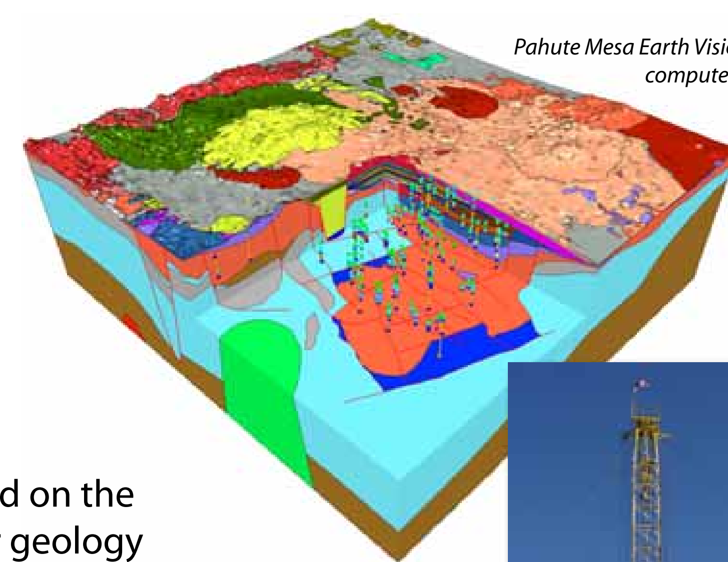
Nevada National Security Site
Underground Test Area (UGTA) Overview

828 underground nuclear tests were conducted on the Nevada National Security Site from 1951 to 1992. Some of the tests occurred near or below the water table, resulting in groundwater contamination.

The UGTA team is responsible for evaluating the impact of historic nuclear tests on groundwater resources and studying the extent of contaminant migration.

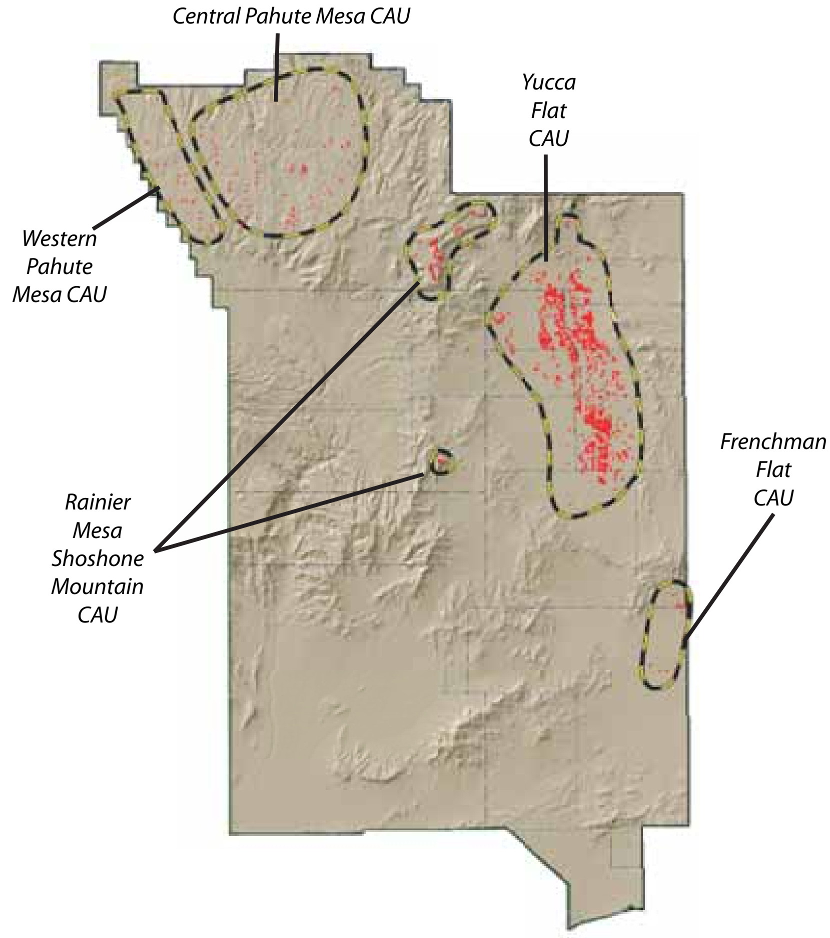


Pahute Mesa Earth Vision three-dimensional computer model

The UGTA Approach:

- Organized into five Corrective Action Units (CAUs)
- A CAU is a grouping of Corrective Action Sites (CASs), based on the locations of historic underground nuclear tests and similar geology
- Each CAU is analyzed and evaluated
- Wells are drilled to collect field data (samples)
- Field data is used to create three-dimensional computer models
- Models are used to estimate groundwater flow and transport parameters
- Models are decision tools for identifying locations and forecasting potential transport of radionuclides
- Monitoring of groundwater is used to evaluate model predictions and ensure compliance with regulatory requirements

Drill rig during mobilization on Yucca Flat



UGTA Corrective Action Unit (CAU) Boundaries

(A CAU is a grouping of sites where underground tests were conducted)

The UGTA team is composed of DOE staff and a number of organizations, including:

- *Lawrence Livermore National Laboratory*
- *Los Alamos National Laboratory*
- *Desert Research Institute*
- *United States Geological Survey*
- *State of Nevada*
- *National Security Technologies*
- *Navarro-Intera*

UGTA activities are conducted in accordance with the *Federal Facility Agreement and Consent Order* (FFACO), a legally binding document agreed to by the State of Nevada, the U.S. Department of Energy, and the U.S. Department of Defense.

safety ❖ performance ❖ cleanup ❖ closure

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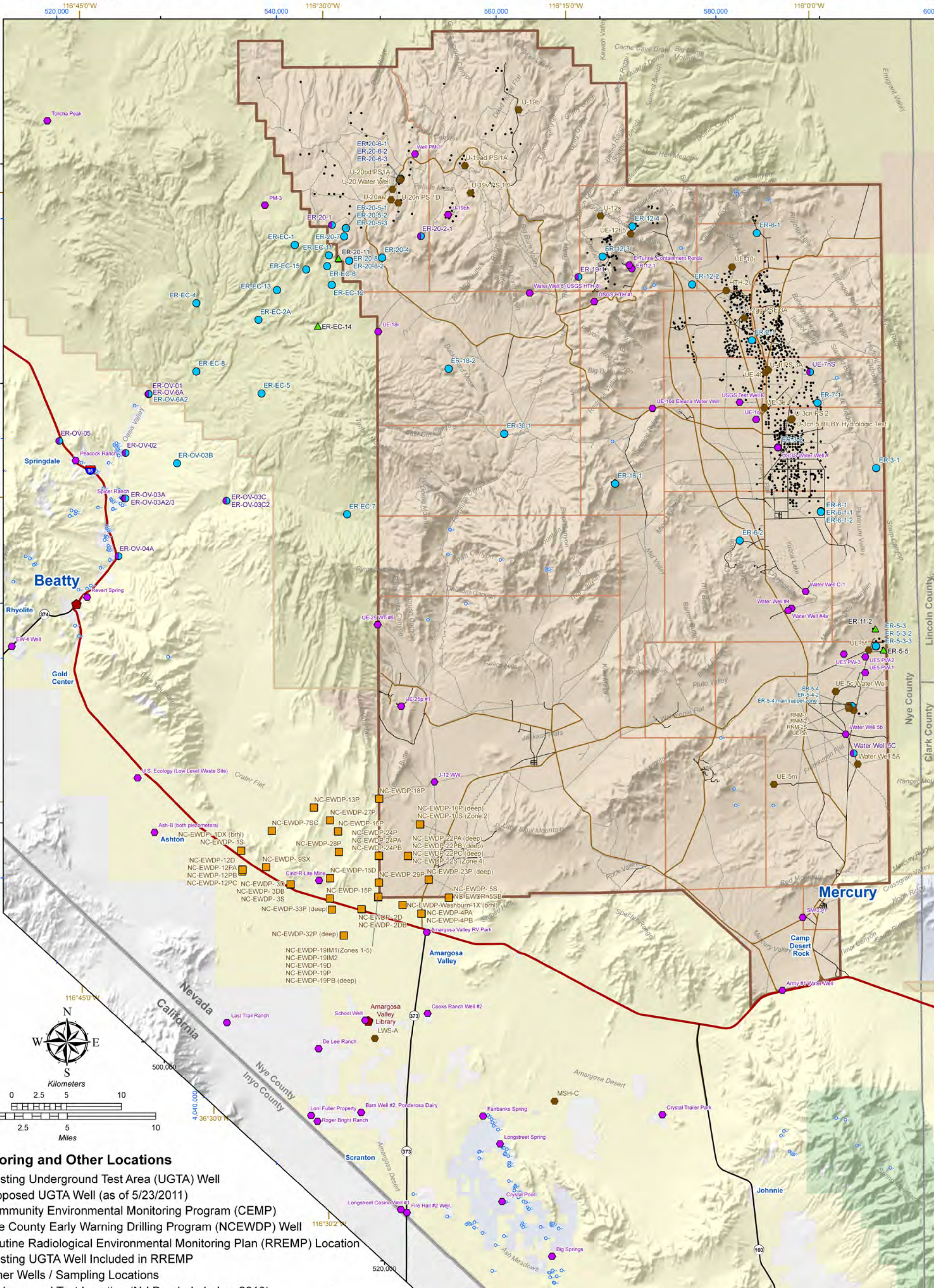
May 2011, Log No. 2011-172

National Nuclear Security Administration

Monitoring & Hydrogeologic Investigation Wells and Springs of the Nevada National Security Site (NNSS)



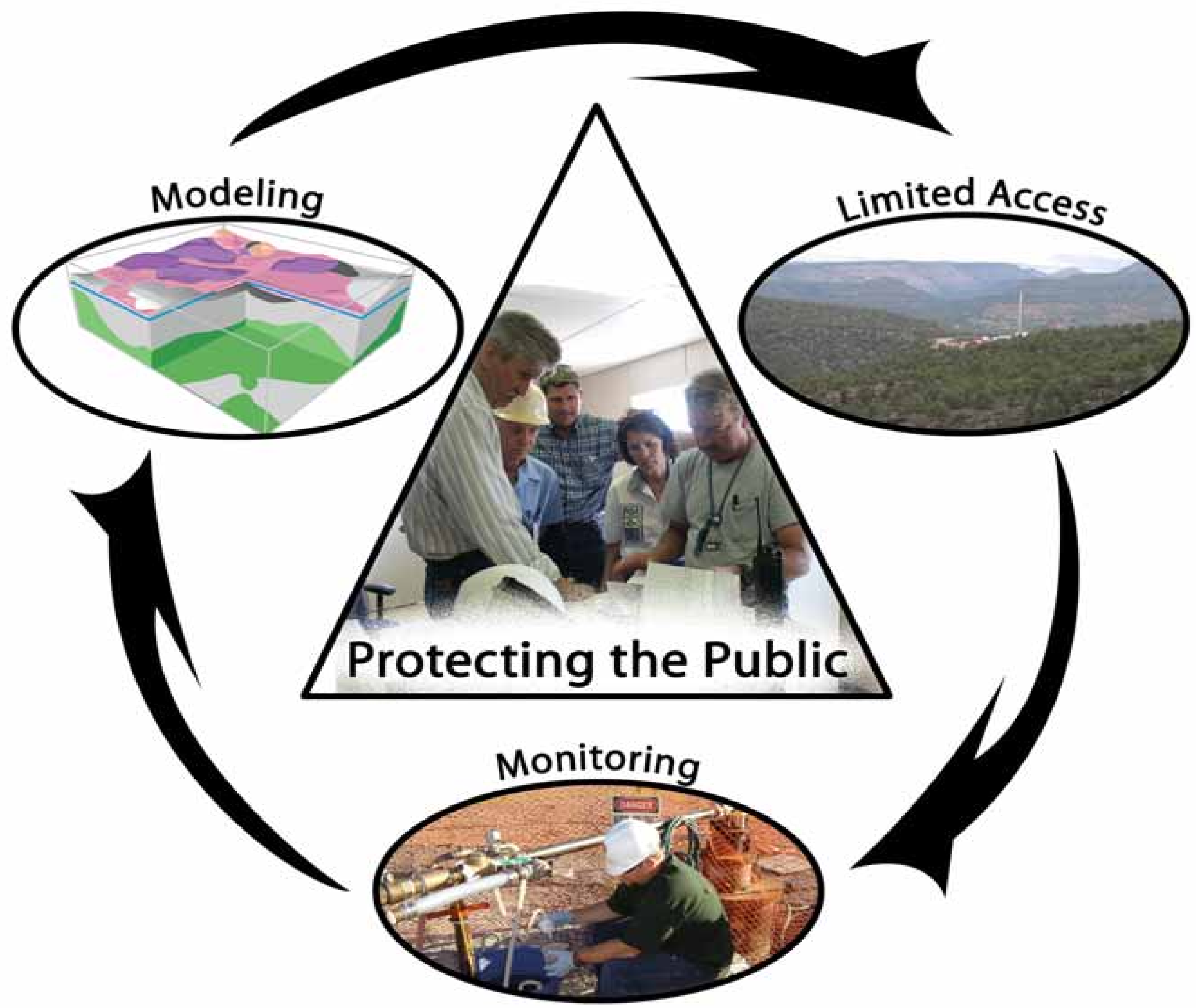
Source: N-I GIS, 2010; Land Jurisdictional data based on 2010 data from US Bureau of Land Management.
Coordinate Systems: Latitude and Longitude values, 15 minute intervals; North American Datum 1927 Universal Trans Mercator Zone 11 North, meters; North American Datum 1983 State Plane Nevada Central, feet

Nevada National Security Site

Protecting the Public

It is a top priority to protect the public from access to groundwater contaminated by historic Nevada National Security Site activities.

Protecting the public is best achieved through computer modeling, ongoing monitoring and limiting access.



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April 2010, DOE/NV-1373

National Nuclear Security Administration

Nevada National Security Site
Federal Facility Agreement and Consent Order*
Underground Test Area (UGTA) Strategy

UGTA Strategy Flowchart

NDEP *- State of Nevada Division of Environmental Protection*

NNSA/NSO *- U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office*

CAU *- Corrective Action Unit: group of sites under investigation. There are five CAUs within UGTA*

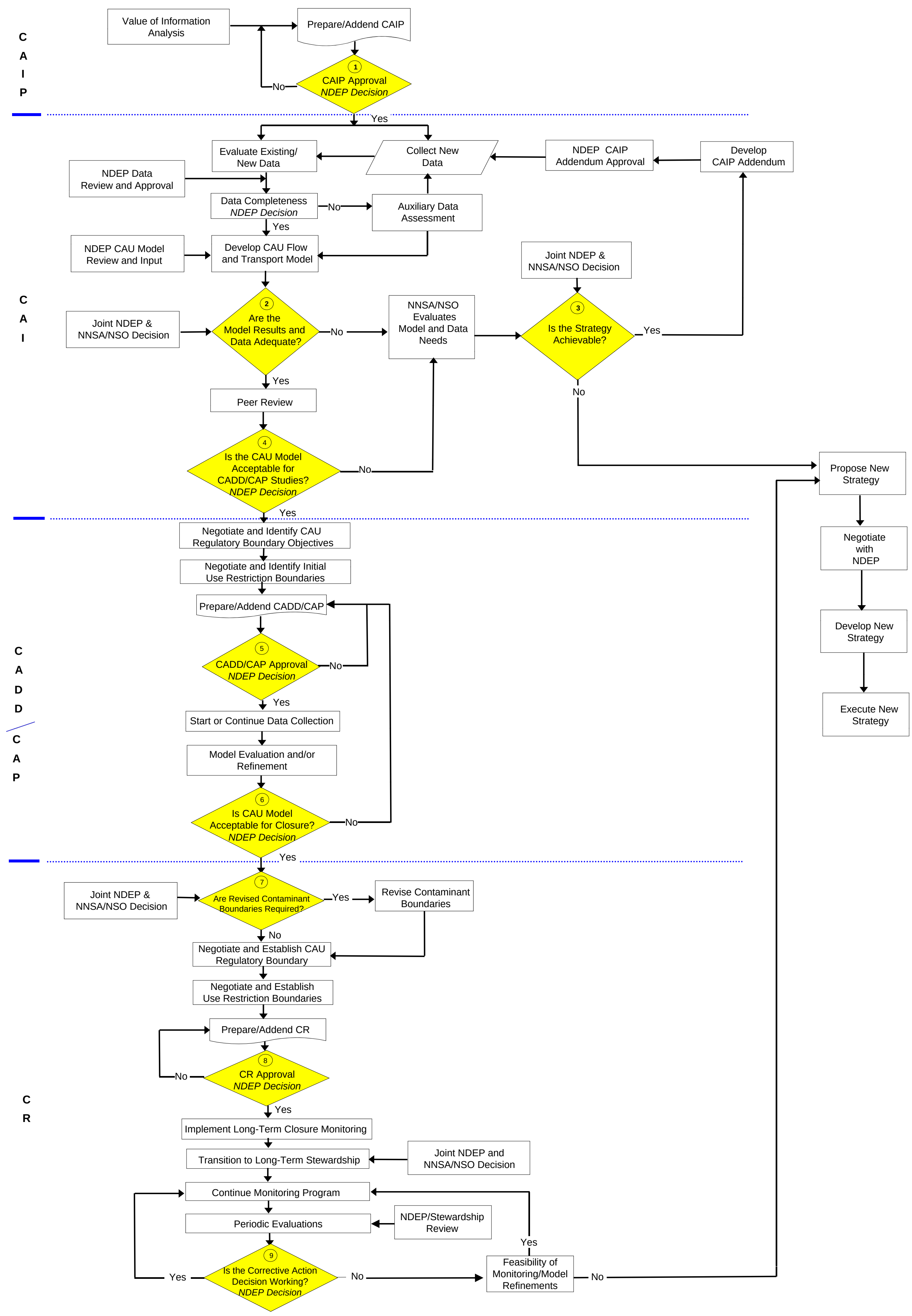
CAIP *- Corrective Action Investigation Plan: looks at existing information from the weapons testing program, the regional flow model, and one-dimensional transport simulations to determine the best options for site characterization and prioritization*

CAI *- Corrective Action Investigation: uses the information from the CAIP stage to develop CAU-specific models of flow and transport, taking the uncertainty of each specific hydrogeologic setting into account--these models are then used to forecast contaminant boundaries for 1,000 years*

CADD/CAP *- Corrective Action Decision Document/Corrective Action Plan: includes developing and negotiating an initial compliance boundary, developing monitoring programs for model testing and closure, and identifying institutional controls*

CR *- Closure Report: involves negotiating the final compliance boundary for CAU closure; developing a closure report, which must be approved by NDEP; and developing and initiating a long-term closure monitoring program*

**Legally-binding agreement between the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management.*



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National Nuclear Security Administration

NEVADA DIVISION OF WATER RESOURCES

(aka NEVADA STATE ENGINEER'S OFFICE)

WHAT WE DO

WATER RIGHTS (SURFACE AND GROUNDWATER)

- APPROPRIATIONS
- REALLOCATION
- MONITORING

WATER AVAILABILITY (PERENNIAL YIELD)

ADJUDICATIONS

DAM SAFETY

FLOODPLAIN MANAGEMENT

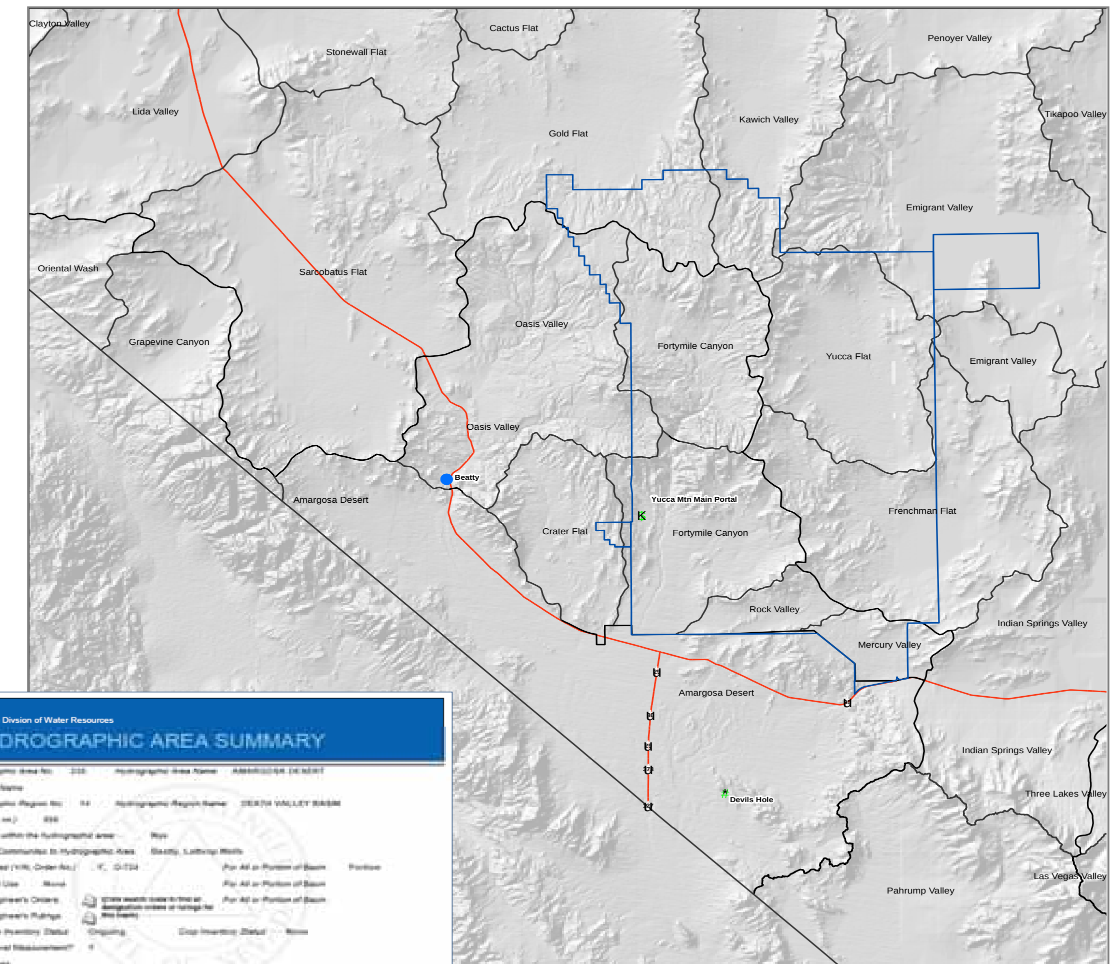
WELL DRILLING REGULATIONS

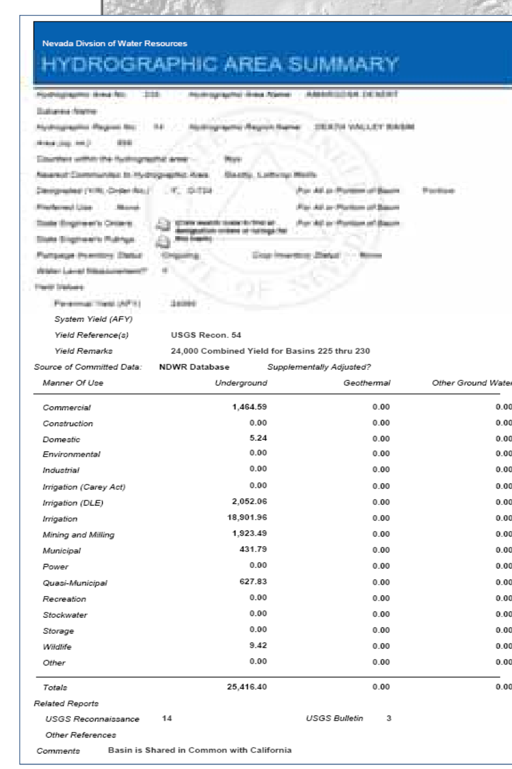
Nevada water law is based on two fundamental concepts: prior appropriation and beneficial use. Prior appropriation (also known as "first in time, first in right") allows for the orderly use of the state's water resources by granting priority to senior water rights. This concept ensures the senior uses are protected, even as new uses for water are allocated.

All water may be appropriated for beneficial use as provided in Chapters 533 and 534 of the Nevada Revised Statutes. Irrigation, mining, recreation, commercial/industrial and municipal uses are examples of beneficial uses, among others.

Department of Conservation and Natural Resources
Office of the State Engineer
Division of Water Resources
901 S. Stewart St.
Carson City, NV 89701

Jason King, P.E.
State Engineer





Nevada Division of Water Resources

HYDROGRAPHIC AREA SUMMARY

System Yield (AFY)

Yield Reference(s): USGS Recon. 54

Yield Remarks: 24,000 Combined Yield for Basins 225 thru 230

Source of Committed Data: NDWR Database   Supplementally Adjusted?

Manner Of Use	Underground	Geothermal	Other Ground Water
Commercial	1,464.59	0.00	0.00
Construction	0.00	0.00	0.00
Domestic	5.24	0.00	0.00
Environmental	0.00	0.00	0.00
Industrial	0.00	0.00	0.00
Irrigation (Carey Act)	0.00	0.00	0.00
Irrigation (DLE)	2,052.06	0.00	0.00
Irrigation	18,901.96	0.00	0.00
Mining and Milling	1,923.49	0.00	0.00
Municipal	431.79	0.00	0.00
Power	0.00	0.00	0.00
Quasi-Municipal	627.83	0.00	0.00
Recreation	0.00	0.00	0.00
Stockwater	0.00	0.00	0.00
Storage	0.00	0.00	0.00
Wildlife	9.42	0.00	0.00
Other	0.00	0.00	0.00
Totals	25,416.40	0.00	0.00

Related Reports

USGS Reconnaissance 14   USGS Bulletin 3

Other References

Comments: Basin is Shared in Common with California

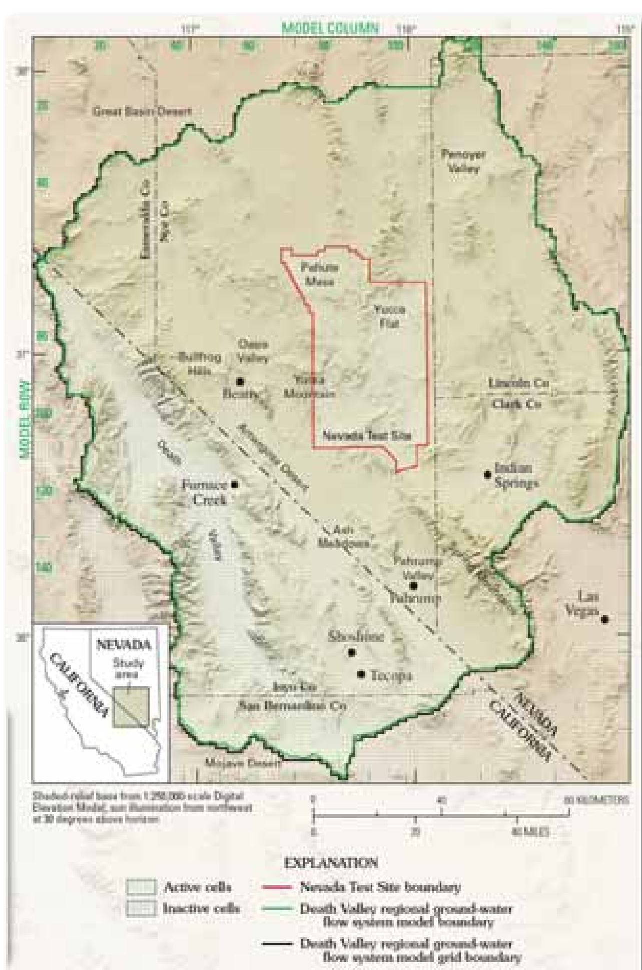
WATER RIGHTS ALLOCATIONS IN THE BEATTY AREA BASINS

HYDROGRAPHIC BASIN	PERENNIAL YIELD (acre feet)	EXISTING APPROPRIATIONS (acre feet)
Mercury Valley	24,000 (These Basins have a combined perennial yield)	0
Rock Valley		0
Fortymile Canyon - Jackass Flats		58
Fortymile Canyon - Buckboard Mesa		0
Oasis Valley		1,296
Crater Flat		681
Amargosa Desert		25,416
Grapevine Canyon	400	12
Oriental Wash	150	237
Lida Valley	350	76
Sarcobatus Flat	3,000	3,535
Stonewall Flat	100	12
Gold Flat	1,900	414
Kawich Valley	2,200	0
Emigrant Valley - Groom Lake Valley	2,800	12
Emigrant Valley - Papoose Lake Valley	10	0
Yucca Flat	350	0
Frenchman Flat	100	0
Indian Springs Valley	500	1,392
Pahrump Valley	12,000	62,433

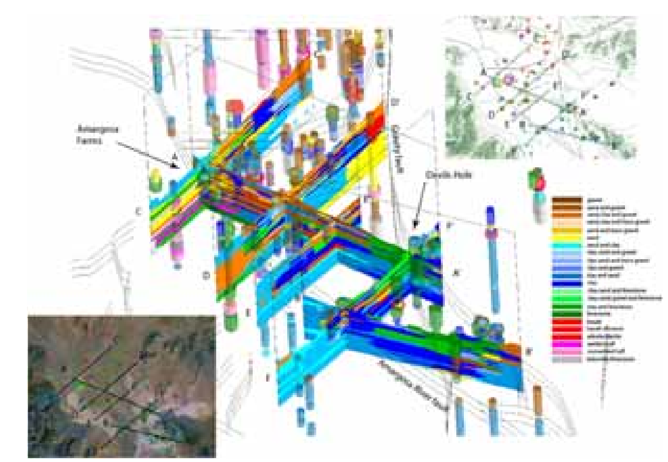
http://water.nv.gov/

Modeling the Death Valley Regional Ground Water Flow System and the Southern Amargosa Desert

U.S. Geological Survey (USGS) is updating and revising the Death Valley regional ground water flow system model and constructing a detailed model inset within it for the southern part of the Amargosa Desert.



- Ground water flow can be described by mathematical equations; these equations can be represented as a model containing important features of the flow system on a computer
- USGS is simulating ground water flow in the southern part of the Amargosa Desert in Nevada and California to assess the effects of pumping from agriculture and solar project development on endangered species habitat, spring flow to the Amargosa River, and the alteration of flow paths from the Nevada National Security Site (NNSS)
  - ♦ USGS is revising the Death Valley regional ground water flow system model and constructing a detailed model inset into the area of the southern Amargosa Desert
  - ♦ Revision to the regional model includes extending the simulation period of the model from 1998 through 2003 and updating and correcting the hydrogeologic framework model with NNSS model information
  - ♦ Lithology of the Amargosa Desert is being examined to incorporate more detail of the basin-fill deposits into the inset model
  - ♦ Pumping scenarios will be run on the calibrated linked models



Nevada National Security Site

Complex Geology

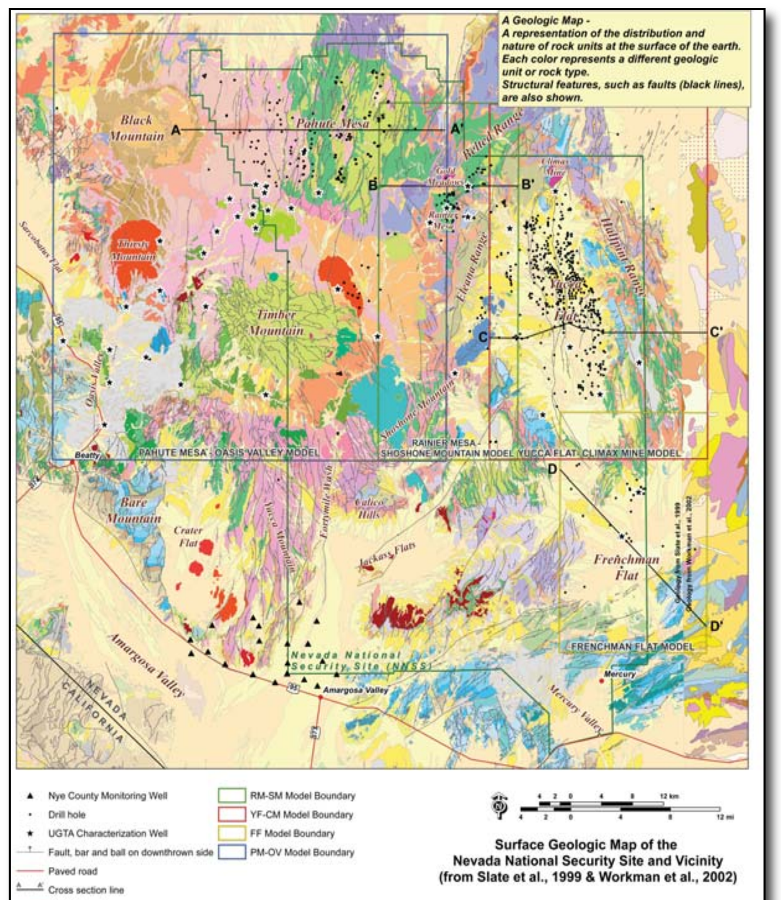
The geology is diverse and complex at the Nevada National Security Site.

The complex sub-surface geology creates technical challenges for scientists to accurately determine where and how fast groundwater and contaminants migrate. Underground Test Area activities involve characterizing the geology and the uncertainty of contaminant migration. The geologic models provide the initial framework for all Underground Test Area modeling.

The complex geologic features of the Nevada National Security Site include:

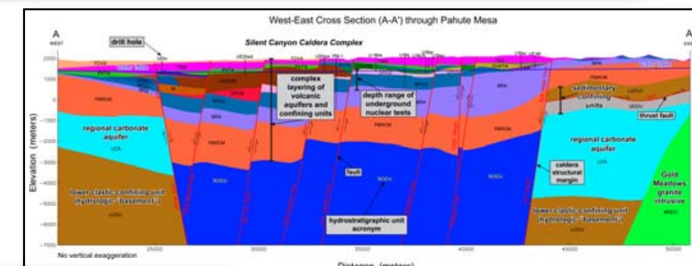
- More than 300 different geologic units representing more than 500 million years of geologic history
- At least seven Tertiary*-age calderas (i.e., large volcanic depressions)
- Mesozoic*-age thrust faults and folds (relatively "old") – due to compression
- Basin-and-range normal faults (relatively "young") – due to extension
- Granite rising through highly deformed sedimentary rocks
- Several deep (up to a mile) alluvial-filled basins

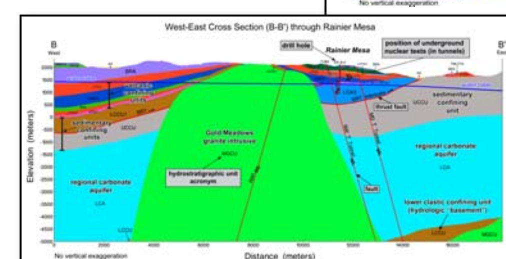
* **Tertiary Period** (dates from 65 to 1.8 million years ago). Virtually all major existing mountain ranges were formed during this period.
* **Mesozoic Era** (dates from around 250 to 65 million years ago). This era marks the beginning of land animals and plants.



Surface Geologic Map of the Nevada National Security Site and Vicinity (from Slate et al., 1999 & Workman et al., 2002)

Aquifers vs. Confining Units
Aquifer – Unit through which water moves.
Confining unit (also referred to as an "aquitard") – Unit that generally is impermeable to water movement.

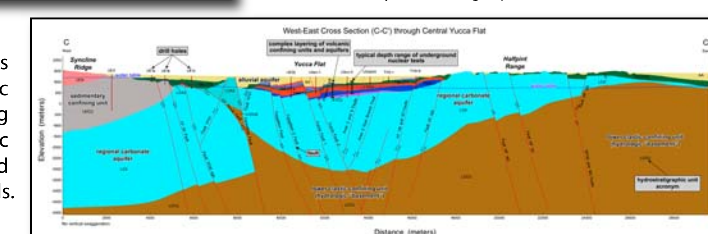


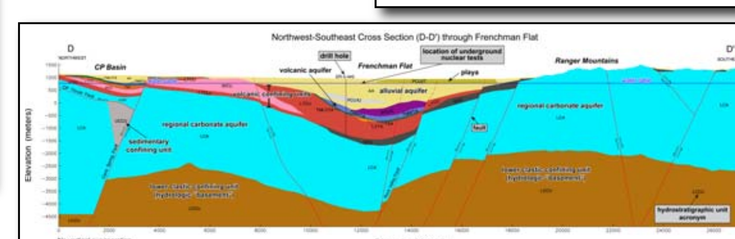


The rocks of the Nevada National Security Site are categorized according to their hydrologic properties (e.g., aquifer or confining unit).

These units are then grouped into larger hydrostratigraphic units (colored layers on the cross sections). These hydrostratigraphic units together with faults, form the three-dimensional Hydrostratigraphic Framework Models.

Cross Sections – Vertical slices through the Hydrostratigraphic Framework Models showing arrangement of hydrostratigraphic units below ground level and inside the models.





In addition to recent groundwater studies, the Underground Test Area team is tapping into, and expanding upon, approximately 50 years of groundwater research.

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National Nuclear Security Administration

Nevada National Security Site

Drilling Hydrogeologic Investigation Wells

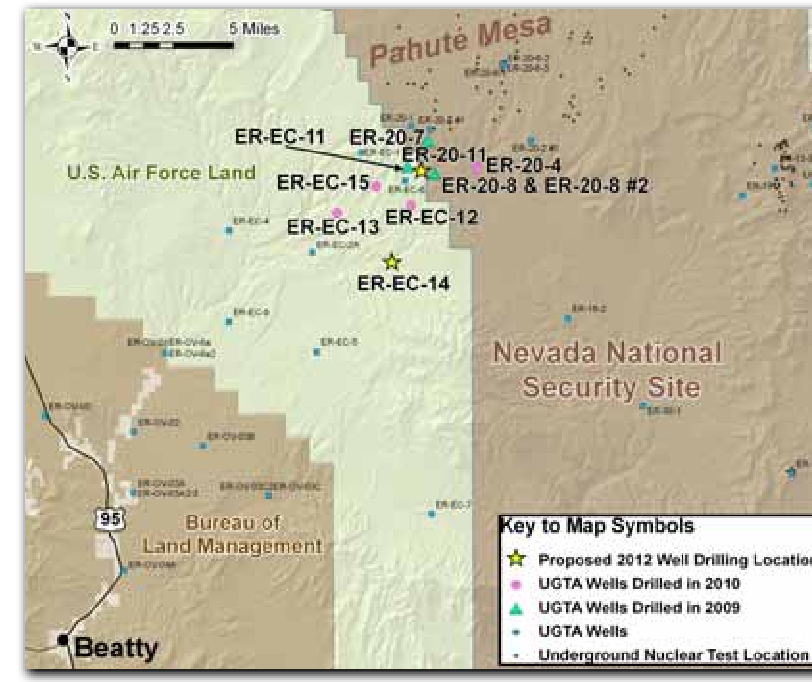
Wells are drilled to collect geologic and aquifer data, which is used in computer models to predict groundwater movement and contaminant boundaries.

- During 2009, four hydrogeologic investigation wells were drilled and completed (ER-EC-11, ER-20-7, ER-20-8 and ER-20-8 #2); tritium contaminated groundwater was encountered at these wells, located both on and off the Nevada National Security Site
- During 2010, four additional wells (ER-EC-12, ER-20-4, ER-EC-13 and ER-EC-15) were drilled and completed; no tritium discovered in these wells

- Two more wells (ER-20-11 and ER-EC-14) planned for drilling in the summer of 2012; total of 10 wells drilled as part of the Pahute Mesa Phase II characterization effort
- Wells drilled to depths of approximately 2,000 to 4,000 feet and completed with multiple isolated completion zones; well construction allows for subsequent aquifer specific testing

Pahute Mesa Drilling Campaign Summary

YEAR	WELL NUMBER	PLANNED DRILLING DEPTH (feet)	ACTUAL DRILLING DEPTH (feet)	DRILLING DEPTH DELTA (feet)	NUMBER OF COMPLETION ZONES
2009	ER-20-7	2,600	2,936	336	1
	ER-20-8	3,700	3,442	(258)	2
	ER-20-8 #2	2,400	2,338	(62)	1
	ER-EC-11	3,500	4,148	648	2
2010	ER-EC-12	3,650	4,070	420	3
	ER-20-4	3,100	3,499	399	1
	ER-EC-13	3,000	3,000	0	2
	ER-EC-15	3,200	3,255	55	3
2012 (Planned)	ER-20-11	3,200	tbd	tbd	1
	ER-EC-14	3,900	tbd	tbd	2



Excavated sumps are used to contain drilling fluids, geologic material, and groundwater removed during well construction

Well drilling and construction occurs 24 hours a day, 7 days a week for approximately 20-30 days

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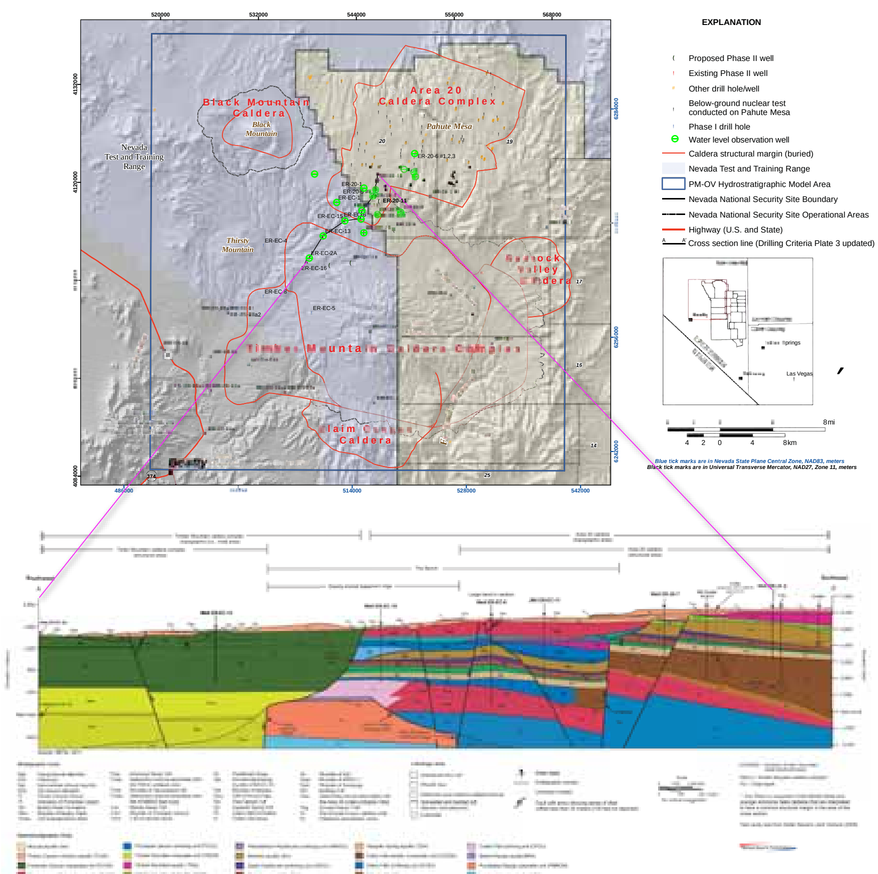
National Nuclear Security Administration

Nevada National Security Site

Well Development, Hydraulic Testing and Groundwater Sampling on Pahute Mesa

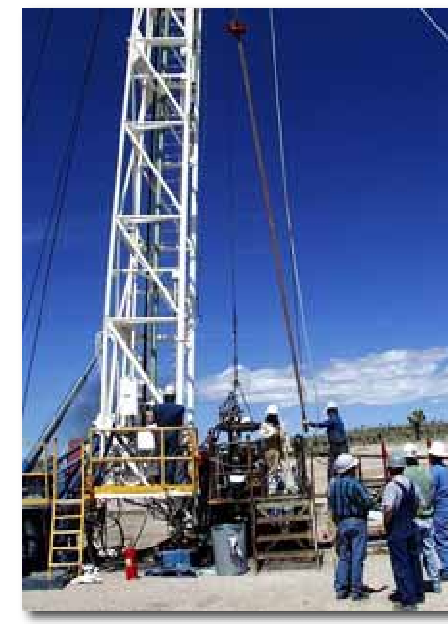
During well development, characterization wells are pumped to remove drilling fluids and particulates. Hydraulic testing and sampling are then performed to collect aquifer data for use in computer models to predict groundwater movement and contaminant boundaries.

- During 2010, well development, testing and sampling completed at wells ER-20-8#2, ER-EC-11 and ER-20-7
- In 2011, well development, testing and sampling planned for wells ER-20-4, ER-20-8 and ER-EC-12
- In 2012, well development, testing and sampling planned for wells ER-20-11 and ER-EC-13

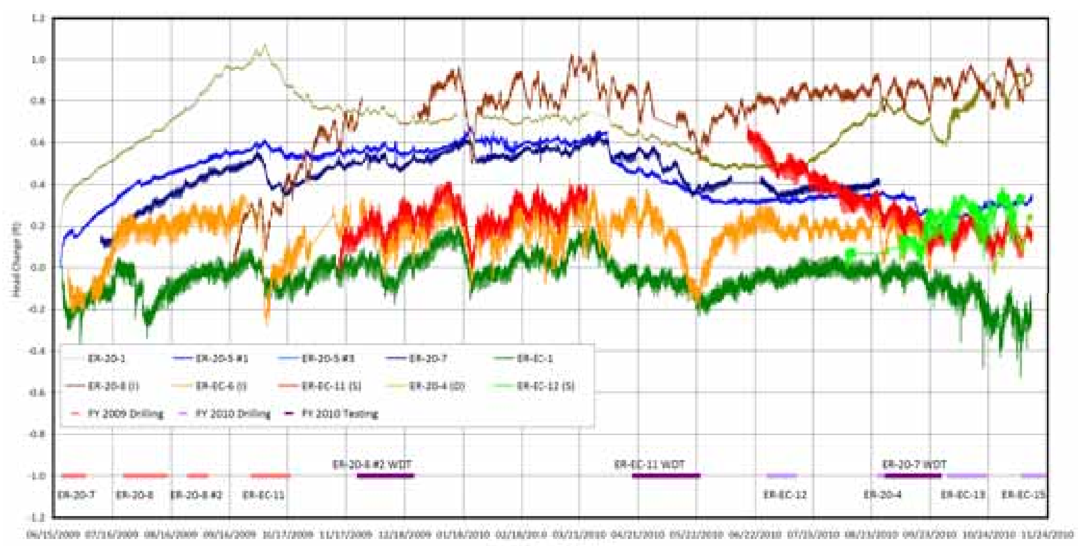


Typical fluid storage sump near well

- Completed wells are instrumented with pressure transducers to monitor aquifer specific water level responses related to pumping/drilling

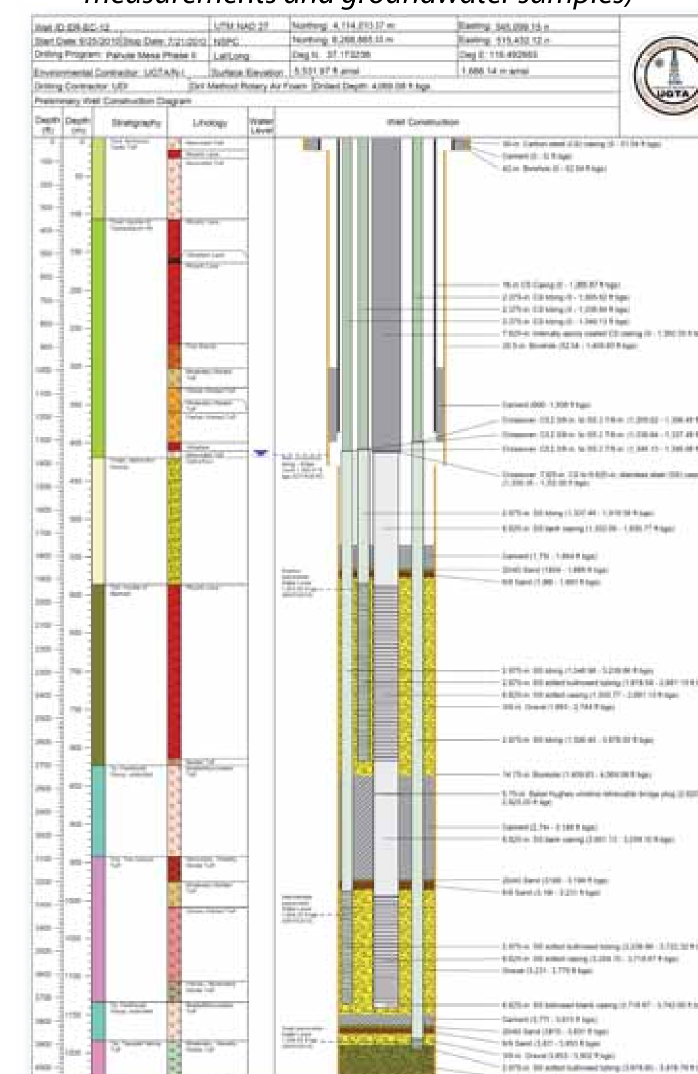


Workers install pump at a well



Overlay of Long-Term Water Level Measurements for Central Bench Area and North

Well completion designs allow for testing of isolated aquifers and discrete access to collect aquifer-specific data (e.g. water levels/head measurements and groundwater samples)



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Nevada National Security Site

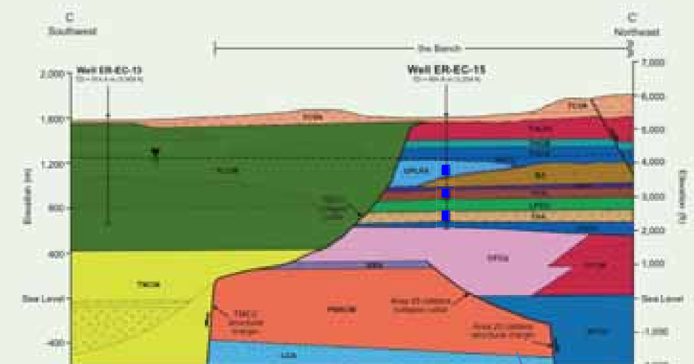
Sampling Results from 2010 Drilling

No contamination was found in wells during 2010 drilling.

Well ER-EC-15

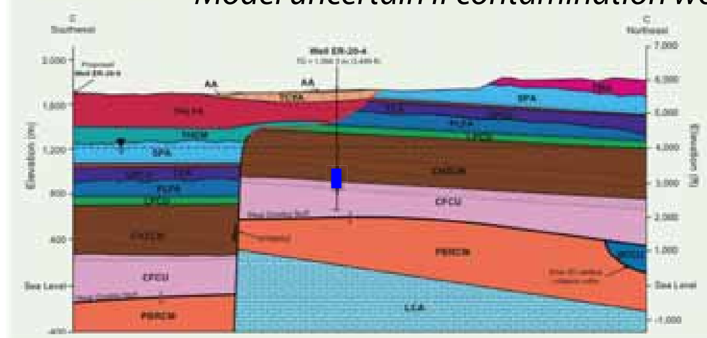
Model showed no expectation of contamination

- Located in the Bench subdomain, downgradient of underground nuclear tests in southwest Pahute Mesa
- Three saturated aquifers
  - UPLFA – slotted completion zone over lava flow*
  - TCA – slotted completion zone over entire welded ash-flow tuff*
  - TSA - slotted completion zone over entire welded ash-flow tuff*



Well ER-20-4

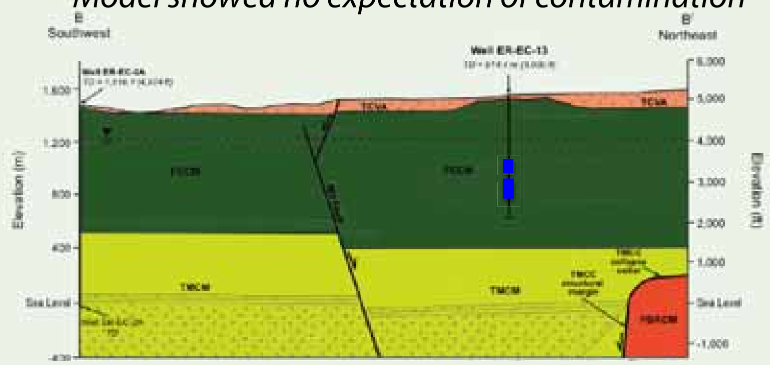
Model uncertain if contamination would be encountered



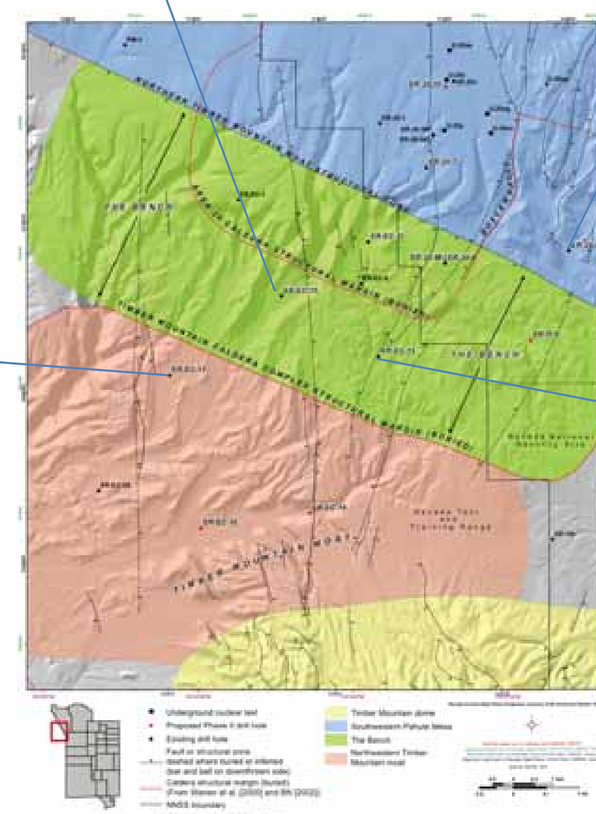
- Located in the Southwestern Pahute Mesa subdomain, downgradient of underground nuclear tests in Central Pahute Mesa
- One saturated completion zone
  - CHZCM/CFCU – slotted completion zone over two adjacent lava flows*

Well ER-EC-13

Model showed no expectation of contamination

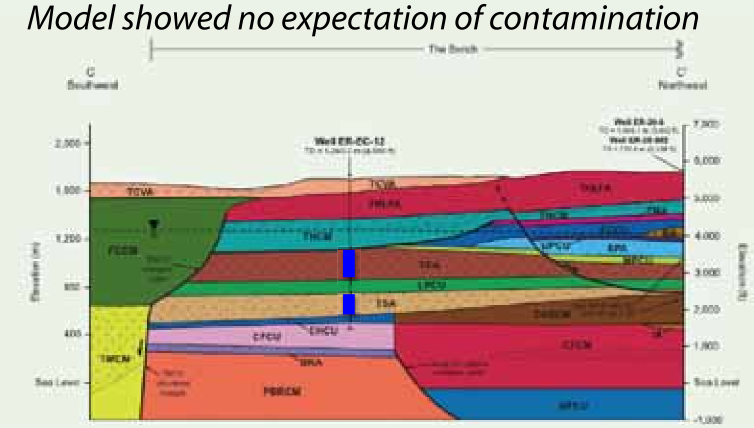


- Located in the Northwestern Timber Mountain Moat subdomain, downgradient of underground nuclear tests in southwest Pahute Mesa
- Two saturated aquifers
  - FCCM-upper – slotted completion zone over upper portion of lava flow*
  - FCCM-lower – slotted completion zone over lower portion of lava flow*



Well ER-EC-12

Model showed no expectation of contamination



- Located in the Bench subdomain, downgradient of underground nuclear tests in southwest Pahute Mesa; did not expect to see contamination
- Two saturated aquifers
  - TCA – slotted completion zone over entire welded ash-flow tuff*
  - TSA - slotted completion zone over entire welded ash-flow tuff*

LEGEND

FCCM: Fortymile Canyon composite unit
UPLFA: Upper Paintbrush lava flow aquifer
TCA: Tiva Canyon aquifer
TSA: Topopah Spring aquifer
CHZCM: Calico Hills composite unit
Bench: Identified area that is geologically complex

*No contamination was found in drilling discharge with field equipment and confirmed with discrete samples analyzed in an offsite laboratory.

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National Nuclear Security Administration

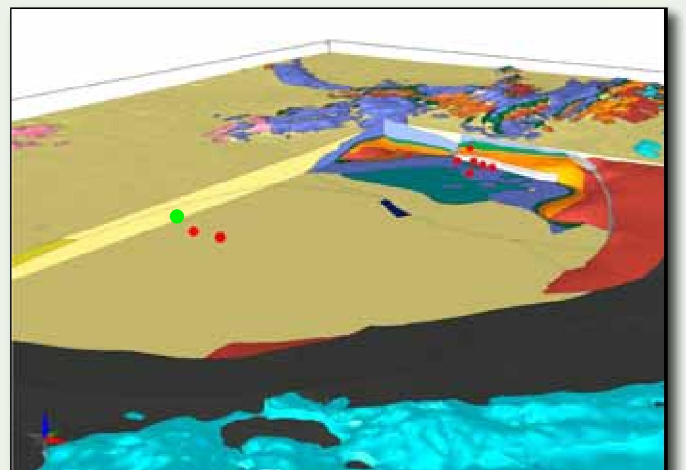
Nevada National Security Site

Source Term Information

The Nevada National Security Site hosted 828 underground nuclear detonations. Understanding the source term is key for modeling contaminant transport in groundwater.

Frenchman Flat

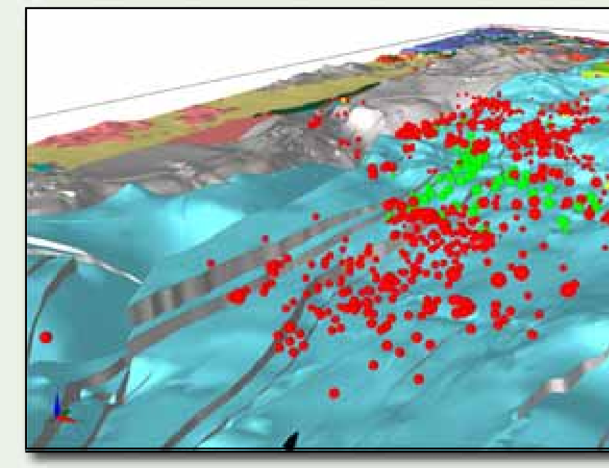
- 10 detonations
- Most announced yields are <20 kiloton, giving a calculated cavity radius of about 40 m*
- Represents about 0.2% of the Nevada National Security Site (NNSS) underground nuclear test inventory activity**
- All detonations were in vertical shafts
- Detonation points are saturated
- Cavities are located in alluvial and volcanic rocks



Frenchman Flat tests
Frenchman Flat tests showing working point above water (red dots), working point below water table (green dot). Sphere is 2 cavity radii at maximum announced yield.

Yucca Flat/Climax Mine

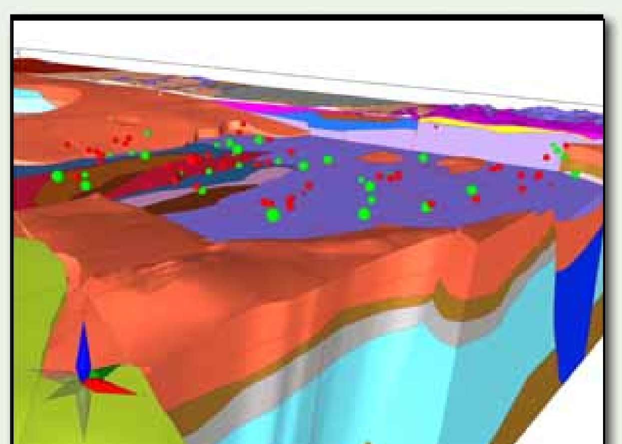
- 747 detonations (three in Climax Mine)
- Announced yields range from zero to 500 kiloton (maximum of announced yield range), making the largest calculated cavity radius about 87 m*
- Represents about 39% of the NNSS underground nuclear test inventory activity**; 12% associated with unsaturated tests, 27% with saturated tests
- Most detonations were in vertical shafts; two were in tunnels in Climax Mine
- 170 saturated and 577 unsaturated detonation points
- Cavities located in alluvial, volcanic, carbonate and granitic rocks



Yucca Flat/Climax Mine tests
Yucca Flat/Climax Mine tests showing working point above water (red dots), working point below water table (green dots), working point in granite (pink dots) and working point in carbonate (yellow dots). Sphere is 2 cavity radii at maximum announced yield.

Pahute Mesa

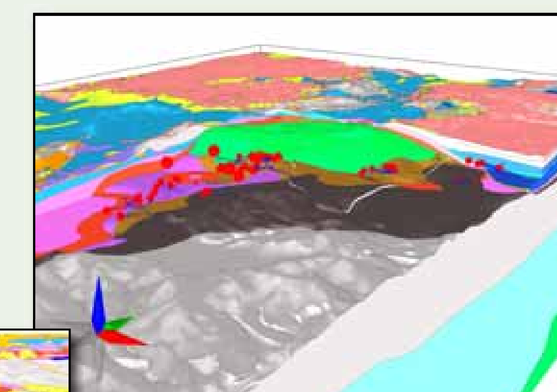
- 18 detonations in Western Pahute Mesa; 64 detonations in Central Pahute Mesa
- Announced yields range from 19 kiloton to 1.3 megaton, giving calculated cavity radii of 30 m and 115 m*, respectively
- Represents about 60% of the NNSS underground nuclear test inventory activity**
- All detonations were in vertical shafts
- All detonation points are considered saturated
- All cavities are in volcanic rock



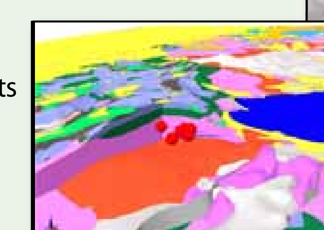
Pahute Mesa tests
Pahute Mesa tests showing working point above water (red dots), working point below water table (green dots). Sphere is 2 cavity radii at maximum announced yield.

Rainier Mesa/Shoshone Mountain

- 68 detonations
- Most announced yields are <20 kiloton, giving a calculated cavity radius of about 36 m*; two vertical tests have a calculated cavity radii of about 72 m* (at the maximum of the announced yield range of 200 kiloton)
- Represents about 1% of the NNSS underground nuclear test inventory activity**
- Almost all detonations were in tunnels; two were in vertical shafts
- Working points are above the water table; detonations are unsaturated (most) and saturated
- Cavities are located in volcanic rocks



Rainier Mesa tests
Rainier Mesa tests showing working point above water (red dots). Sphere is 2 cavity radii at maximum announced yield.



Shoshone Mountain tests
Shoshone Mountain tests showing working point above water (red dots). Sphere is 2 cavity radii at maximum announced yield.

* Cavity radius calculation based on maximum of yield range identified in DOE/NV-209 (Pawloski, 1999)
** Decay corrected to Sept 23, 1992

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May 2011, Log No. 2011-184

National Nuclear Security Administration

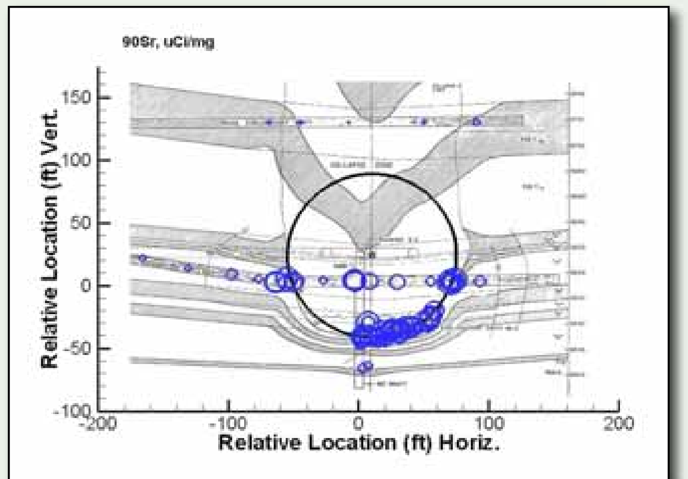
Nevada National Security Site

Hydrologic Source Term Modeling

Hydrologic source term modeling shows how radionuclides are released and migrate in groundwater.

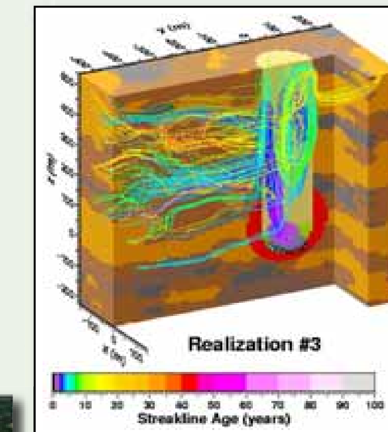
1) Where are radionuclides after underground testing?

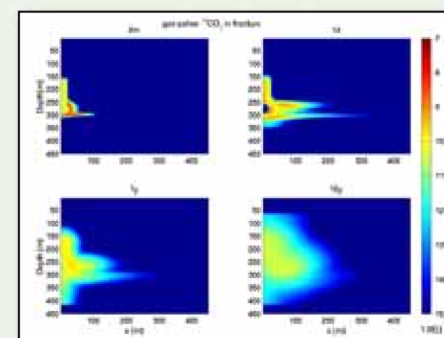
- Post-test drilling, re-entry mining and sampling over time shows radionuclides are in melt glass, on rubble, and soluble in water



2) What affects radionuclide release to groundwater?

- For tests located in/near the unsaturated zone, gas transport can disperse and dilute radionuclide inventory before it affects the saturated zone
- Altered zones can speed up or slow down release
- Test heat can speed up initial transport
- Convection in chimney can cause upward transport

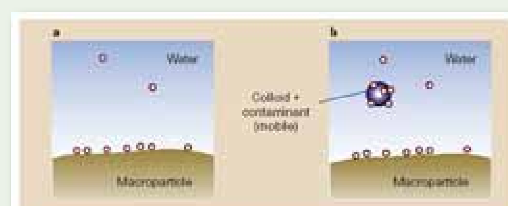


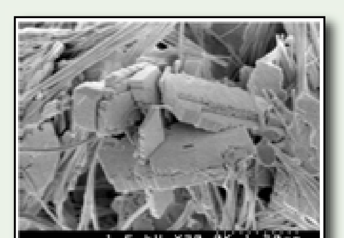


Melt glass zone near the bottom of the cavity must be dissolved to release radionuclides.

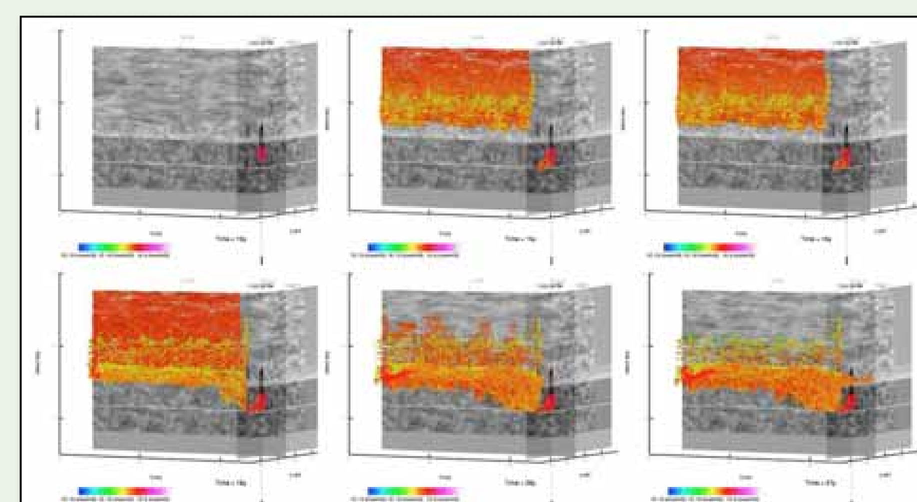
3) How do the radionuclides move in groundwater once released?

- Dissolved in groundwater and move with it; affected by solubility constraints and sorption to rock surfaces
- Diffusion into the rock matrix slows transport
- Plutonium can move on colloids (sub-microscopic particles) and be filtered out by fractures
- Pumping can remove and re-introduce radionuclides





Per controlled radionuclide migration studies conducted in Frenchman Flat, these figures show examples of how pumping can move radionuclides from a cavity to a pumping well, and how pumping discharge at the surface can infiltrate through the unsaturated zone. Snapshots show ambient conditions at 10 years after detonation (no pumping has occurred), pumping at 14, 17, 18, and 26 years, and after pumping at 27 years.



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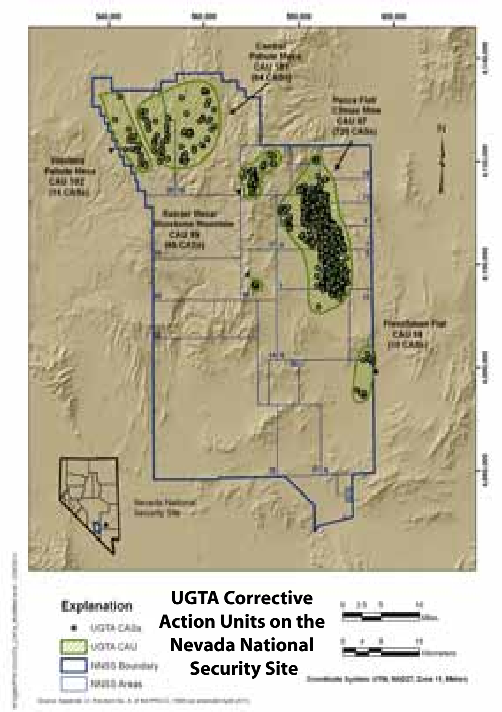
UGTA Groundwater Flow Models

Flow models help scientists forecast how groundwater moves



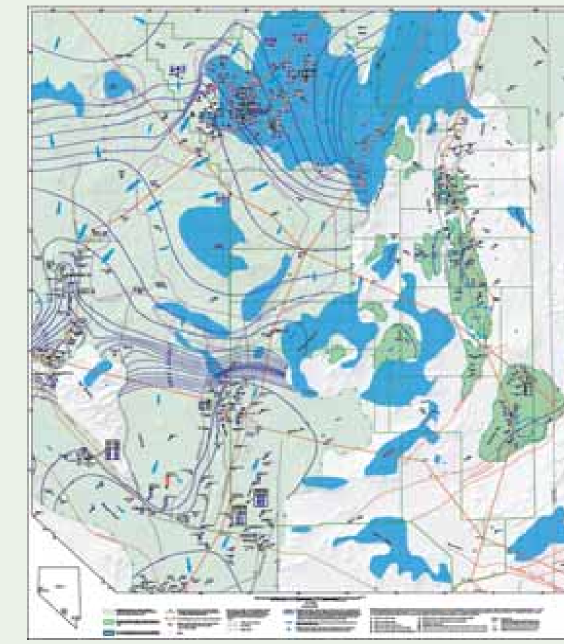
An agreement between the U.S. Department of Energy and the State of Nevada Division of Environmental Protection requires that groundwater flow and transport models be created for each Underground Test Area (UGTA) Corrective Action Unit to forecast radionuclide migration in groundwater for the next 1,000 years.

A groundwater model is a mathematical approximation of real groundwater flow and transport used to forecast the location and future movement of contaminants in complex geologic settings.

Flow Modeling Process

Element	Description
1. Develop Conceptual Model	Describe, using field data, pictures, and words how reality is thought to work – state the problem. Also identify what is uncertain.
2. Build Mathematical Model	Create a grid that mimics key features (geology), specify properties needed to compute groundwater flow.
3. Calibrate the mathematical model to reality	Adjust mathematical model to match reality. Rock properties, groundwater flow directions, etc. must be considered.
4. Check the uncertainty in the mathematical model	Not everything is known or certain. Do calculations to see how much predictions might change.

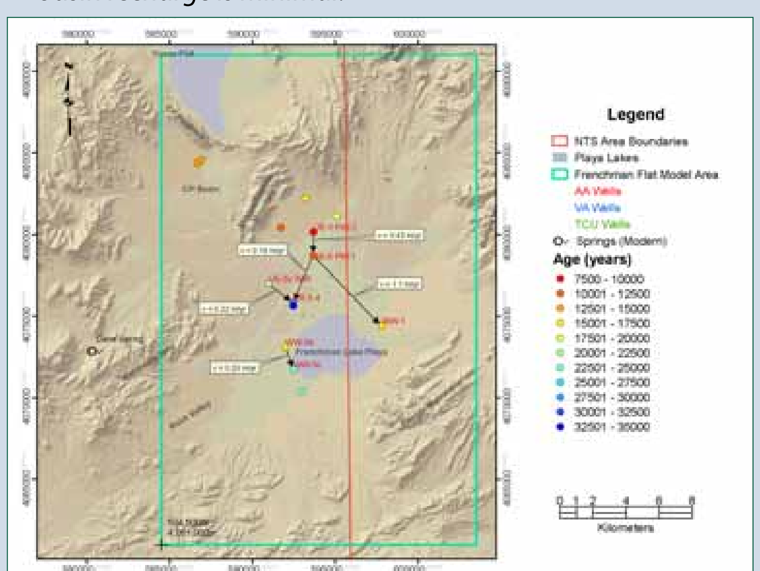
Pahute Mesa Status

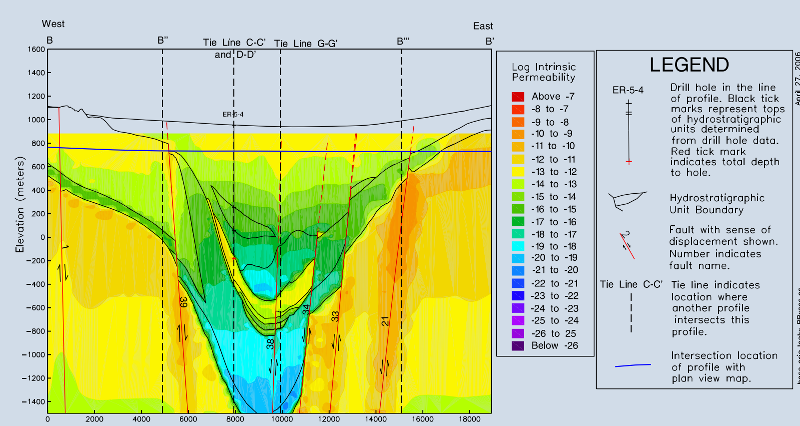


- Groundwater from Area 20 flows toward Oasis Valley.
- Rocks in southwestern Area 20 are caldera ash flows - groundwater flows only through the cooling and tectonic fractures.

Frenchman Flat Example

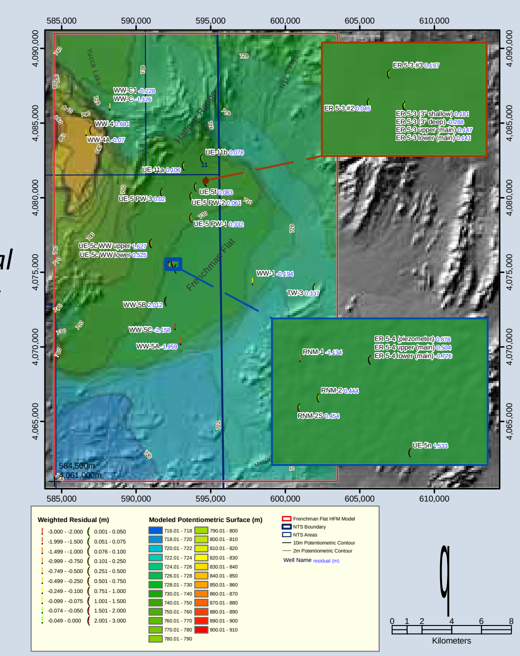
1. *Water flows slowly in the alluvium in Frenchman Flat because basin recharge is minimal.*

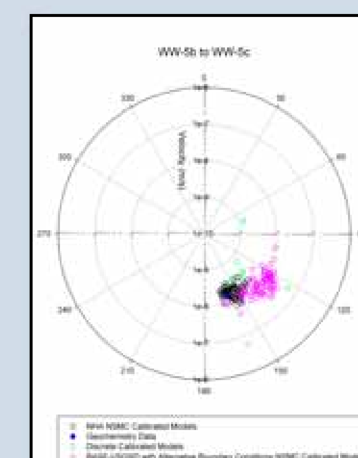




2. *Water transmitting properties of rock are assigned to different geologic units.*

3. *Compare mathematical model results to data.*





4. *Uncertain knowledge impact on geochemical velocity.*

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May 2011, Log No. 2011-174

Nevada National Security Site

UGTA Groundwater Transport Models

Models help scientists understand how contaminants move in groundwater.

Transport Modeling Process

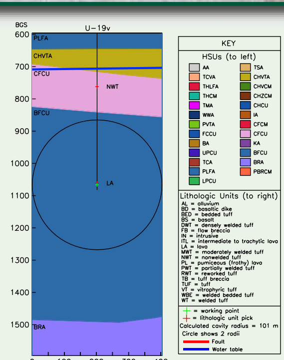
Element	Description
1. Develop Conceptual Model	Describe, using field data, pictures, and words how reality is thought to work – state the problem. Also identify what is uncertain.
2. Build Mathematical Model	Create a grid that mimics key features (geology), specify properties needed to compute groundwater transport.
3. Calibrate the mathematical model to reality	Adjust mathematical model to match reality. Rock properties, groundwater flow directions, etc. must be considered.
4. Check the uncertainty in the mathematical model	The FFACO *requires* an evaluation of radionuclide migration uncertainty via the "contaminant boundary."

An agreement (*Federal Facility Agreement and Consent Order, FFACO*) between the U.S. Department of Energy and the State of Nevada Division of Environmental Protection requires that groundwater flow and transport models be created for each UGTA Corrective Action Unit. These models are designed to forecast radionuclide migration in groundwater for the next 1,000 years.

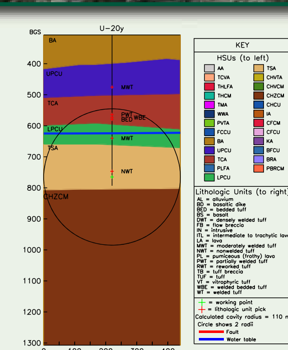
A groundwater model is a mathematical approximation of real groundwater flow and transport used to forecast the location and future movement of contaminants in complex geologic settings.

Pahute Mesa Status

- Radionuclides may be released slowly from tests in porous rocks.
- Radionuclides may be released quickly from tests in hard, fractured rocks
- Areas where hard, fractured rock is predominant and underground nuclear testing was conducted may be of more concern.

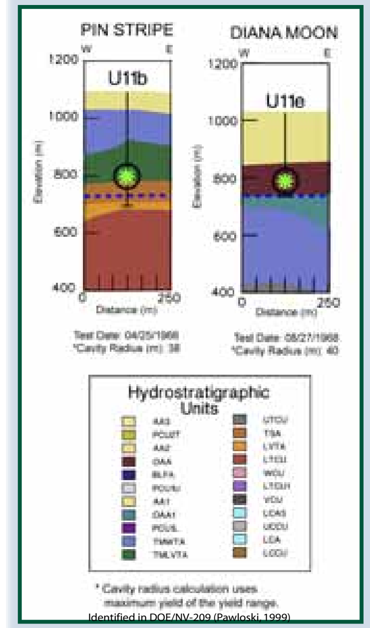


* Cavity radius calculation uses maximum yield range. Identified in DOE/NV-209 (Pawloski, 1999)



* Cavity radius calculation uses maximum yield range. Identified in DOE/NV-209 (Pawloski, 1999)

Frenchman Flat Example



* Cavity radius calculation uses maximum yield of the yield range. Identified in DOE/NV-209 (Pawloski, 1999)

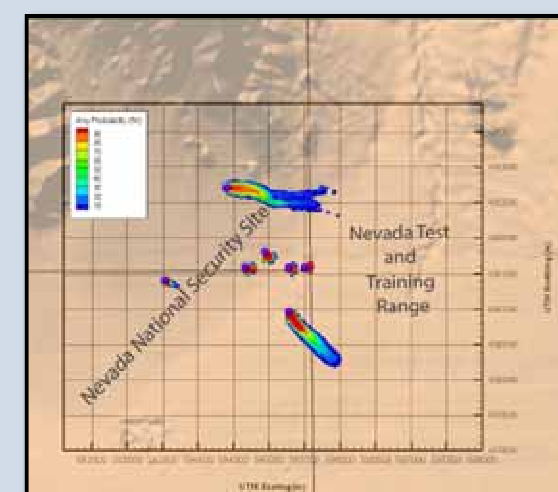
Radionuclides will move slowly from tests in alluvium, but readily from tests in hard, fractured rock.

Radionuclide Regulatory Groups

Regulatory Group	Bowen et. al (2001 Radionuclide)	Maximum Contaminant Level
Beta/Photo Emitter	^{3}H, ^{14}C, ^{26}Al, ^{36}Cl, ^{39}Ar, ^{40}K, ^{41}Ca, ^{113m}Cd, $^{59/63}Ni$, ^{85}Kr, ^{90}Sr, ^{93}Zr, $^{93m/94}Nb$, ^{99}Tc, ^{107}Pd, $^{121m/126}Sn$, ^{129}I, $^{135/137}Cs$, ^{241}Pu, $^{150/152/154}Eu$, ^{151}Sm, ^{166}Ho	4 mrem/yr
Gross Alpha Particles	^{232}Th, ^{237}Np, $^{239/240/242}Pu$, ^{238}Pu, $^{241/243}Am$, ^{244}Cm	15 pCi/L
U	All Isotopes	30μg/L

The contaminant boundary is the region where there is a 95 percent chance that contaminants do not exceed *Safe Drinking Water Act* regulatory standards, as specified in the FFACO. That is, the area outside the contaminant boundary has only a five percent chance to be contaminated during the next 1,000 years.

Frenchman Flat Contaminant Boundary



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May 2011, Log No. 2011-173

National Nuclear Security Administration

Nevada National Security Site

Frenchman Flat Peer Review and Model Evaluation

The peer review process is a key component of the UGTA strategy.

Frenchman Flat Peer Review

In 2010, a peer review was conducted that provided an independent evaluation of the Frenchman Flat (FF) model by nationally recognized experts.

Peer Review Participants:

- Dr. Mary Lou Zoback, Risk Management Solutions, Newark, California.
- Dr. Chunmiao Zheng, Department of Geological Sciences, University of Alabama.
- Dr. Douglas Walker, Illinois State Water Survey, Champaign, Illinois
- Mr. James Rumbaugh, Environmental Simulations Inc., Reinholds, Pennsylvania
- Dr. Ken Czerwinski, Department of Chemistry, University of Nevada, Las Vegas
- Dr. Charles Andrews, S.S. Papadopulos & Associates, Inc., Bethesda, Maryland

The U.S. Department of Energy and State of Nevada Division of Environmental Protection, as part of the *Federal Facility and Consent Order* (FFACO) strategy, considered the recommendations of the peer review panel while determining whether or not the FF model is an acceptable tool for forecasting and monitoring radionuclide transport in the groundwater.

Peer Review Process

The FF Model Peer Review committee addressed the following specific questions:

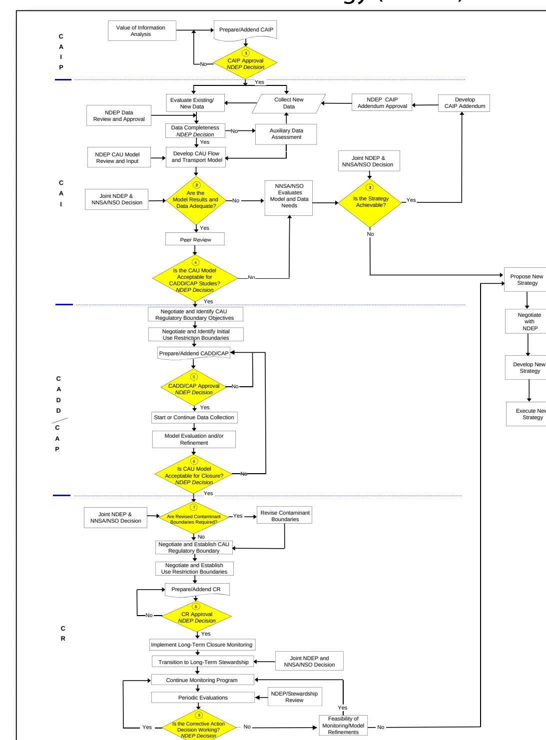
1. Are the modeling approaches, assumptions, and results consistent with the use of the model as a decision tool?
2. Do the results adequately account for uncertainty?
3. Do the data and model results support transition to model evaluation (Corrective Action Decision Document/ Corrective Action Plan [CADD/CAP] stage)?

Peer Review Conclusions

The FF model explored a wide range of assumptions, methods, and data and concluded the work should proceed to the CADD/CAP stage with an emphasis on monitoring.

An internal technical panel noted a caveat to the above statement by identifying the need for a few additional studies (examples include water level monitoring, non steady-state simulations, seismic events, climate change) in order to enhance the results.

Groundwater Strategy (FFACO)



DOE's Response

- Generally accepted Peer Review conclusions
- Answered all peer review comments
- Requested State approval to advance to CADD/CAP stage

State of Nevada's Response

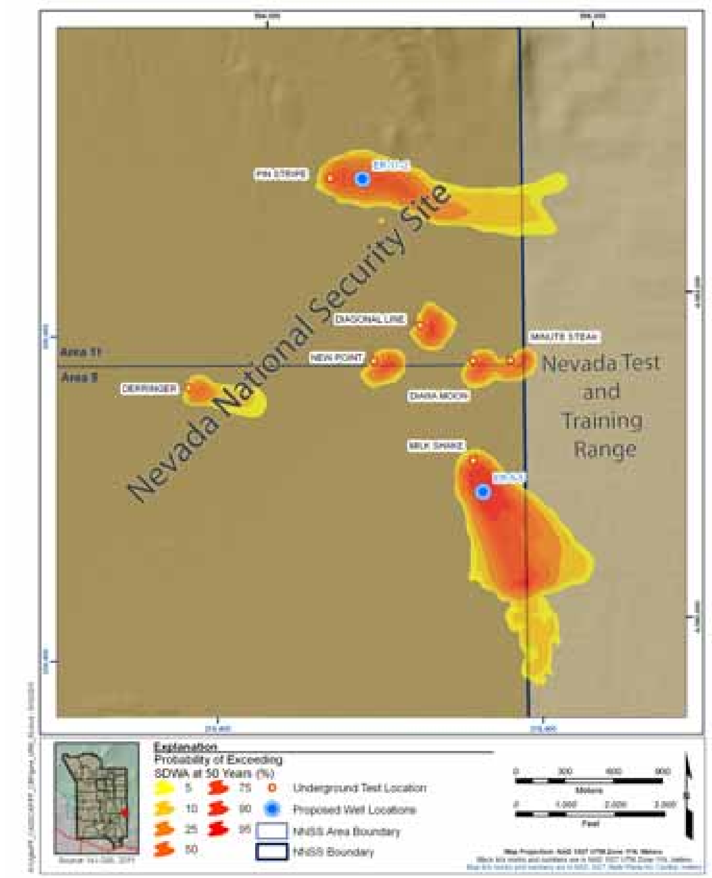
The State of Nevada Division of Environmental Protection considered the recommendations of the peer review panel in determining if the model was suitable for corrective action studies.

The State accepted the FF model in November 2010. Acceptance was predicated on DOE incorporating previously agreed to corrections to the FFACO strategy, computer codes, and peer review recommendations into the CADD/CAP.

Model Evaluation Studies

The preferred corrective action is *Closure in Place* with monitoring and institutional controls. The focus of the CADD/CAP is on model evaluation. Data collection activities will be undertaken to address key remaining uncertainties in the flow and transport models and to build confidence in model forecasts.

Model evaluation well locations were identified based on the Frenchman Flat model and the results of the surface magnetic survey conducted subsequently.



Recommended locations for Frenchman Flat model evaluation wells. Two model evaluation wells are planned to be drilled in 2012. Geologic, geochemical, and hydraulic information will be collected to test model assumptions and address concerns raised by the State of Nevada and Peer Review Panel.

Results from the model evaluation studies will be used to determine if the model is sufficient to proceed to the closure stage. If not, the model may be updated and/or additional model evaluation data will be collected.

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National Nuclear Security Administration

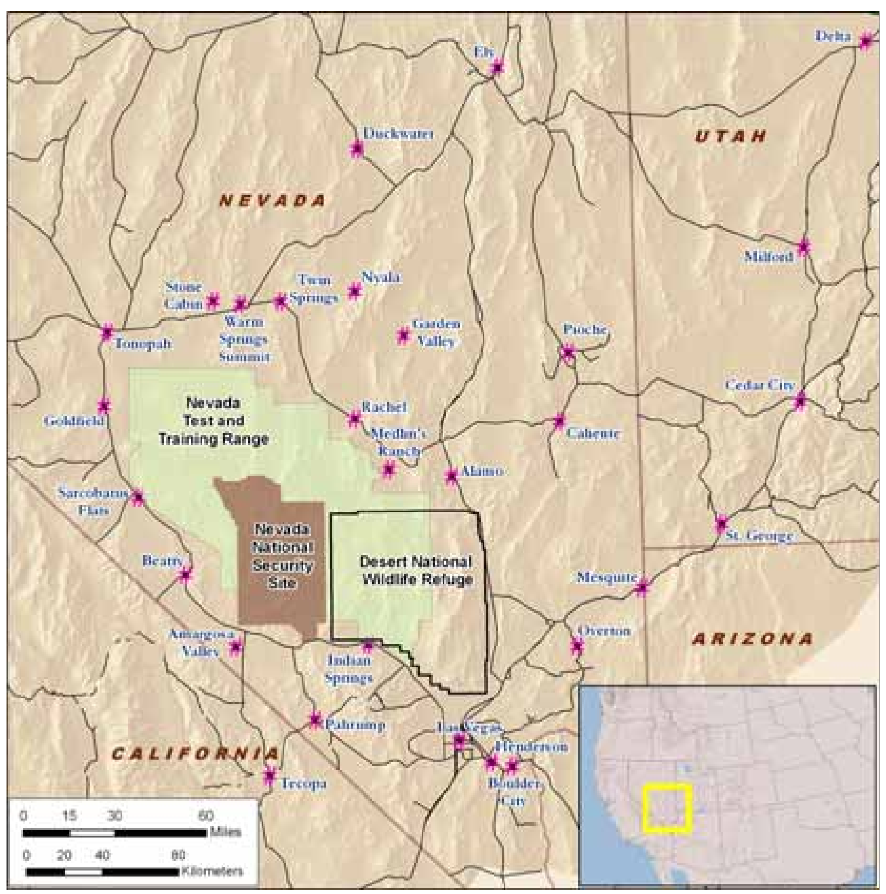
Nevada National Security Site

Community Environmental Monitoring Program (CEMP)

To date, monitoring station results show that tritium levels are at or below background. *

The CEMP samples water supplies yearly from selected communities that host a CEMP station. These stations test for the presence of man-made radioactivity. CEMP analyzes the samples for tritium because it bonds easily with water and typically is the first radioactive contaminant to be detected in groundwater.

CEMP monitoring test results are available at www.cemp.dri.edu



Twenty-nine radiation and air monitoring stations are located in communities and on ranches near the Nevada National Security Site.

- CEMP's network of monitoring stations use instruments to detect airborne radiation (if present) and record weather data. This information is available real-time on the CEMP web site at www.cemp.dri.edu.
- Private citizens operate CEMP monitoring stations in Nevada, Utah, and California communities and ranches near the Nevada National Security Site.
- Desert Research Institute administers the CEMP the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office.

Tritium Results from CEMP offsite water tests (^3H - pCi/L)

Location	2010	2009	2008‡	2007	2006	2005	2004	2003	2002	2001
Adaven Springs*	13.8	12.4	10.7	9.7	22.6	20	12	16	15	
Alamo^	-0.3	0.4	0.8	-6.4	-9.7	-4	-3	-1	2	7
Amargosa Valley^	-0.3	-0.1	0.0	6.4	-6.4	-3	-2	3	0.1	3
Beatty^	0.4	0.1	-0.2	3.2	-12.9	-3	-2	0	2	3
Boulder City*	22.6	21.6	24.1	19.3	35.4	24	29	35	27	34
Caliente^	4.7	4.7	5.4	3.2	-3.2	8	7	5	8	12
Cedar City^	-0.2	-0.1	0.2	6.4	0.0	3	-4	-4	-3	1
Delta^	0.1	-0.1	-0.1	3.2	6.4	-8	2	-1	-0.8	1
Duckwater^	0.2	0.1	0.3	6.4						
Ely*	2.7	2.7	2.8	16.1	9.7	-2				
Goldfield^	0.2	0.0	0.4	3.2	-9.7	0	-4	5	-0.3	<1
Henderson*	23.5	22.4	23.2	32.2	16.1	24	27	27	26	34
Indian Springs^	0.1	-0.3	0.1	3.2	9.7	-5	-1	4	5	2
Las Vegas^	0.3	0.8	0.8	12.9	3.2	-5	3	-2	1	<1
Medlin's Ranch*	8.4	3.8	5.1	3.2	0.0	10	9	9	4	13
Mesquite^	0.2	-0.1	0.0	0.0	0.0					
Milford^	-0.3	0.0	-0.3	0.0	12.9	1	-5	-2	-1	<1
Nyala Ranch^	0.0	0.5	0.5	-3.2	9.7	0	-1	-4	-1	
Overton^	0.0	0.1	-0.1	12.9	6.4	-4	3	2	0.4	1
Pahrump^	0.1	0.1	0.1	0.0	3.2	-5	-1	2	-2.0	1
Pioche^	-0.2	-0.1	0.1	0.0	6.4	-7	2	-1	4	<1
Rachel^	0.0	-0.1	-0.2	-6.4	3.2	-1	-1	-9	1	<1
Sarcobatus Flats^	0.4	0.3	0.1	19.3	-3.2	-3	3	-7	-4	
Stone Cabin Ranch*	0.6	0.5	0.8	-6.4	0.0	2	-2	3	2	
St. George*	8.5	9.3	9.4	22.6	9.7	8	-3	4	8	9
Tecopa^	0.6	0.4	-0.2							
Tonopah^	0.0	-0.3	-0.1	9.7	-3.2	-4	-2	4	-2	<1
Twin Springs^	0.0	0.0	-0.1	-9.7	3.2	-2	-3	-1	0.7	

* Sample taken from spring or surface water. ^ Sample taken from well water. ‡ In 2008, analyses began to be conducted using enriched gas proportional counting. Prior to that year gas proportional or liquid scintillation counting was used. The safe drinking water standard for tritium allows 20,000 pCi/L. Source: Nevada Test Site Environmental Reports
MDA 2001-2005= 21 pCi/L (enriched liquid scintillation counting)
MDA 2006, 2007= 24 pCi/L, 26.5 pCi/L respectively (gas proportional counting).
Some 2007 results were anomalously high and not repeated in subsequent samples.
MDA 2008-2010= ~1.0 pCi/L (enriched gas proportional counting)

***** Those results that are slightly above background are far below U.S. Environmental Protection Agency regulatory limits.

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April 2011, Log No. 2011-171

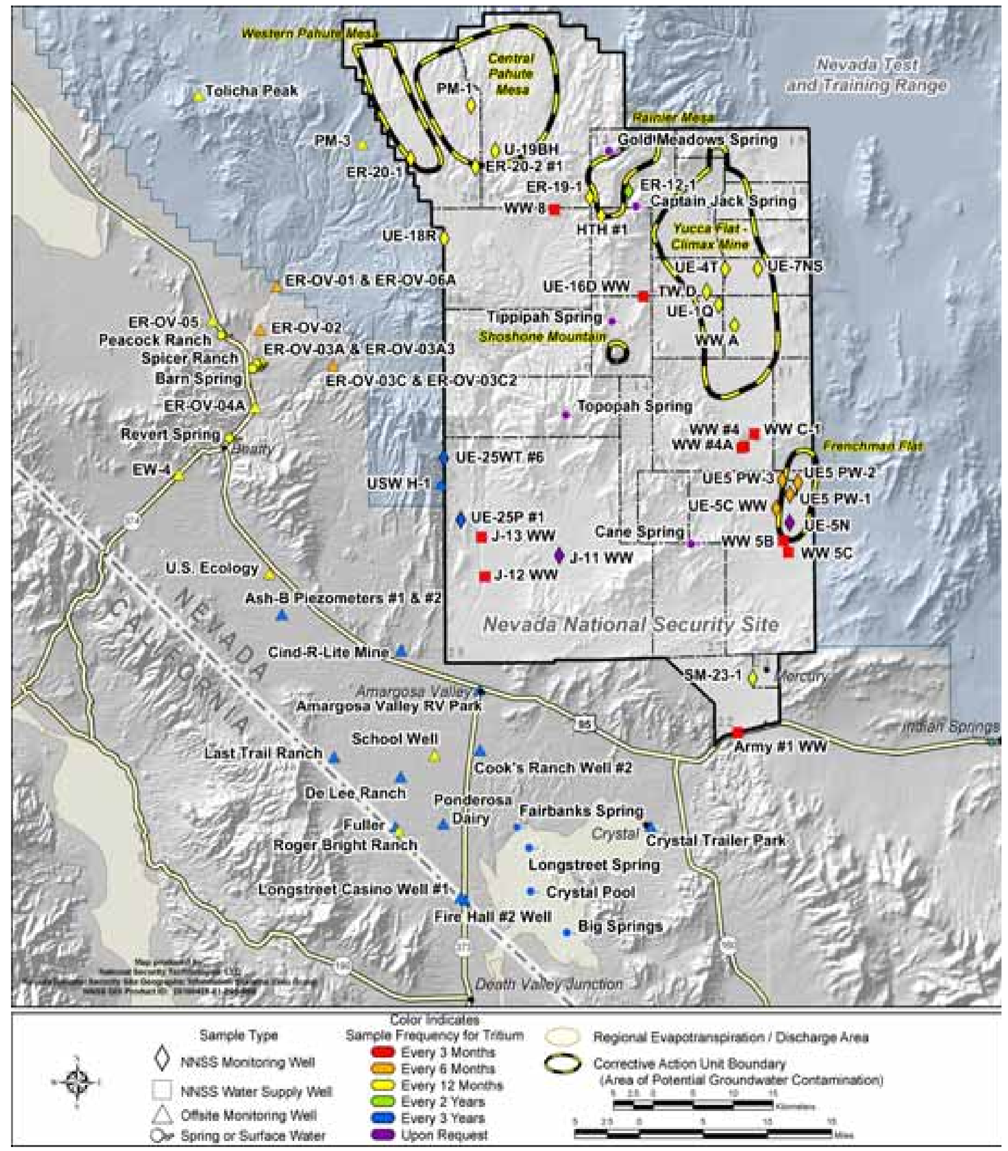
NNSA National Nuclear Security Administration

Nevada National Security Site

Routine Radiological Environmental Monitoring Program (RREMP)

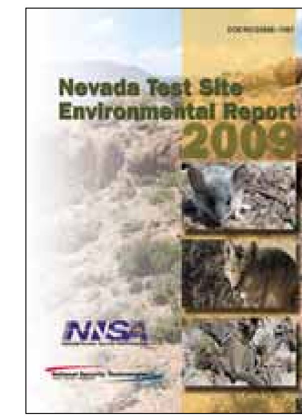
The NNSS monitors a comprehensive network of wells, springs and surface water locations.

- Wells and springs on the Nevada National Security Site are sampled to help locate groundwater contamination.
- In areas where groundwater contamination has been located on the Nevada National Security Site, wells and springs are monitored over time to determine if the levels of radioactivity are changing.
- Groundwater wells and springs near the Nevada National Security Site are monitored to determine if any radioactivity has migrated off the site.



Planned sample frequencies for wells and springs in the RREMP network differ and are related to their proximity to source areas (UGTA CAUs) and the availability of baseline data for each well/spring. Changes in planned sample frequencies are primarily related to evolving objectives, owner requests, and well/spring accessibility (e.g., road and weather conditions, owner permission).

Monitoring results are updated annually in the Nevada National Security Site Environmental Report. This report is available at www.nv.energy.gov/library/publications/aser.aspx



Sampling results from monitoring sites located off the Nevada National Security Site (2000-2010)

Location	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
	Average Tritium Concentration (pCi/L)										
Non-Potable NNSA/NSO Wells											
Ash-B Piezometer #1	-	3.0	-	-	-	16.8	-	-	-7.0	-	16.4
Ash-B Piezometer #2	-	7.4	-	-	-	7.4	-	-	-8.8	-	-6.3
ER-OV-01	-1.5	-0.2	-3.7	-3.8	10.9	5.2	-	18.3	-3.5	-13.4	-2.4
ER-OV-02	-4.0	-1.8	2.0	2.1	8.8	5.7	-5.9	6.7	-1.9	-8.1	-5.8
ER-OV-03A	-2.3	-4.6	9.1	-6.1	8.1	24.1	-6.9	1.0	-4.4	-8.7	-6.2
ER-OV-03A3	0.0	0.0	3.3	-11.0	12.4	15.6	-9.0	-	0.0	4.1	-5.6
ER-OV-03C	-3.2	1.4	-10.5	-5.9	20.7	9.9	-7.2	12.3	-0.7	-13.1	-4.6
ER-OV-03C2	-3.6	-0.6	-3.0	-12.8	16.7	13.9	7.8	20.8	2.2	-10.5	-6.5
ER-OV-04A	1.7	3.2	-8.4	-4.3	23.2	3.3	-10.9	20.1	0.2	-6.8	-6.0
ER-OV-05	-4.1	3.3	4.2	-12.9	9.6	9.0	-4.8	-8.5	4.2	-1.2	-9.8
ER-OV-06A	-1.8	1.4	-10.7	-11.5	10.6	8.7	-	4.3	3.9	-11.9	-4.1
PM-3 (1560 ft bgs)	47.6	23.8	21.9	16.0	29.0	9.3	18.8	-9.5	3.4	-3.6	0.5
PM-3 (1993 ft bgs)	27.1	4.7	8.5	15.8	3.5	10.1	-	-4.9	-1.0	-17.1	-4.7
Offsite Private/Community Drinking Water Wells											
Amargosa Valley RV Park	-	6.1	-	-	-	1.3	-	-10.4	-	4.4	1.4
Barn Well #2 - Ponderosa Dairy	-	20.1	-	-	-	3.5	-	-	-	-	19.3
Beatty Water and Sewer (a)	-	-	-	-	11.6	5.0	6.0	29.9	0.7	-8.9	6.8
Cind-R-Lite Mine	-	-9.0	-	-	-	0.1	-	9.4	-	-6.6	-1.6
Cook's Ranch Well #2	-	-6.0	-	-	-	6.5	-	-20.1	-	-0.4	9.5
Crystal Trailer Park (b)	-	-3.8	-	-	-	-8.4	11.2	-10.9	-	-13.9	-9.7
DeLee Ranch	-	-4.0	-	-	-	3.3	-	-13.2	-	-6.0	3.8
EW-4 Well (b)	0.6	-0.8	-	-	-	-	-	-	-	-	-
Fire Hall #2 Well	-	3.0	-	-	-	-2.7	-	8.3	-	-11.8	-7.9
Fuller Property (b)	-	-6.9	-	-	11.1	-5.4	-	-	-	-	-
Last Trail Ranch	-	1.5	-	-	-	2.1	-	-	-	0.0	-7.0
Longstreet Casino Well #1	-	-3.0	-	-	-	0.4	-	-16.1	-	-0.5	-
Roger Bright Ranch	0.14	-3.7	-	-16.8	14.1	-7.9	8.9	-7.9	14.8	-1.0	-4.7
School Well	-1.3	4.0	-	-1.0	19.9	4.5	3.0	-13.9	7.4	-6.3	-7.0
Tolicha Peak	0.54	-1.2	-	-6.2	9.3	-1.0	9.5	7.1	-10.3	-0.6	4.7
U.S. Ecology	0.53	-10.2	-	2.1	12.9	4.6	11.2	10.0	37.4	-6.2	0.0
Offsite Springs/Surface Waters											
Barn Spring (b)	-	-	-	6.8	-	-	-	-	-	-	-
Big Springs	-	-5.1	-	-	18.7	-	-	-4.7	-9.6	-2.0	-7.5
Crystal Pool	-	-10.7	-	-	13.9	-	-	-2.3	-12.8	-3.0	-4.7
Fairbanks Spring	-	-0.7	-	-	14.0	-	-	0.8	-8.1	4.0	-4.9
Longstreet Spring	-	-11.6	-	-	13.4	-	-	15.4	-15.2	-1.0	-3.6
Peacock Ranch	-2.2	0.9	-	-2.9	24.9	-1.1	-	-	-7.9	-4.0	-1.0
Revert Spring	-3.0	-1.3	-	-4.5	15.4	0.6	-1.1	-5.4	-9.5	-2.3	-2.1
Spicer Ranch	-3.1	-7.1	-	-6.9	22.2	10.6	6.7	-7.3	-26.7	-4.4	4.6

- Not Sampled
(a) Site is no longer monitored
(b) Site monitored at Nevada Site Office request; no set schedule

Reported tritium values are differences between measurements made of water samples obtained at target locations (wells and springs) and measurements of background water samples. The inherent randomness of radioactive emissions and the generally low concentrations of tritium in well/spring samples make it possible to obtain background measurements larger than well/spring measurements, resulting in negative reported values.

safety ❖ performance ❖ cleanup ❖ closure

National Nuclear Security Administration

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May 2011, Log No. 2011-169

Nevada National Security Site

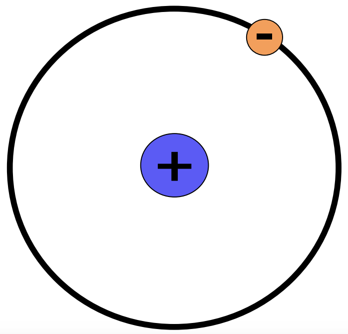
Radiation Facts

Radiation occurs naturally in the environment.

Tritium and What it Means to You

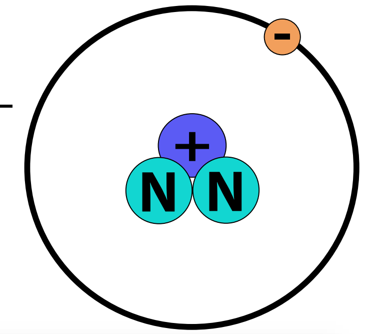
Hydrogen Atom

One proton
No neutrons
One electron



Tritium Atom

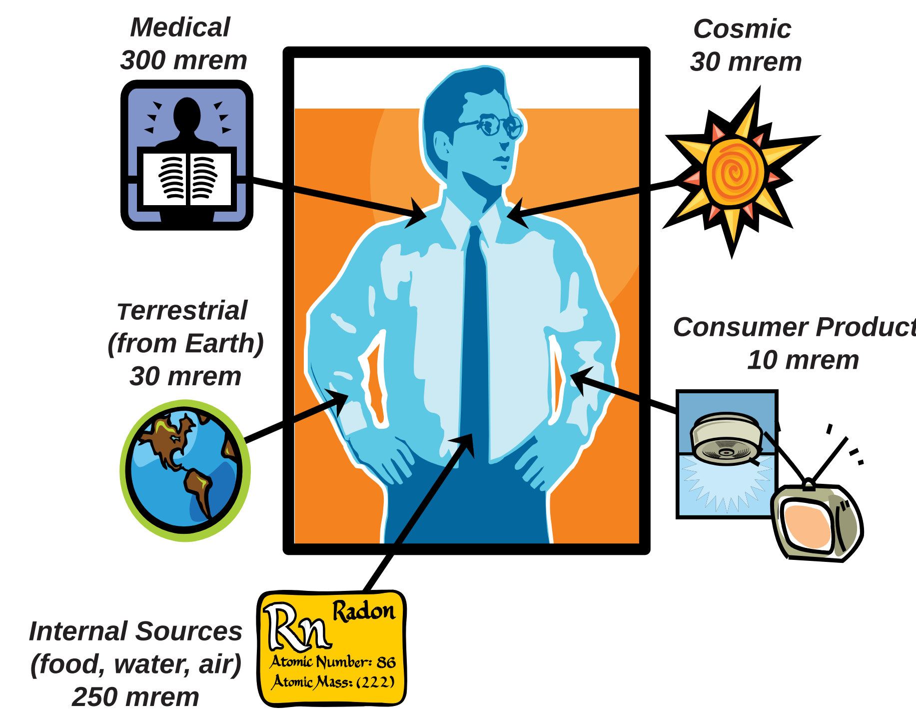
One proton
Two neutrons
One electron

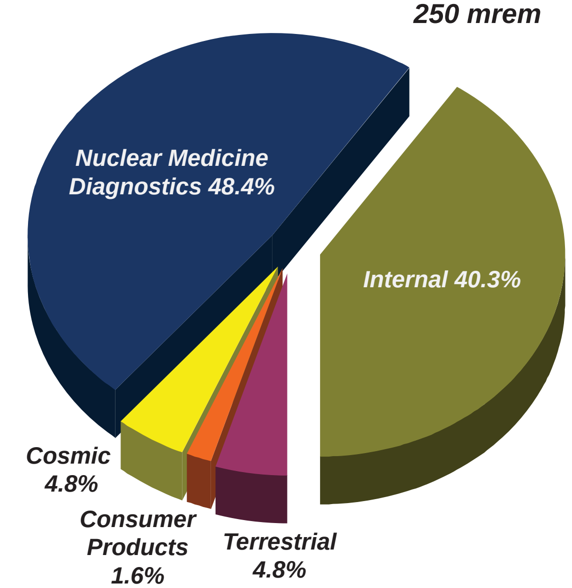


- Tritium is a radioactive form (isotope) of hydrogen
- Half-life is 12.3 years
- Like hydrogen, tritium can bond with oxygen to form tritiated water which is chemically identical to normal water
- Tritium naturally occurs in surface waters at 10 to 30 picocuries per liter (U.S. Environmental Protection Agency standard for safe drinking water is 20,000 picocuries per liter [4 mrem per year])
- Tritium primarily enters the body when people eat or drink water containing tritium
- Tritium emits a weak form of radiation (low-energy beta particle) that cannot penetrate deeply into tissue or travel far in air
- Half of tritium is excreted about 10 days after exposure

**Rem* measures the biological damage, or "dose" of radiation.
A ***millirem*** (mrem) is one one-thousandth of a rem.

Average Annual Radiation Source and Dose*





The average person receives approximately 620 mrem of radiation per year from all sources. The maximum legal radiation dose limit for a person whose profession permits exposure is 5,000 mrem per year.

Source: NCRP Report No. 160, March 3, 2009

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May 2011, Log No. 2011-165

National Nuclear Security Administration

Nye County Groundwater Evaluation Program

Levi Kryder, Nye County Nuclear Waste Repository Project Office

Beatty Groundwater Open House May 25, 2011

INTRODUCTION

Under a grant from the Department of Energy (DE-FG52-06NA27205), the Nye County Nuclear Waste Repository Project Office (NWRPO) is currently conducting groundwater characterization studies in southern Nye County. The objective of these groundwater evaluation (GWE) studies is to better understand groundwater flow and chemistry conditions in the Pahrump, Amargosa, and Oasis Valleys.

WORK ELEMENTS

Work under this grant has been divided into four work elements:

1. Water resource characterization and monitoring
2. Water resource sustainability
3. Water quality protection
4. Resource management

Work previously accomplished under the GWE grant includes:

- Geophysical studies and determination of soil characteristics near Ash Meadows (Eric Parks, 2010)
- Established the Nye County Water District
- Construction of a groundwater flow model for the Pahrump Valley (Comartin, 2010)

WATER RESOURCE CHARACTERIZATION AND MONITORING

NWRPO staff and contractors drilled, sampled, and completed 14 wells (Panel A) in Pahrump, Amargosa, and Oasis Valleys in two phases:

- May to June 2010
- November 2010 to January 2011

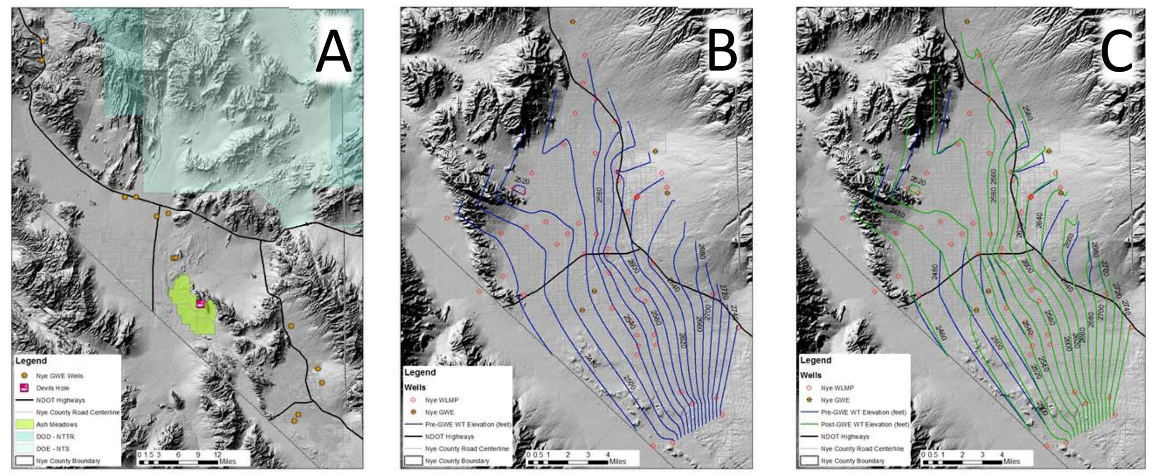
Specific objectives are to infill data gaps in the Nye County Water Level Measurement Program (WLMP), collect data on the head relationships at the Gravity Fault, and collect baseline groundwater flow data.

Boreholes were generally drilled to a depth of 100 feet below the top of the water table, cuttings samples collected on 5-foot intervals, and the boreholes geophysically logged. Each borehole was then completed as a 4-inch PVC piezometer. An example well completion is shown in Panel H.

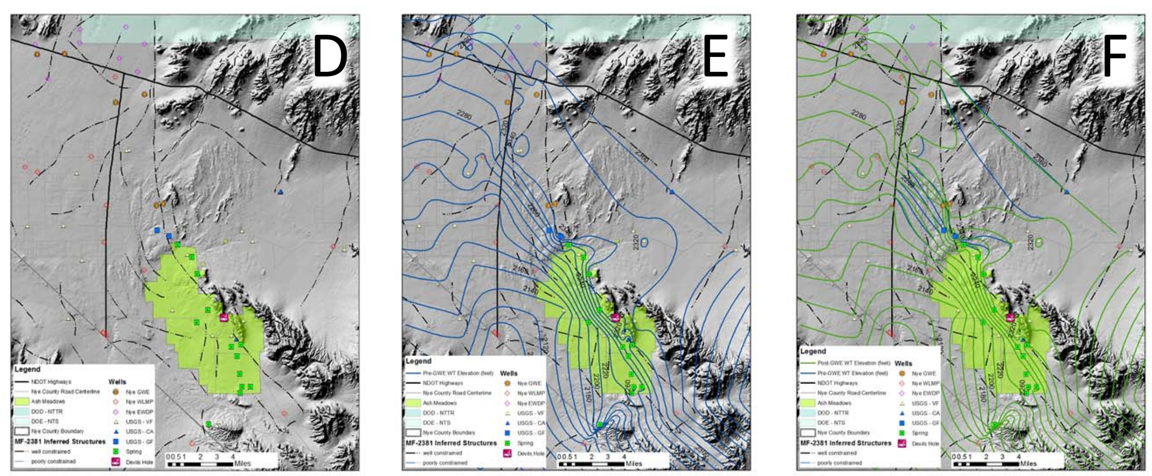
Pump testing, well development, and water sampling activities are currently underway at the recently completed wells.

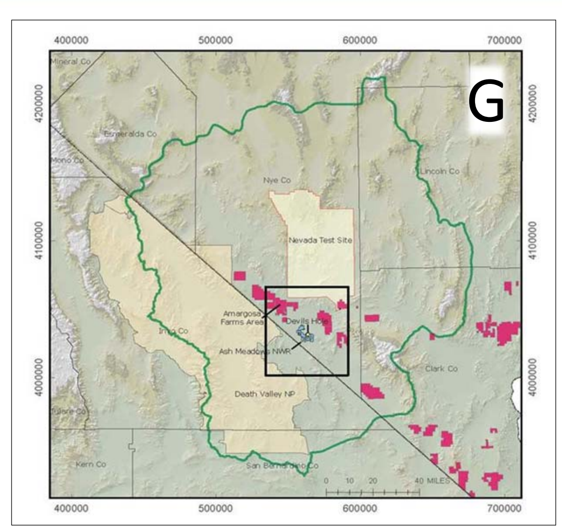
Each of the GWE wells have been incorporated into the WLMP, and water levels are measured approximately every six weeks. Water table elevation data in Pahrump were contoured prior to incorporation of GWE data (Panel B), and after incorporation of GWE data (Panel C). Addition of the GWE data better defines the contours in the northeastern and southwestern parts of the Valley.

Panel D shows the GWE wells in the Amargosa Valley area. Three of these wells straddle the Gravity Fault. Water table elevation data were contoured before incorporation of the GWE data (Panel E) and after incorporating the GWE data (Panel F). Addition of these data seems to have a particularly strong effect on water table elevations in the Gravity Fault area.

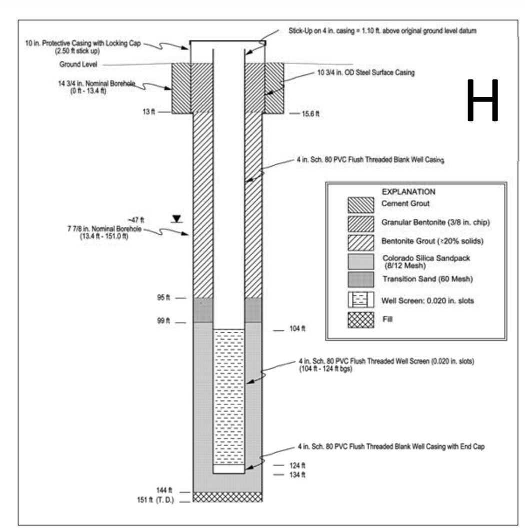


Panels showing location of GWE wells and changes in water table elevation contours based on incorporation of GWE water level data into WLMP data set. Specific panels are: A – map showing location of GWE wells in Pahrump, Amargosa, and Oasis Valleys; B – water table elevation contours (blue lines) in Pahrump Valley before incorporation of GWE water level data; C – water table elevation contours in Pahrump Valley after incorporation of GWE water level data (green lines); D – GWE and other wells in the Amargosa Desert in relation to the Gravity Fault; E – water table elevation contours in Amargosa Desert before incorporation of GWE water level data (blue lines); and F – water table elevation contours in Amargosa Desert after incorporation of GWE water level data (green lines).





Panel G. Map showing the boundary of the DVRFSM (green line) and SAMM (black line). Proposed solar developments (as of April 2009) are shown in pink. From Belcher and Bright 2009.



Panel H. Example well completion diagram for recently drilled GWE wells. All wells were completed as 4-inch Schedule 80 PVC piezometers.

WATER RESOURCE SUSTAINABILITY

Nye County is cooperating with the US Geological Survey (USGS) Nevada Water Science Center on two studies:

- Evapotranspiration (ET)
- Southern Amargosa eMbedded Model (SAMM)

Previous USGS studies may have underestimated the amount of recharge in the Amargosa Desert hydrographic area by as much as 28,000 acre-feet. USGS and NWRPO personnel will collect ET data at two sites where groundwater is shallow (less than 50 feet) to determine the ET rate, which will tell us how much ground water discharge potentially occurs, and may provide better control on recharge estimates.

The SAMM uses local grid refinement within the Death Valley Regional Flow System Model (DVRFSM), which will be used to simulate local pumping effects. The grid size in the SAMM is 500 x 500 meters, approximately nine times smaller than the DVRFSM grid. Additionally, hydrologic and geologic frameworks from the DVRFSM are being refined for the SAMM. The DVRFSM and SAMM areas are shown in Panel G.

WATER QUALITY PROTECTION

To expand on the regional ground water chemistry data set, NWRPO is collaborating with Desert Research Institute to collect water samples at 25 wells and springs in Pahrump Valley, Amargosa Desert, and Oasis Valley. Sampling is currently underway at the new GWE wells.

Sample analyses include:

- Major anions and cations, trace metals, nutrients
- Selected isotopes
- Gross alpha, beta, and Tritium
- DNA
- Radiocarbon

RESOURCE MANAGEMENT

One of the major challenges to development in the Lathrop Wells area is availability and quality of groundwater. Many of the wells in the area have low yields and poor water quality (i.e., Arsenic concentrations generally exceed EPA Safe Drinking Water Act Standards). Under this grant, Day Engineering completed a Preliminary Engineering Report evaluating groundwater sources and alternatives in the area.

One Nye County well was identified as a potential water supply well for development in the area; however, one of the major challenges remaining is the construction of a pipeline to move the water from the well to its point of use.

REFERENCES

- Belcher, W. R., and Bright, D. J. 2009. Project proposal for evaluation of ground-water flow in the southern part of Amargosa Desert, Nevada and California: Phase 2. US Geological Survey proposal NV10-XX.
- Comartin, L. 2010. Development of a groundwater flow model of Pahrump Valley, Nye County, Nevada, and Inyo County, California for basin-scale water resource management. University of Nevada, Reno: Master of Science thesis.
- Parks, E. M. 2010. Analysis of electromagnetic and seismic geophysical methods for investigating shallow sub-surface hydrogeology. Brigham Young University: Master of Science thesis.
- Workman, J. B., et al. 2002. Geologic map of the Death Valley ground-water model area, Nevada and California. US Geological Survey: Miscellaneous Field Studies Map MF-2381.

Far-Field Hydrogeologic Characterization Relevant to Underground Nuclear Test Areas – A Nye County Proposal

Levi Kryder – Nye County Nuclear Waste Repository Project Office

Beatty Groundwater Open House May 25, 2011

INTRODUCTION

Nye County is committed to protecting the health, welfare, and economic well-being of its citizens, particularly in areas where past nuclear testing by the US Department of Energy (DOE) has the potential to affect the population. Recent data collected by the DOE Underground Test Area (UGTA) program indicate that contaminants from decades-old nuclear tests conducted on the Nevada National Security Site (NNSS) (formerly the Nevada Test Site) are migrating off the site. In particular, the recently drilled UGTA well ER-EC-11, located just off Pahute Mesa on the US Air Force Nevada Test and Training Range (NTTR) and southwest of the BENHAM and TYBO nuclear tests, showed elevated amounts of tritium (~12,500 picocuries per liter; DOE/NNSA 2009). Groundwater flow modeling efforts conducted by UGTA indicate that radionuclides in this area are migrating southwest and could eventually reach the town of Beatty (Stoller-Navarro 2009).

PURPOSE

This proposal presents a series of locations for exploratory drilling, well construction, and testing; water sampling; and water level monitoring. The work proposed is intended to characterize groundwater flow paths and hydrogeology down gradient from designated Corrective Action Units (CAUs) at legacy nuclear testing areas (e.g., Frenchman Flat (CAU 98), Yucca Flat (CAU 97), and Western Pahute Mesa (CAU 102). Where possible, these activities will be conducted in cooperation with DOE's UGTA program to provide far-field data that can be used as part of the contaminant modeling/migration prediction effort. These data will supplement data currently being collected as part of DOE's UGTA program and should help to improve estimates of travel times for radionuclides escaping the testing areas.

QUALIFICATIONS

Since 1994, the Nye County Nuclear Waste Repository Project Office (NWRPO), as part of its DOE-funded Early Warning Drilling Program (EWDP) and Independent Scientific Investigation Program (ISIP), has drilled and completed 40 wells down gradient of the proposed nuclear waste repository site on the southwestern boundary of the NNSS. These wells were drilled to characterize the geology and groundwater flow system down gradient from the proposed repository site, and provided the infrastructure for a number of successful tests and data collection efforts, including:

- Aquifer tests
- Tracer tests (single-well, cross-hole, and natural-gradient)
- Conventional and cutting-edge geophysical logging
- Baseline water chemistry
- Water level measurements

A number of these EWDP and ISIP data collection efforts were conducted in cooperation with the DOE, US Geological Survey (USGS), Los Alamos National Laboratory, Lawrence Livermore National Laboratory, and other agencies. All data collection was performed in accordance with the NWRPO Quality Assurance (QA) program (which was accepted by the US Nuclear Regulatory Commission), and much of the data were used by DOE in developing the hydrologic and transport models that supported the repository License Application.

In 2006, Nye County secured a grant from DOE's Nevada Site Office for the evaluation of groundwater in southern Nye County. Under this Groundwater Evaluation (GWE) grant, the NWRPO has implemented several studies to better understand the quantity, quality, and availability of groundwater resources in the Oasis, Amargosa, and Pahrump Valleys. These studies include:

- Shallow water-table piezometer well drilling program
- Evapotranspiration studies in Amargosa Valley (cooperative with USGS)
- Groundwater flow models in Pahrump and Amargosa Valleys (cooperative with Desert Research Institute and USGS)
- Water sampling and analysis program

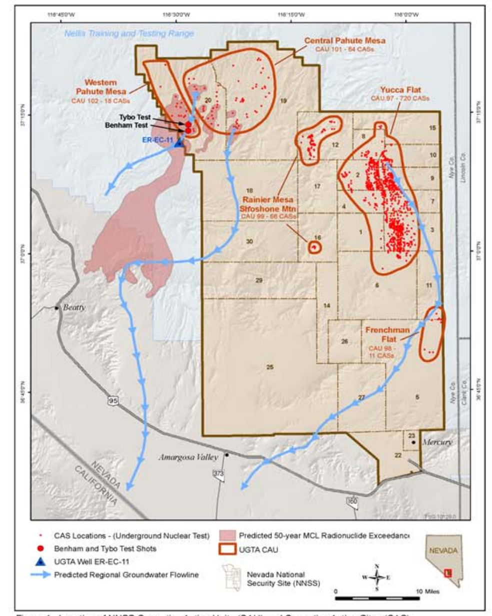


Figure 1. Location of NNSS Corrective Action Units (CAU) and Corrective Action Sites (CAS).

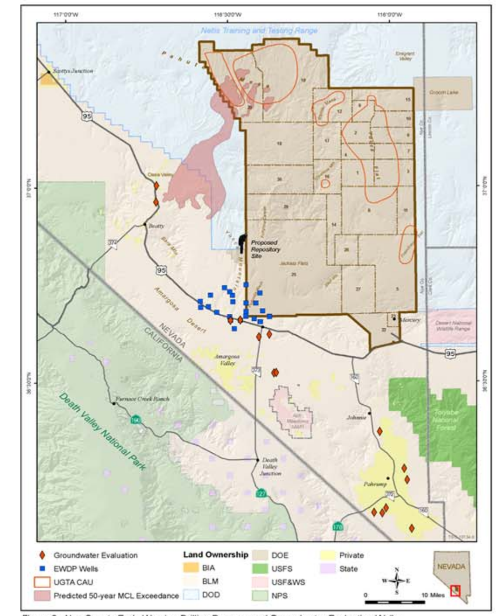


Figure 2. Nye County Early Warning Drilling Program and Groundwater Evaluation Wells.

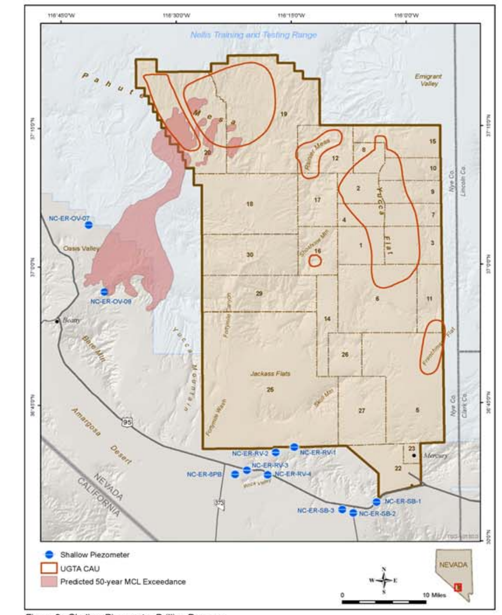


Figure 3. Shallow Piezometer Drilling Program.

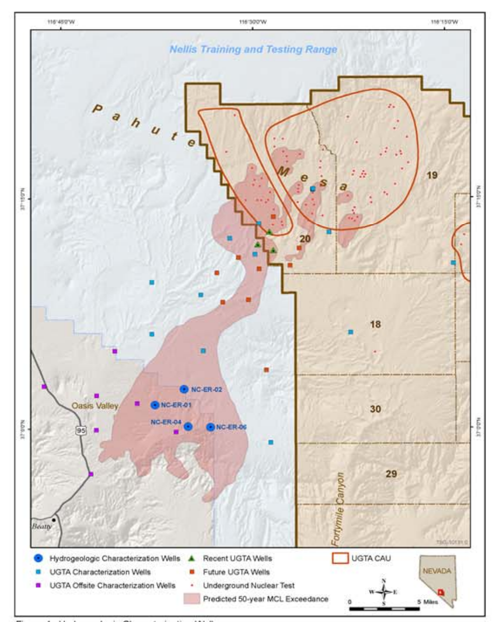


Figure 4. Hydrogeologic Characterization Wells.

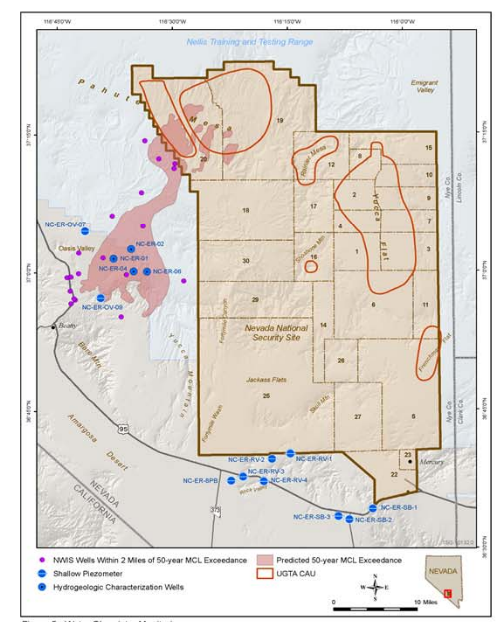


Figure 5. Water Chemistry Monitoring.

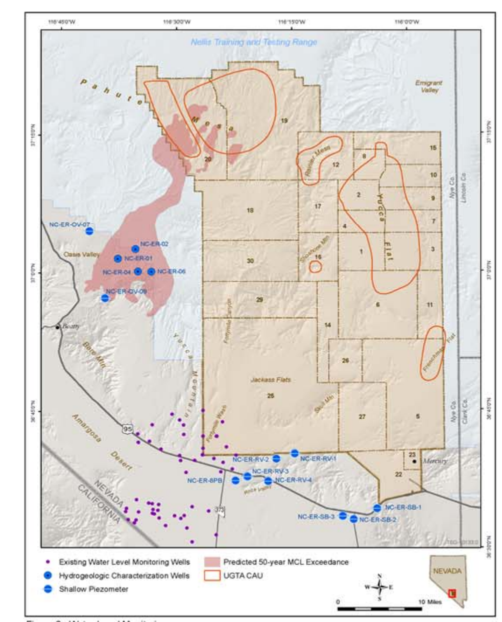


Figure 6. Water Level Monitoring.

PROPOSED ACTIVITIES

This section describes the scientific activities required to better characterize the groundwater flow system down gradient from the legacy testing areas discussed above. The first of the drilling activities are intended to characterize the shallow subsurface (i.e., the unsaturated zone and top of the saturated zone) at off-site locations in the areas down gradient from Pahute Mesa and Frenchman and Yucca Flats. These wells are located in or near potential flow paths (DOE 2007), in areas where radionuclides are not currently considered to be moving (DOE 1997).

The second major activity involves the drilling, completion, and testing of larger-diameter wells sited within the predicted 50-year Maximum Contaminant Level (MCL) exceedance area depicted down gradient from Pahute Mesa in Stoller-Navarro (2009). Because radionuclides are presently moving offsite from nuclear test locations on Pahute Mesa, these wells will serve as "early warning" monitoring locations, and are considered to be of the highest priority to Nye County.

The last work activity involves collection and analysis of groundwater chemistry samples and addition of the new wells to the Nye County water level monitoring program (WLMP). Selected nearby wells may also be included in the water chemistry and water level monitoring effort.

Nevada Site Specific Advisory Board

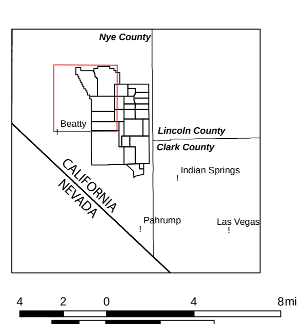
Current and past NSSAB members reside in Beatty, Amargosa Valley, Pahrump, and Las Vegas.

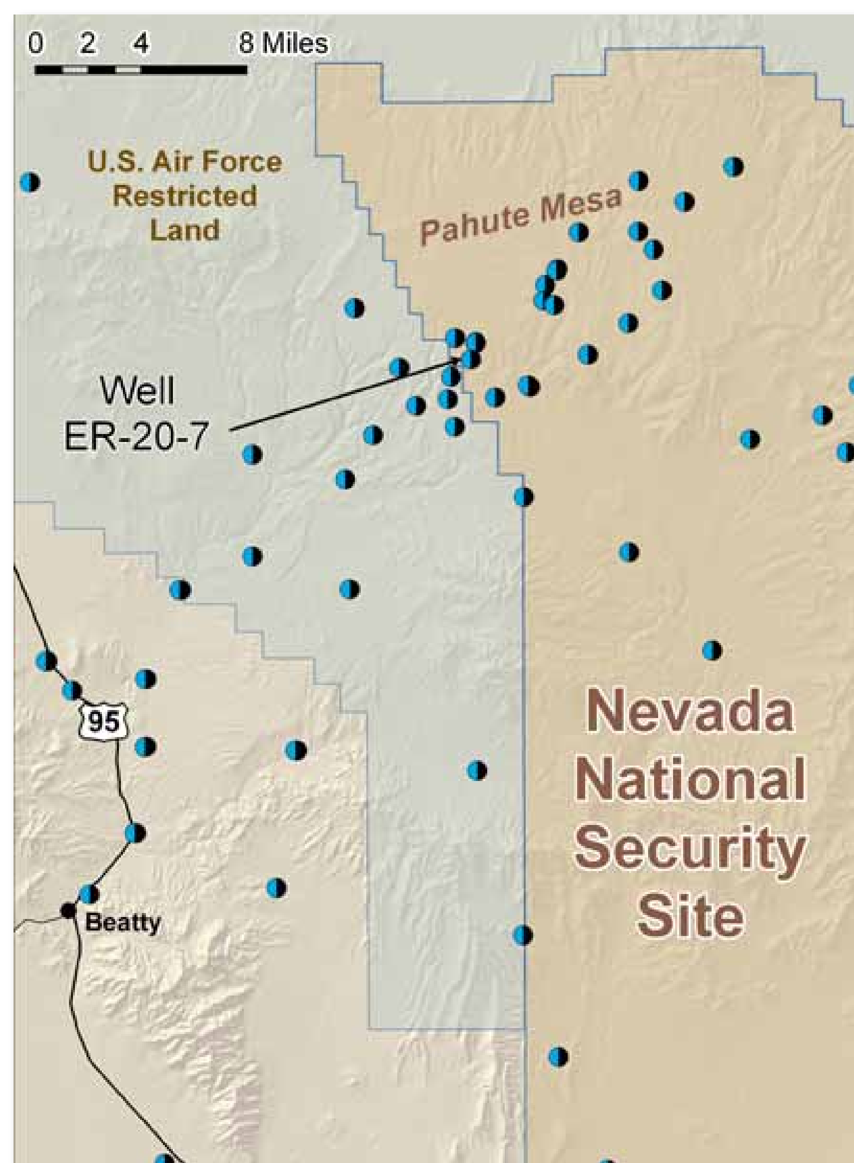
The Nevada Site Specific Advisory Board (NSSAB) is made up of southern Nevada residents and is federally chartered to provide recommendations to the Environmental Management Program at the Nevada National Security Site.

In 2002, the U.S. Department of Energy asked the NSSAB to site the location of a groundwater well that could be used to gain data for the groundwater characterization activities. In 2006, after four years of extensive research, the NSSAB recommended three groundwater wells on and near Pahute Mesa. In 2009, the U.S. Department of Energy drilled well ER-20-7, which was one of the NSSAB's recommended sites.

Nevada Site Specific Advisory Board members tour the drill site they recommended. Well ER-20-7 is located on Pahute Mesa at the Nevada National Security Site.

A Nevada Site Specific Advisory Board meeting held in Las Vegas, Nevada





Federal Groundwater Sampling Location

safety ❖ performance ❖ cleanup ❖ closure

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National Nuclear Security Administration
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Did You Know...

the

Nevada Test Site

is now the...

NNSA
National Nuclear Security Administration

Nevada National Security Site

On August 23, 2010, National Nuclear Security Administration (NNSA) Administrator Thomas D'Agostino joined representatives from Nevada's congressional delegation, the U.S. Department of State, U.S. Department of Defense and the U.S. Department of Homeland Security to announce the new name of NNSA's 1,360 square mile facility located 65 miles northwest of Las Vegas.

The new name for the site – the Nevada National Security Site (NNSS) – better reflects the diversity of nuclear, energy and homeland security activities conducted at the site.

For further NNSS information contact:
Office of Public Affairs
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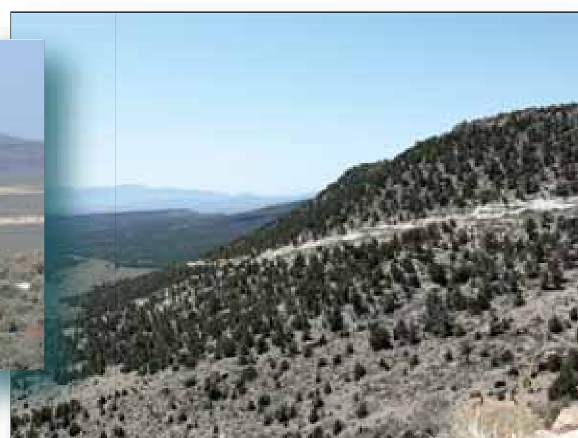
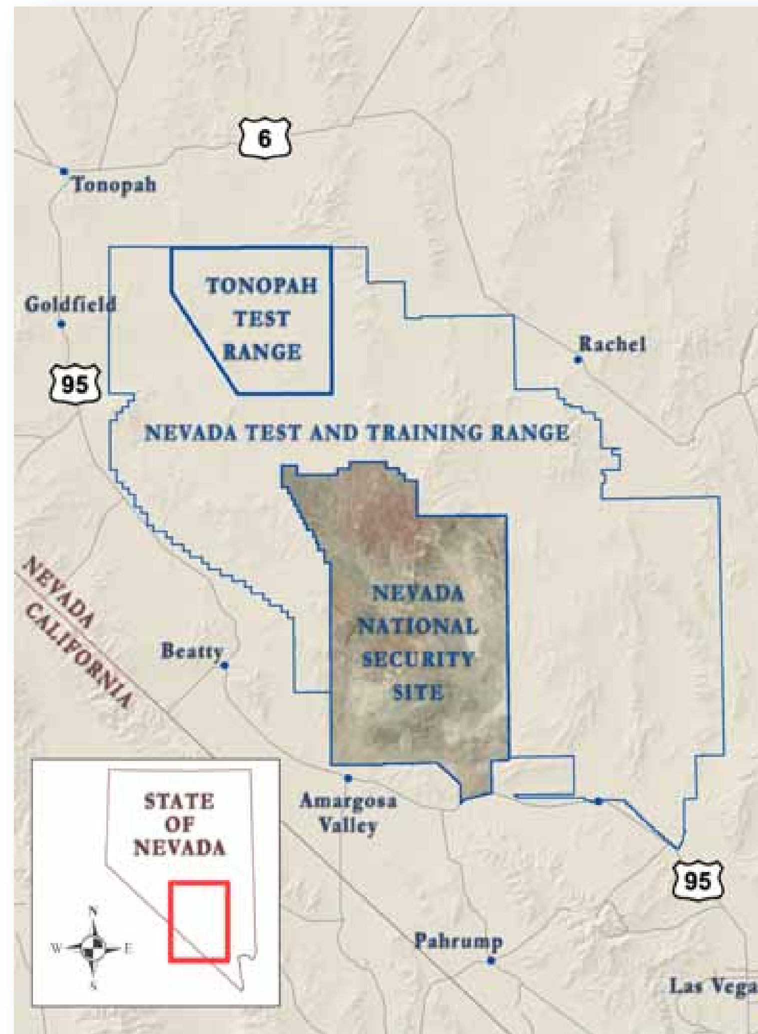
NNSA
National Nuclear Security Administration

Nevada National Security Site (NNSS)

A large, geographically diverse outdoor laboratory, the NNSS is a preferred testing ground for National Nuclear Security Administration (NNSA) defense programs as well as many other research and development efforts.

- Big - 1,360 square miles
- Secure - Access to the site is controlled
- Remote - Surrounded by federally owned land



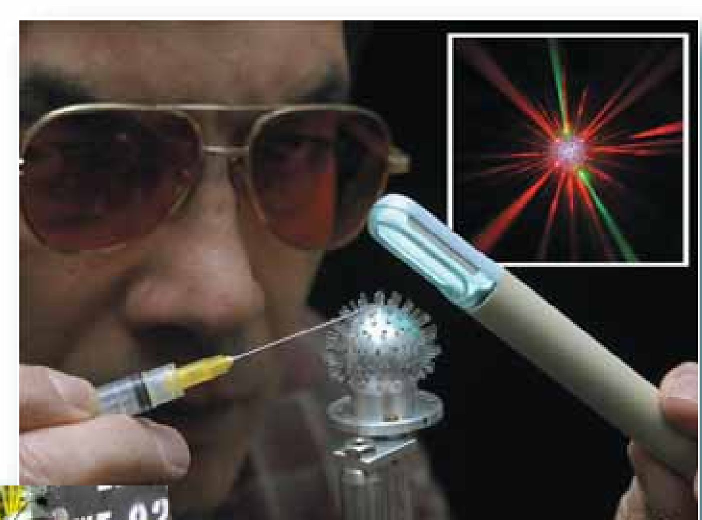


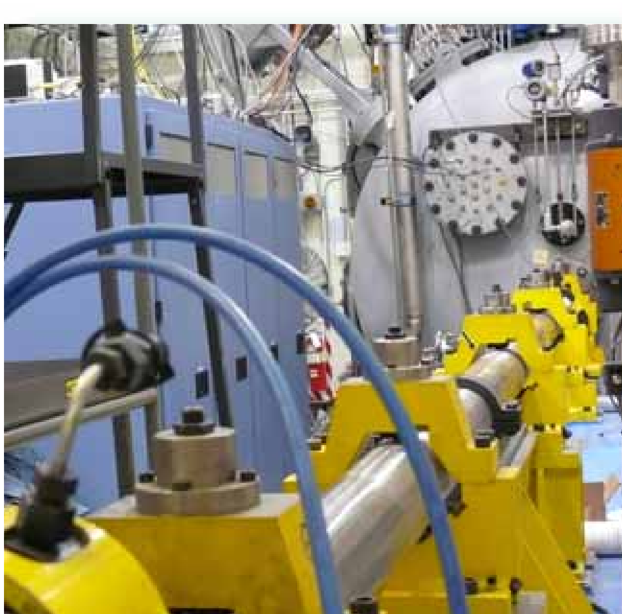
NNSS Programs

Defense Experimentation and Stockpile Stewardship

A primary mission of the NNSS is to help ensure that the nation's nuclear weapons remain safe, secure, and reliable. The Stockpile Stewardship program conducts a wide range of experiments using advanced diagnostic technologies, many of which were developed at the NNSS.

- Device Assembly Facility
- Criticality Experiments Facility
- U1a Complex
- Joint Actinide Shock Physics Experimental Research
- Big Explosives Experimental Facility
- Dense Plasma Focus





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National Nuclear Security Administration

Nevada National Security Site (NNSS)

Nevada National Security Site

NNSS Programs

Homeland Security and Defense Applications

Homeland Security and Defense Applications personnel are the nation's experts in detecting and locating "dirty bombs," "loose nukes," and radiological sources. They train and enable our nation's first responders who would be among the first to confront a radiological or nuclear emergency.

- Remote Sensing Laboratory
- Federal Radiological Monitoring and Assessment Center
- T-1 Training Area
- Nonproliferation Test and Evaluation Complex
- Radiological/Nuclear Countermeasures Test and Evaluation Complex


Aerial Radiation Measurement


Plume Mapping


Emergency Response Training

National Center for Nuclear Security

As the United States embarks on a new era of arms control, the tools for treaty verification must be more accurate and reliable and must work at stand-off distances. The National Center for Nuclear Security is poised to become the proving grounds for these technologies.

Environmental Management

The Environmental Management Program addresses the environmental legacy from historic nuclear weapons-related activities, while ensuring the health and safety of workers, the public, and the environment.

- Environmental Restoration
- Waste Management


Low-Level Radioactive Waste Disposal

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NNSA National Nuclear Security Administration