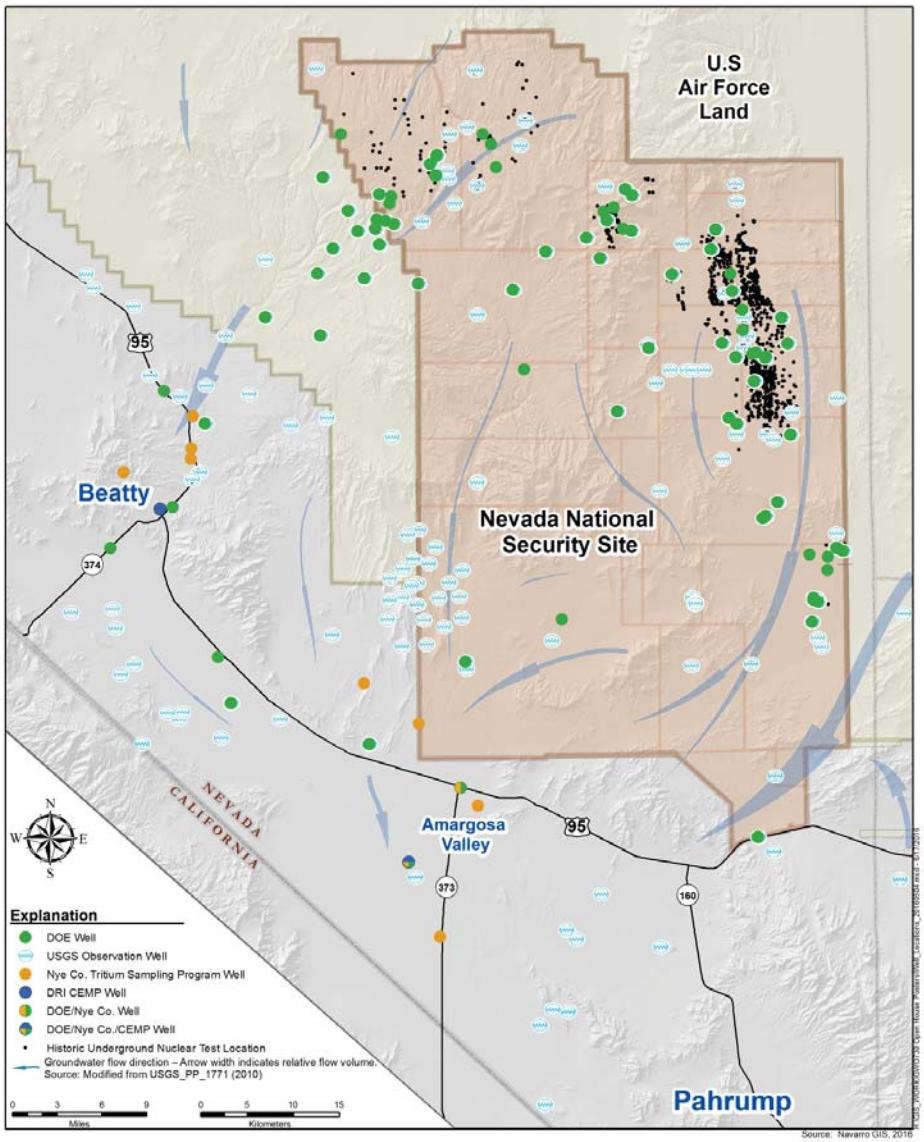
No. Contaminated groundwater at levels that exceed Safe Drinking Water Act standards is not expected to reach publicly-accessible areas. In fact, water drawn from permitted wells located on the Nevada National Security Site meets Safe Drinking Water standards.

Did You Know?

A radionuclide is a radioactive atom that can be produced through nuclear experiments, medical testing, or natural means. A picocurie is a general unit of measurement for levels of radioactivity and is most often associated with radioactivity in water. The word contaminant refers to any substance found at a particular location where it is not naturally occurring.

How is groundwater sampled?

Groundwater is sampled to measure groundwater chemistry, fluid levels, and temperature. Well samples are sent to Nevada-certified, independent laboratories for analysis. The Department of Energy Integrated Groundwater Sampling Plan provides a comprehensive approach for collecting and analyzing groundwater samples.



Did You Know?

Tritium is the most common radionuclide found in groundwater at the Nevada National Security Site. While mobile in groundwater, its half-life is only 12.3 years.

Q What would happen if groundwater contamination is found in a publicly-accessible well beyond the boundaries of the Nevada National Security Site and surrounding Air Force land?

A If groundwater contaminants from Nevada National Security Site activities were verified at a publicly-accessible water source and the levels exceeded Safe Drinking Water Act standards, the Nevada Field Office would work with the State of Nevada to monitor, shut down, and/or pursue an alternate water supply, as appropriate to meet the requirements of the Safe Drinking Water Act.

Construction costs for each well, which can include excavation, equipment, and various infrastructure needs, are between $4 million to $6 million.

Q How are well sites chosen?

A The Nevada Field Office typically installs groundwater characterization wells at locations where additional sampling data would most benefit the computer model. The 2015 - 2016 drilling campaign installed one well on Pahute Mesa and three in Yucca Flat. The new data gathered will provide input into the models to give scientists a clearer understanding of how groundwater moves through the subsurface.

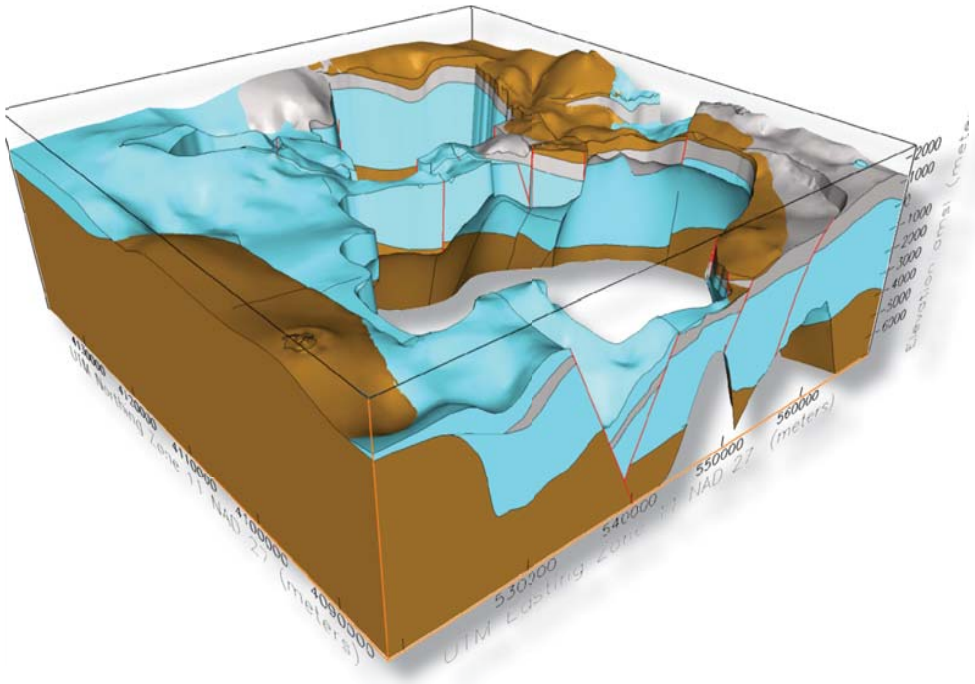
Stakeholder input has also played a role in the well selection process. The Nevada Site Specific Advisory Board, a group of volunteers from communities near the Nevada National Security Site, was instrumental in selecting the location of a well drilled on Pahute Mesa in 2009.

Q What are computer models and how do they help protect the public?

A Computer models are programs that simulate groundwater flow and contaminant transport. They give scientists detailed glimpses into areas that are otherwise inaccessible. Computer models are especially useful to Nevada National Security Site scientists, as complex geology and vast size make its subsurface challenging to map. Information gathered from drilling, sampling, research, and analysis all become data points in the computer model. These models help scientists forecast where contaminants in groundwater may migrate and how fast they are travelling. These forecasts are continually refined as new data is gathered.

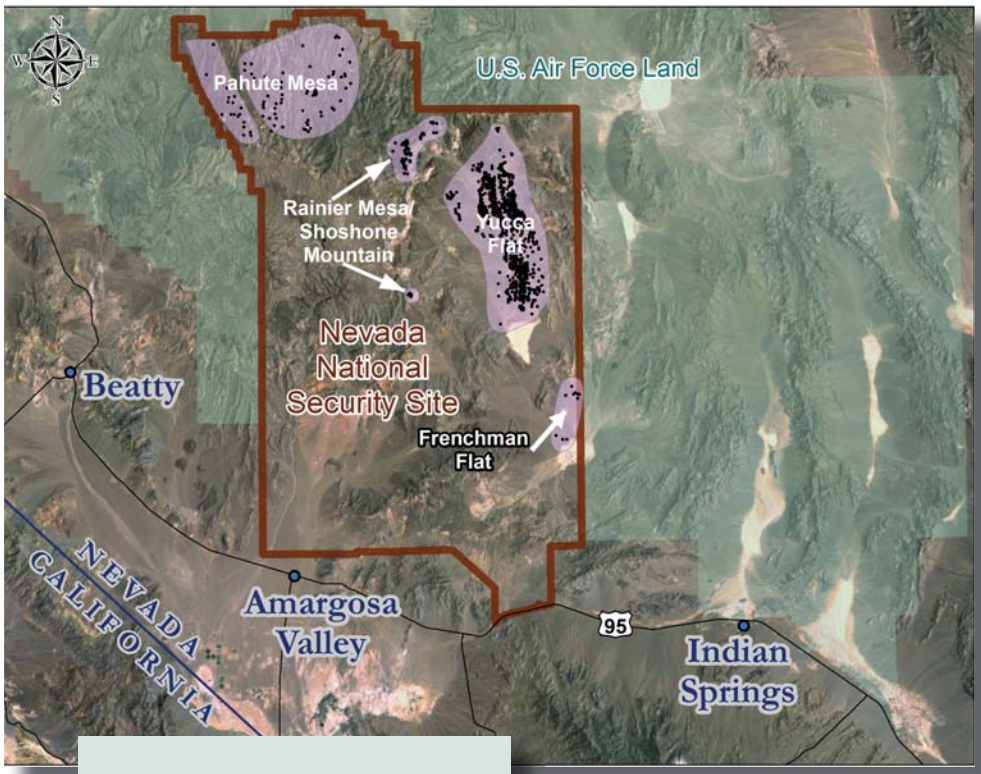
Q When do groundwater characterization studies transition to long-term monitoring?

A After an independent scientific panel successfully completes a review of Nevada National Security Site groundwater investigations, the Department of Energy conducts a thorough evaluation of the computer models. If sampling data is consistent with model results and accepted by the State of Nevada Division of Environmental Protection, groundwater characterization activities transition to long-term monitoring. During long-term monitoring, sampling results will be periodically reviewed by the Nevada Field Office and State of Nevada Division of Environmental Protection. The results will be compared to model predictions to ensure the nature of groundwater flow and extent of contaminant transport is within the range of expectations.



A computer model is a computer-generated, three-dimensional representation of how water and contaminants move through complex geology.

A Major Success at Frenchman Flat



Frenchman Flat is a groundwater investigation area at the Nevada National Security Site. In 2014, the Nevada Division of Environmental Protection approved transitioning to long-term monitoring. Long-term monitoring is the final stage of the strategy outlined in the Federal Facility Agreement and Consent Order for all groundwater investigation areas at the Site. After the transition, monitoring at Frenchman Flat will continue and monitoring results will be reported annually in a publicly-released report.

Frenchman Flat sets the stage for advancing other groundwater investigation areas.

Did You Know?

Ten underground nuclear tests were conducted at Frenchman Flat between 1965 and 1971.

Transitioning to long-term monitoring at Frenchman Flat involved...

- Refining the regulatory process.
- A peer review process of external and internal committees to provide confidence that the strategy is protective of the public and the environment.
- State-of-the-art methodologies developed and applied by a highly technical team of experts from numerous scientific organizations.

Transitioning Frenchman Flat provided an invaluable experience for understanding the necessary balance of modeling, monitoring, and restricted access that is protective of public health and the environment.

Key Findings:

Contaminated groundwater is not expected to leave the Frenchman Flat basin.

Modeling indicates that radionuclides in groundwater will travel less than 1 mile in 1,000 years.

Nevada National Security Site (NNSS) Groundwater Sampling and Reporting: Key Organizations and Resources

DOE Groundwater Programs

Nevada Field Office Groundwater Characterization Program
Evaluates the impact of historic nuclear tests on groundwater.
http://nnss.gov/pages/programs/em/GroundwaterCharacterization.html

NNSS Integrated Groundwater Sampling Plan
Comprehensive approach for collecting and analyzing groundwater samples.
www.osti.gov/scitech/servlets/purl/1159277

Compliance & Reporting

Federal Facility Agreement and Consent Order (FFACO)
An agreement with the State of Nevada that identifies/prioritizes sites of potential historic contamination and outlines a schedule of cleanup and monitoring commitments.
http://ndep.nv.gov/boff/ffaco13.htm

NNSS Environmental Report
An annual report containing sampling results of water, air, plants and animals on and around the Site.
http://nnss.gov/pages/resources/library/NNSSER.html

Independent Sampling and Monitoring

Nye County Tritium Sampling and Monitoring Program
Tritium groundwater monitoring program that includes selection and sampling of wells and participation in technical reviews of NNSS activities.

Community Environmental Monitoring Program (CEMP)
Community-based network of monitoring stations managed by the Desert Research Institute and staffed by communities.
http://cemp.dri.edu

Stakeholder Involvement

The Nevada Site Specific Advisory Board
Provides recommendations and serves as a link to the community. www.nnss.gov/NSSAB

Groundwater Open House
Hosted by the Nevada Field Office annually to keep the public informed of recent and upcoming groundwater characterization activities.
http://nnss.gov/pages/PublicAffairsOutreach/GroundwaterOpenHouse.html

For further information or questions relating to
groundwater at the Nevada National Security Site, contact:

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