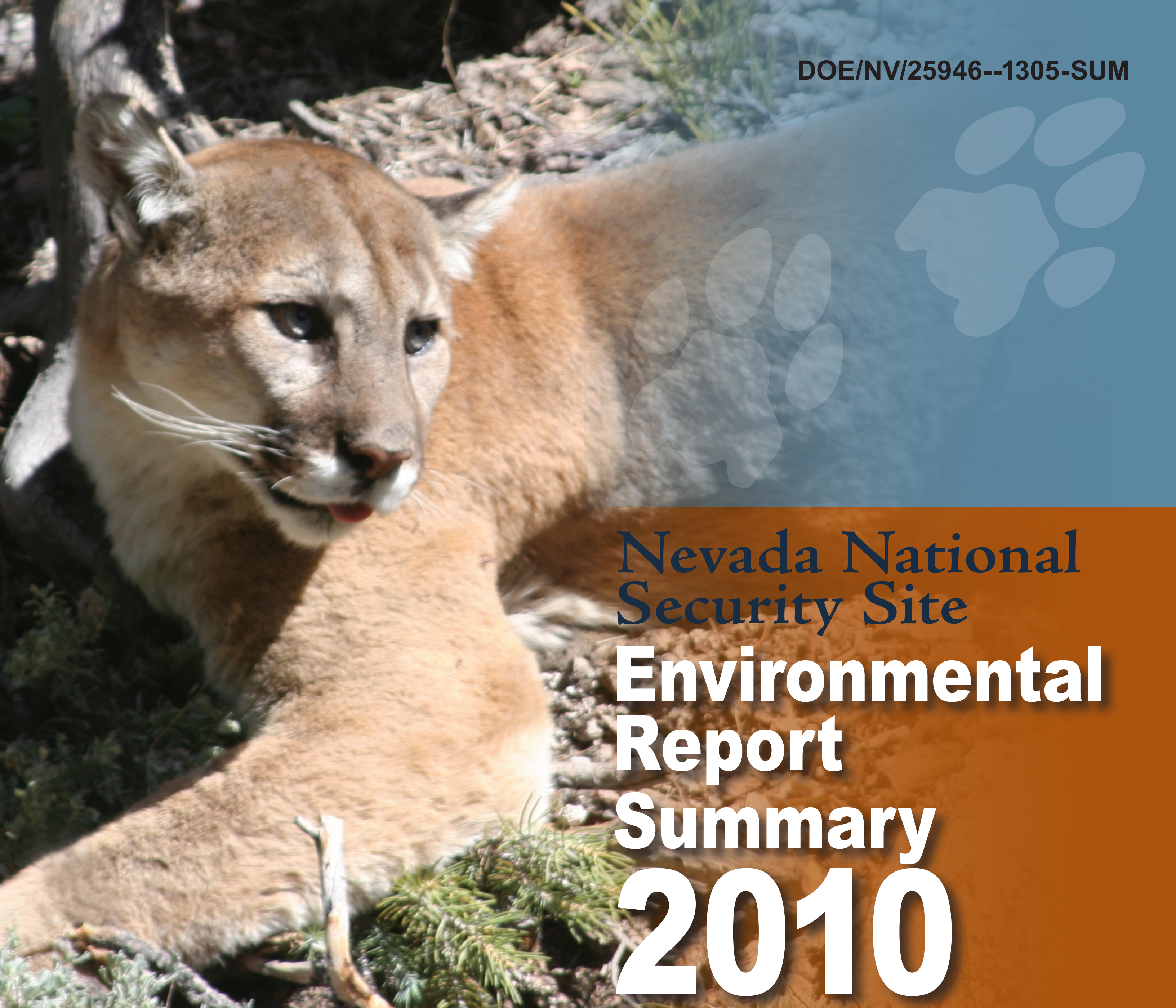

DOE/NV/25946--1305-SUM

Nevada National Security Site

Environmental Report Summary 2010

September 2011

Nevada National Security Site

Managed and Operated by National Security Technologies, LLC

National Security Technologies LLC

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The information presented in this document is explained in greater detail in the ***Nevada National Security Site Environmental Report 2010*** (DOE/NV/25946--1305). A compact disc of this document is included on the back inside cover. This document can also be downloaded from the U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office at **http://www.nv.energy.gov/library/publications/aser.aspx**.

For more information about the Nevada National Security Site Environmental Report, contact **Pete Sanders** at **(702) 295-1037** or **sanders@nv.doe.gov**.

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Nevada Site Office

By:

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Front cover photographs ...
This 140-pound male puma (mountain lion) was captured April 19, 2011, on Timber Mountain in the west-central area of the NNSS. He is helping researchers understand where these elusive predators live, what they eat, and how best to manage the potential risks to workers who have experienced an increase in puma sightings over the past 5 years. The puma study began in December 2010 with the goal of tracking four pumas, fitted with Global Positioning System collars, over a 2-year period. Two female pumas were previously captured and collared in December 2010 and January 2011. Prior to collaring and releasing the animals, scientists collect several measurements as well as hair and blood samples. The study is led by Dr. David Mattson of the U.S. Geological Survey. Check NNSA/NSO news releases regarding this study at **http://www.nv.energy.gov/outreach/news/**.

Back cover photograph ...
A Great Basin collared lizard *(Crotaphytus bicinctores)* on the NNSS watches for prey. This species occurs in the Mohave, Sonoran, and Great Basin deserts, usually in rocky desert scrub habitat. They have powerful jaws, are fast-moving ambush predators, and are commonly seen basking on rocks. They hunt smaller lizards and invertebrates such as beetles. Females usually lay one clutch of 3–7 eggs in loose sand or in crevices under rocks, and hatchlings appear in August.

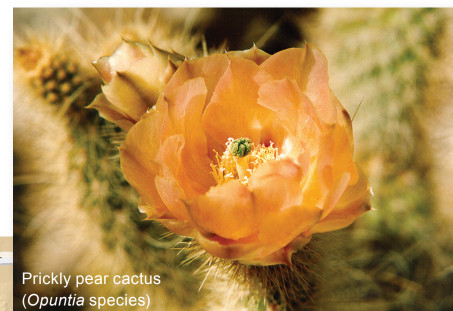
Nevada National Security Site Environmental Report Summary 2010

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) directs the management and operation of the Nevada National Security Site (NNSS). NNSA/NSO prepares the *Nevada National Security Site Environmental Report* (NNSSER) to provide the public an understanding of the environmental monitoring and compliance activities that are conducted on the NNSS to protect the public and the environment from radiation hazards and from nonradiological impacts.

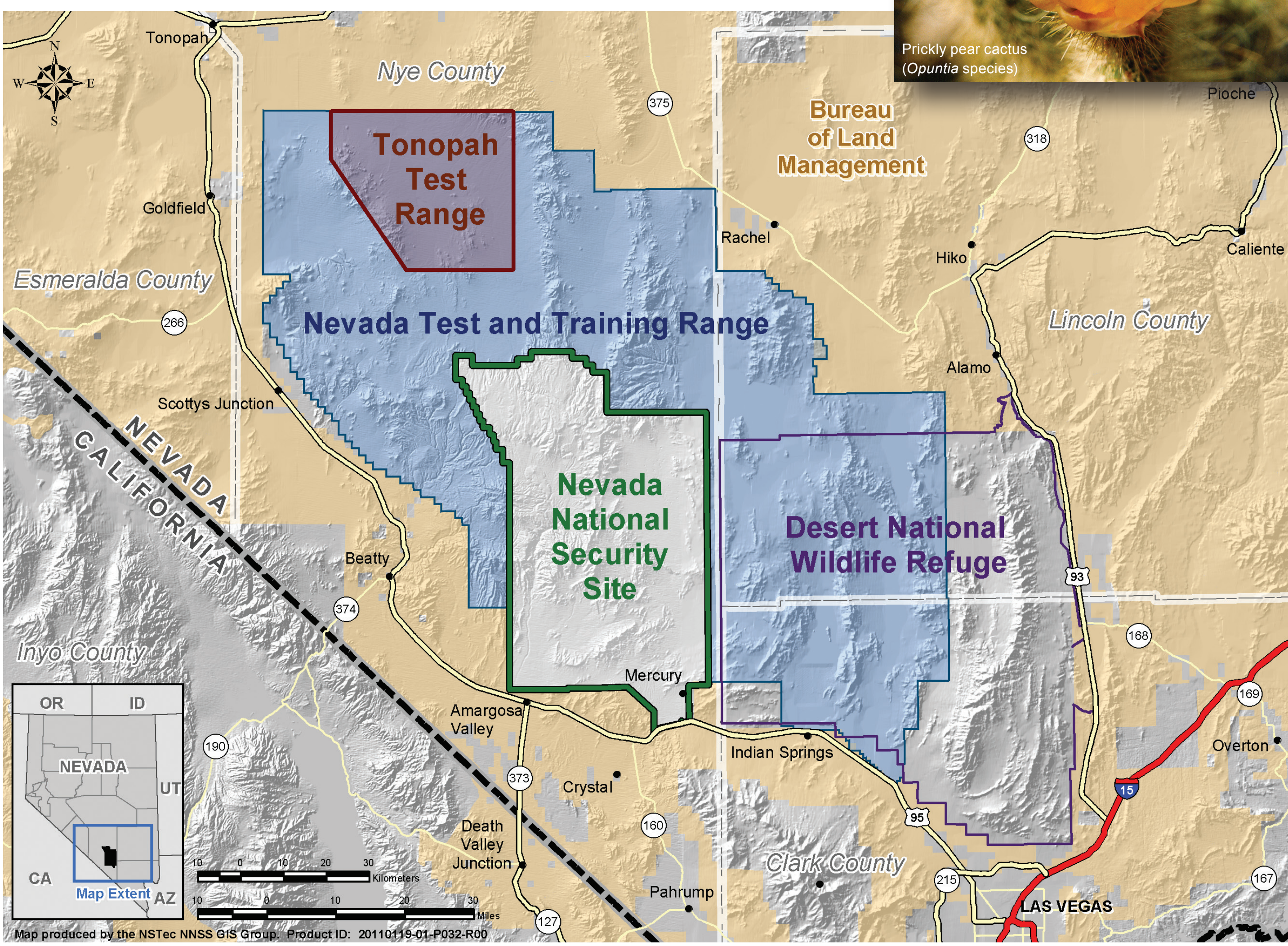
The NNSSER is a comprehensive report of environmental activities performed at the NNSS and offsite facilities over the previous calendar year. It is prepared annually to meet the requirements and guidelines of the U.S. Department of Energy (DOE) and the information needs of NNSA/NSO stakeholders. This summary provides an abbreviated and more readable version of the NNSSER. It does not contain detailed descriptions or presentations of monitoring designs, data collection methods, data tables, the NNSS environment, or all environmental program activities performed throughout the year.

The reader is provided with an electronic file of the full NNSSER and of *Attachment A: Site Description* (see attached compact disc on the inside back cover). The reader may obtain a hard copy of the full NNSSER as directed on the inside front cover of this summary report.

The NNSS is currently the nation's unique site for ongoing national security–related missions and high-risk operations. The NNSS is located about 65 miles northwest of Las Vegas. The approximately 1,360-square mile site is one of the largest restricted access areas in the United States. It is surrounded by federal installations with strictly controlled access, as well as by lands that are open to public entry.



Prickly pear cactus (*Opuntia* species)



NNSS History

Between 1940 and 1950, the area now known as the NNSS was part of the Las Vegas Bombing and Gunnery Range. In 1950, the NNSS was established as the primary location for testing the nation's nuclear explosive devices. Such testing took place from 1951 to 1992.

Tests conducted through the 1950s were predominantly atmospheric tests. These involved a nuclear explosive device detonated while either on the ground surface, on a steel tower, suspended from tethered balloons, dropped from an aircraft, or placed on a rocket. Several tests were categorized as "safety experiments" and "storage-transportation tests," involving the destruction of a nuclear device with non-nuclear explosives. Some of these tests resulted in dispersion of plutonium in the test vicinity. One of these test areas, Project 57, lies just north of the NNSS boundary on the Nevada Test and Training Range (NTTR). Other tests, involving storage-transportation, were conducted at the north end of the NTTR (Double Tracks) and on the Tonopah Test Range (TTR) (Clean Slates I, II, and III). All nuclear device tests are listed in *United States Nuclear Tests, July 1945 through September 1992* (U.S. Department of Energy, Nevada Operations Office, 2000, DOE/NV--209, Rev. 15).

The first underground test, a cratering test, was conducted in 1951. The first totally contained underground test was in 1957. Testing was discontinued during a moratorium that began October 31, 1958, but was resumed in September 1961 after tests by the Union of Soviet Socialist Republics began. Beginning in late 1962, nearly all tests were conducted in sealed vertical shafts drilled into Yucca Flat and Pahute Mesa or in horizontal tunnels mined into Rainier Mesa. From 1951 to 1992, a total of 828 underground nuclear tests were conducted at the NNSS.

Approximately one-third of these tests were detonated near or in the saturated zone.

Five earth-cratering (shallow-burial) tests were conducted over the period of 1962 through 1968 as part of the Plowshare Program, which explored peaceful uses of nuclear explosives. The first and highest yield Plowshare crater test, Sedan, was detonated at the northern end of Yucca Flat on the NNSS. The second-highest yield crater test was Schooner, located in the northwest corner of the NNSS. Mixed fission products, tritium, and plutonium from these tests were entrained in the soil, ejected from the craters, and deposited on the ground surrounding the craters.

Other nuclear-related experiments at the NNSS included the Bare Reactor Experiment–Nevada series in the 1960s. These tests were performed with a 14-million electron volt neutron generator mounted on a 1,527-foot steel tower used to conduct neutron and gamma-ray interaction studies on various materials and to assess radiation doses experienced by the nuclear bomb survivors of Hiroshima and Nagasaki. In addition, from 1959 through 1973 a series of open-air nuclear reactor, nuclear engine, and nuclear furnace tests was conducted in Area 25, and a series of tests with a nuclear ramjet engine was conducted in Area 26. The tests released mostly gaseous radioactivity (radio-iodines, radio-xenons, radio-kryptons) and some fuel particles. These releases resulted in negligible deposition on the ground.

NNSS - Continental Test Site

After the end of World War II, the United States tested nuclear weapons at Bikini Atoll and Enewetak in the Marshall Islands of the Central Pacific.

In June 1950, with the outbreak of hostilities in Korea and U.S. relations with the Soviet Union continuing to deteriorate, the search began for a continental test site to overcome the difficulties with remoteness and security experienced with testing in the Pacific. The final choices included Dugway Proving Ground–Wendover Bombing Range in western Utah, Alamagordo-White Sands Guided Missile Range in south-central New Mexico, and a North Site and a South Site on the Las Vegas Bombing and Gunnery Range in southern Nevada.

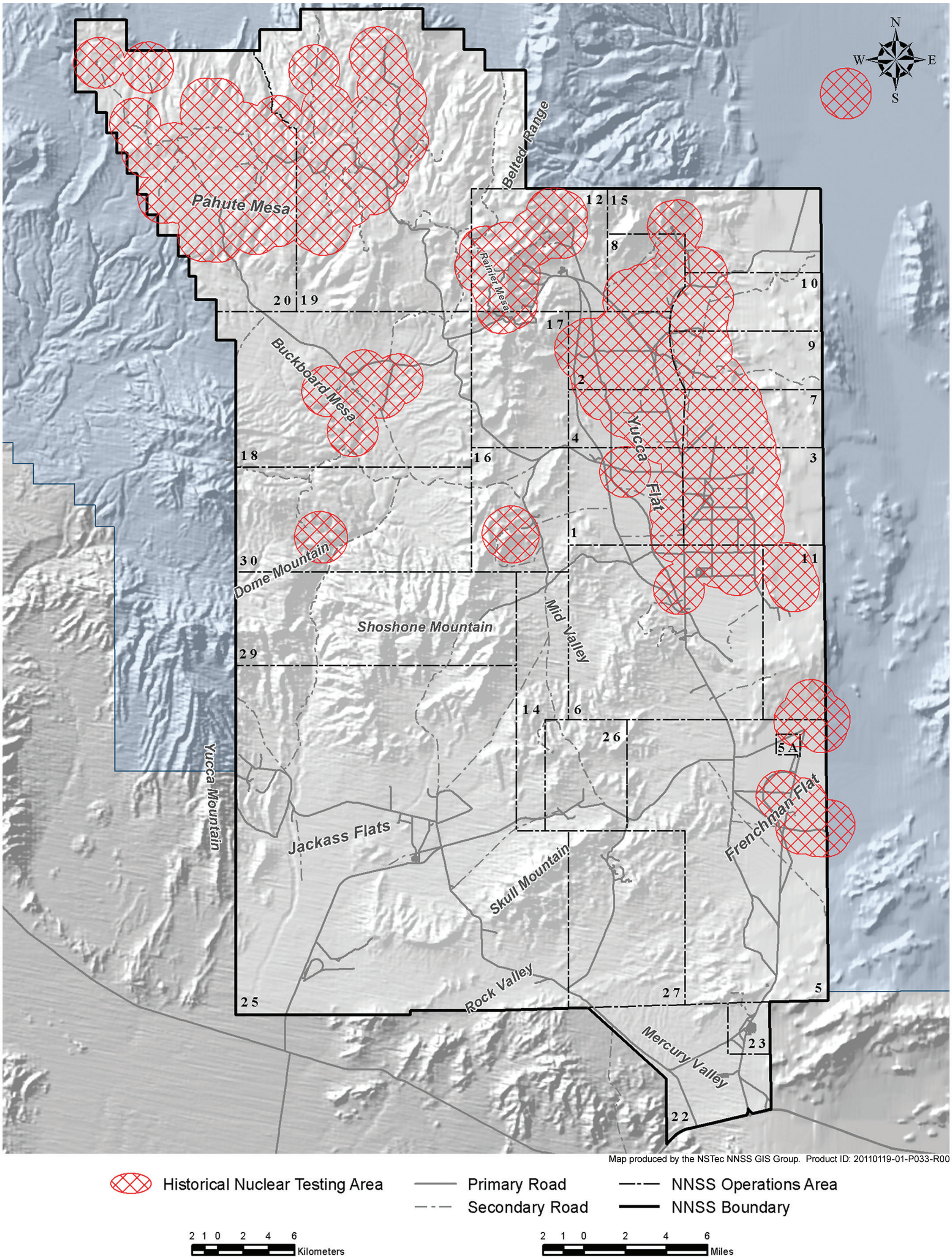
On December 18, 1950, President Truman approved the recommendations of Los Alamos testing officials and the Atomic Energy Commission, christening the South Site on the Las Vegas Bombing and Gunnery Range as the nation's continental test site. It was called the Nevada Proving Ground.

On January 27, 1951, an Air Force B-50D bomber dropped a 1-kiloton yield nuclear bomb over Frenchman Flat. It was the world's tenth nuclear detonation and was the first test at the newly established Nevada Test Site (NTS).

On September 23, 1992, the last underground nuclear test was conducted on the NTS after which Congress imposed a moratorium on nuclear weapons testing. Since 1951, a total of 100 atmospheric and 828 underground nuclear weapons tests have been conducted at the NTS.

On August 23, 2010, the NTS was renamed the Nevada National Security Site to reflect the diversity of nuclear, energy, and homeland security activities conducted at the site.

Source: T. R. Fehner and F. G. Gosling, 2000. *Origins of the Nevada Test Site*, DOE/MA-0518, History Division, Executive Secretariat, Management and Administration, U.S. Department of Energy.



Historical Nuclear Testing Areas On and Adjacent to the NNSS

The NNSS Now

Los Alamos, Lawrence Livermore, and Sandia National Laboratories are the principal organizations that sponsor and implement experimental programs at the NNSS. The three major NNSS missions include National Security/Defense, Environmental Management, and Nondefense. During the conduct of all missions and their programs, NNSA/NSO complies with applicable environmental and public health protection regulations and strives to manage the land and facilities at the NNSS as a unique and valuable national resource. In 2010, National Security Technologies, LLC (NSTec), was the Management and Operations contractor accountable for the successful execution of work and ensuring that work was performed in compliance with environmental regulations.

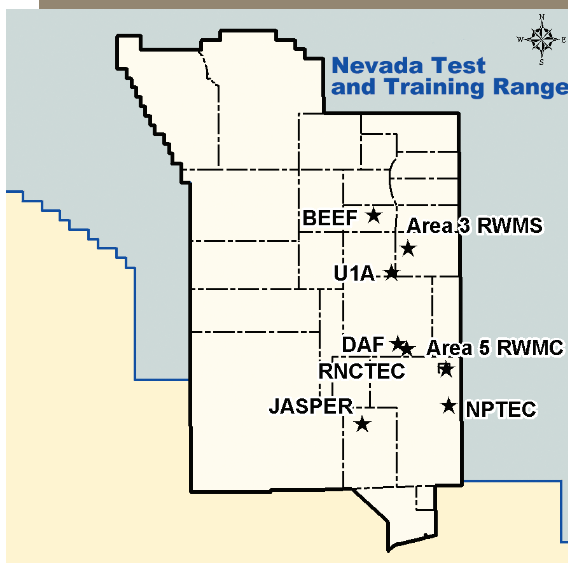
NNSS activities in 2010 continued to be diverse, with the primary goal to ensure that the existing U.S. stockpile of nuclear weapons remains safe and reliable. Other NNSS activities included demilitarization activities; controlled spills of hazardous material at the Nonproliferation Test and Evaluation Complex (NPTEC); remediation of legacy contamination sites; characterizing of waste destined for the Waste Isolation Pilot Plant in Carlsbad, New Mexico, or the Idaho National Laboratory in Idaho Falls, Idaho; disposal of radioactive and mixed waste; and environmental research. Facilities that support the National Security/Defense mission include the U1a Facility, Big Explosives Experimental Facility (BEEF), Device Assembly Facility (DAF), Joint Actinide Shock Physics Experimental Research (JASPER) Facility, and the Radiological/Nuclear Countermeasures Test and Evaluation Complex (RNCTEC). Facilities that support the Environmental Management mission include the Area 5 Radioactive Waste Management Complex (RWMC) and the Area 3 Radioactive Waste Management Site (RWMS), which has been in cold standby since 2006.

NNSS Missions and Their Programs

National Security/Defense

Stockpile Stewardship and Management Program – Conducts high-hazard operations in support of defense-related nuclear and national security experiments.

Nuclear Emergency Response, Nonproliferation, and Counterterrorism Programs – Provides support facilities, training facilities, and capabilities for government agencies involved in emergency response, nonproliferation technology development, national security technology development, and counterterrorism activities.



Work for Others Program – Provides support facilities and capabilities for other agencies/organizations involved in defense-related activities.

Environmental Management

Environmental Restoration Program – Characterizes and remediates the environmental legacy of nuclear weapons and other testing at the NNSS and NTTR locations, and develops and deploys technologies that enhance environmental restoration.

Waste Management Program – Manages and safely disposes of low-level waste and mixed low-level waste received from DOE- and U.S. Department of Defense (DoD)-approved facilities throughout the U.S. and wastes generated in Nevada by NNSA/NSO. Safely manages and characterizes hazardous and transuranic wastes for offsite disposal.

Nondefense

Infrastructure Program – Maintains the buildings, roads, utilities, and facilities required to support all NNSS programs and to provide a safe environment for NNSS workers.

Conservation and Renewable Energy Programs – Operates the pollution prevention program and supports renewable energy and conservation initiatives at the NNSS.

Other Research and Development – Provides support facilities and NNSS access to universities and organizations conducting environmental and other research unique to the regional setting.

The Legacy of NNSS Nuclear Testing

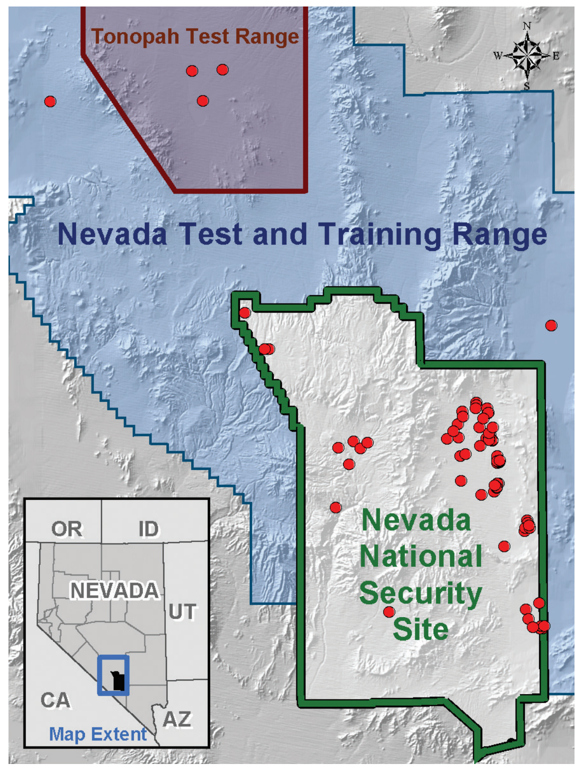
Approximately one-third of the 828 underground nuclear tests on the NNSS were detonated near or in the saturated zone, resulting in the contamination of groundwater in some areas. In addition, the 100 atmospheric nuclear tests conducted on the NNSS and numerous nuclear-related experiments resulted in the contamination of surface soils, materials, equipment, and structures, mainly on the NNSS. The NNSA/NSO Environmental Management mission was established to address this legacy of contamination. Within Environmental Management, the Environmental Restoration Project is responsible for remediating contaminated sites, and the Waste Management Project is responsible for safely managing and disposing of radioactive waste.

The primary regulatory driver of the Environmental Restoration Project is the Federal Facility Agreement and Consent Order (FFACO) between the State of Nevada, DOE, and DoD. The FFACO identifies corrective action units (CAUs), which are groupings of corrective action sites (CASs) that delineate and define areas of concern for contamination. Approximately 2,800 CASs have been identified, many of which have already been remediated and/or closed. The public is kept informed of Environmental Management activities through periodic newsletters, exhibits, and fact sheets, and Environmental Management provides the opportunity for public input via the Nevada Site Specific Advisory Board, consisting of 15–20 citizen volunteers from Nevada.

Legacy Contamination

Groundwater — **As a result of the 828 underground nuclear tests conducted at the NNSS, millions of curies (Ci) of radiation were released underground. The total amount of radiation remaining below the groundwater table is approximately 40 to 60 million Ci, based on the most recent decay-corrected estimate from 1992. The areas of known and potential groundwater contamination on the NNSS due to underground nuclear testing are called Underground Test Area (UGTA) corrective action units (CAUs). The corrective action strategy of the Environmental Management Program is to identify contaminant boundaries for these UGTA CAUs and to implement an effective long-term monitoring system** *(see Page 20)*.

Soil — **Radioactively contaminated surface soils directly resulting from nuclear weapons testing exist at approximately 100 sites on and around the NNSS. Closure of these sites is conducted in accordance with the FFACO and upon approval by the State of Nevada. Corrective actions required to complete closure range from removal of soil to closure in place with restricted access controls, such as fencing and posting. As of December 31, 2010, 18 sites have been approved for closure in accordance with the FFACO by the State of Nevada.**

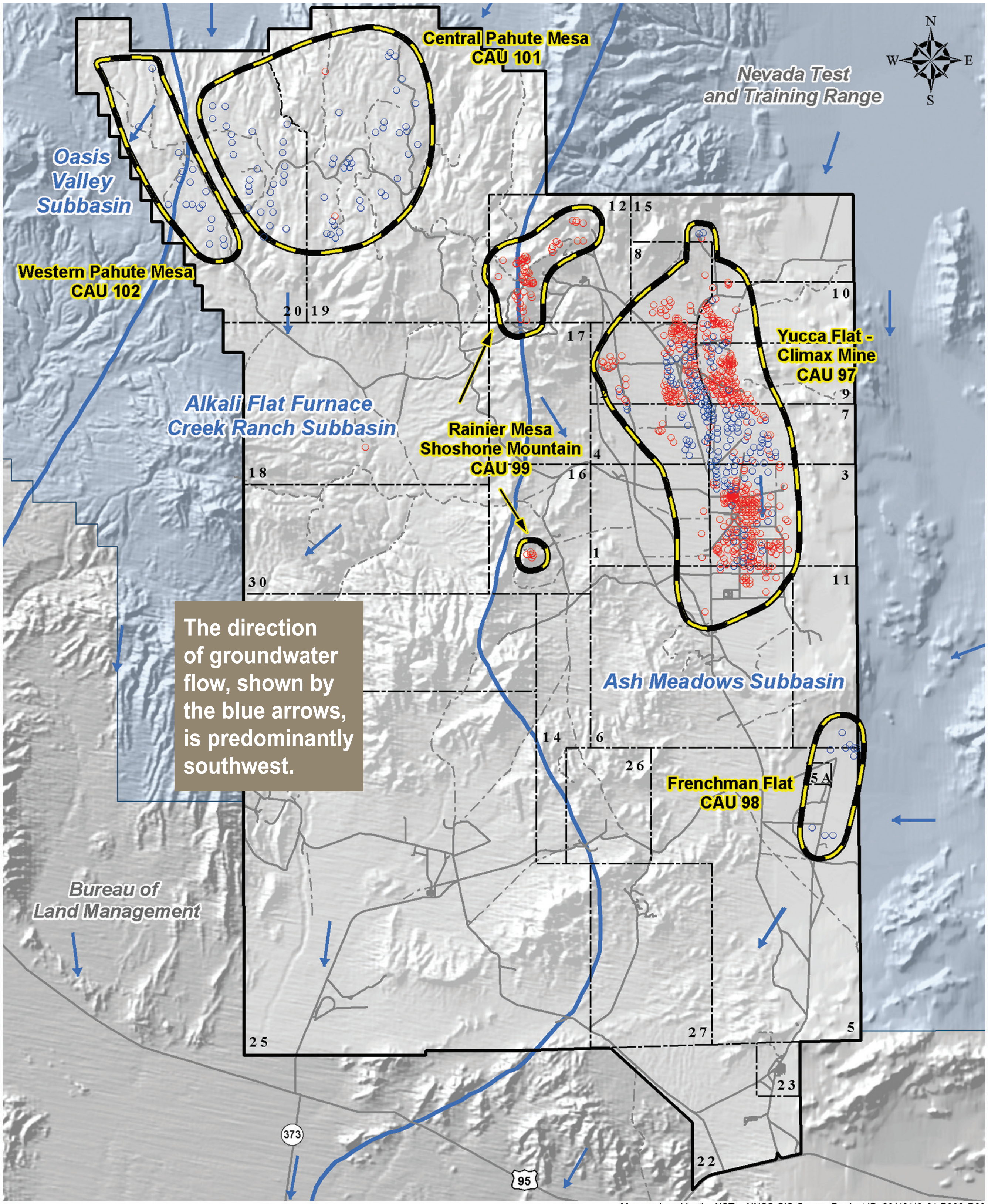


Locations of soil contamination on and off the NNSS

Air — **Airborne radioactive contamination from the resuspension of contaminated soils at legacy sites and from current activities is monitored continuously on and off the NNSS. Since the cessation of atmospheric nuclear testing, the annual amounts of radiation released into the air from the NNSS have ranged from 48 to 2,200 Ci for tritium, 0.0018 to 0.40 Ci for plutonium, and 0.039 to 0.049 Ci for americium. In air measured in communities surrounding the NNSS, these emissions from the NNSS cannot be distinguished from background airborne radiation.**

Structures/Materials — **There are approximately 1,850 sites where facilities, equipment, structures, and/or debris were contaminated by historical nuclear research, development, and testing activities. The responsibility for remediating these Industrial Sites belongs to the Environmental Restoration Project. As of December 31, 2010, 1,780 sites have been approved for final completion in accordance with the FFACO by the State of Nevada.**

Waste Disposal — **Low-level and mixed low-level radioactive wastes have been generated by historical nuclear research, development, and testing activities and environmental cleanup activities. Since the 1960s, nearly 1.47 million cubic yards of this waste have been safely disposed at the Area 3 and Area 5 Radioactive Waste Management Sites through December 31, 2010. The estimated total amount of radioactivity at the time of disposal was 15.08 million Ci. The radioactive content of the disposed waste decays over time at a varied rate depending on the radionuclide.**



The direction of groundwater flow, shown by the blue arrows, is predominantly southwest.

Map produced by the NSTec NNSS GIS Group. Product ID: 20110119-01-P006-R03

Location of Underground Nuclear Tests

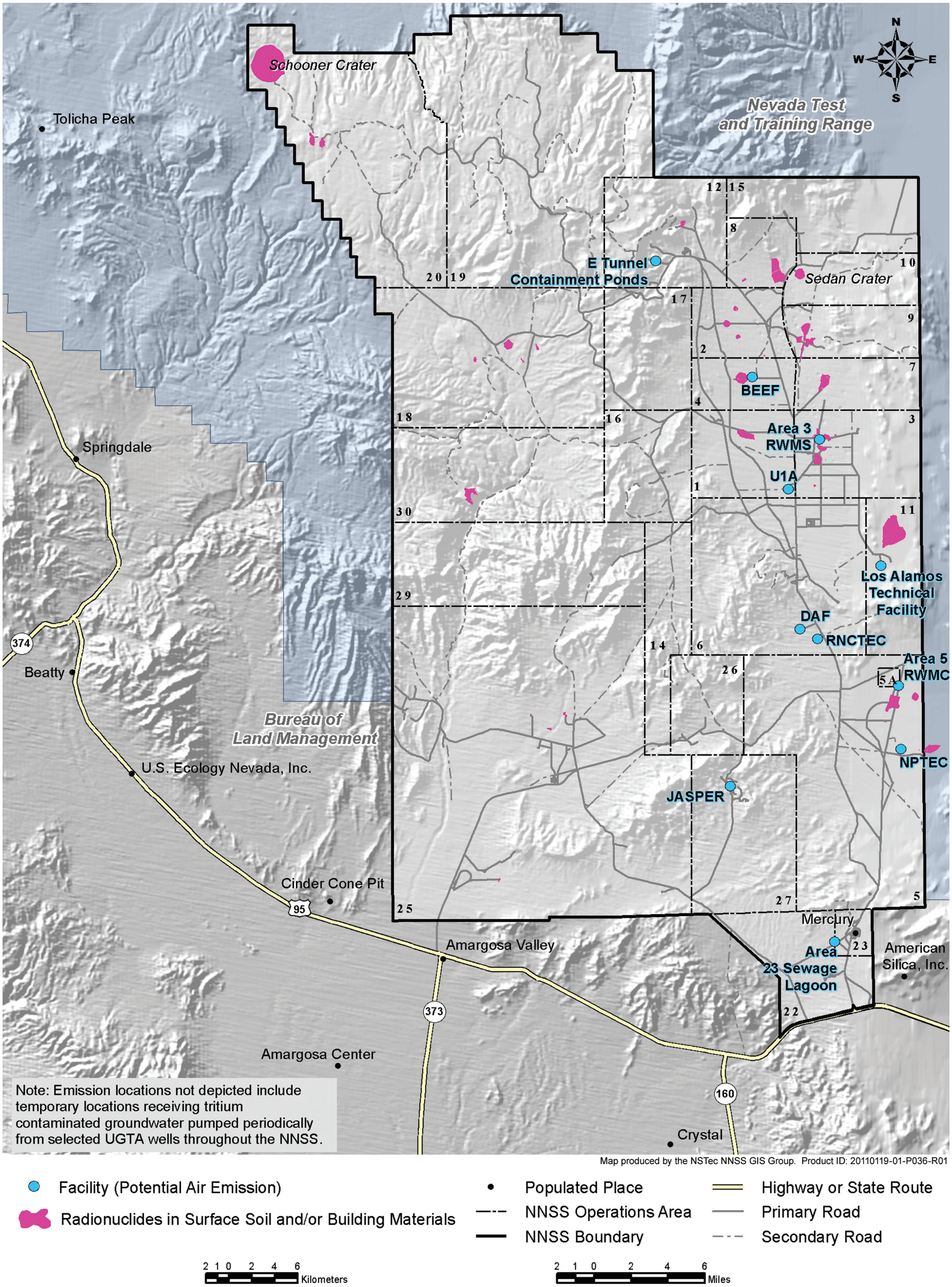
- Tests with no expected interaction with the regional groundwater system [1] (Vadose Zone)
- Tests having potential interaction with the regional groundwater system [1] (Saturated Zone)

(1) Groundwater interaction potential derived from U.S. Department of Energy, Nevada Operations Office, 1997a.
(2) Flow direction from Lazniak et al., 1996.

Regional Groundwater Flow Direction [2]
CAU Boundary
Hydrologic Subbasin

2 1 0 2 4 6 Kilometers
2 1 0 2 4 6 Miles

Areas of Potential Groundwater Contamination on the NNSS



Sources of Radiological Air Emissions on the NNSS

Understanding Radiation

Radiation is energy that travels through matter or space in the form of waves or high-speed particles. Light, heat, and sound are types of radiation. Ionizing radiation is a very high-energy form of electromagnetic radiation. Ionizing radiation consists of particles or rays given off by unstable atoms as they are converted, or decay, into more stable atoms. Ionizing radiation may be found everywhere. Almost all exposure to ionizing radiation comes from natural sources (82 percent in the United States). These sources include cosmic radiation from outer space, terrestrial radiation from materials like uranium and radium in the earth, and naturally occurring radioactive elements (i.e., radionuclides) in our food, water, and the aerosols and gases in the air we breathe. We use man-made sources and applications of ionizing radiation in our everyday life such as smoke-detectors, X-rays, CT scans, and nuclear medicine procedures. For people living in areas around the NNSS, less than 2 percent of their total radiation exposure is attributable to past or current NNSS activities.

Forms of Radiation

Alpha particles are heavy, positively charged particles given off by some decaying atoms. Alpha particles can be blocked by a sheet of paper. Atoms emitting alpha particles are hazardous only if they are swallowed or inhaled.

Beta particles are electrons or positrons (positively charged electrons) ejected from the nucleus of a decaying atom. More penetrating than alpha radiation, beta particles can pass through several millimeters of skin. A sheet of aluminum only a fraction of an inch thick will stop beta radiation. Beta particles can damage skin but are most hazardous if the beta-emitting atoms are swallowed or inhaled.

Gamma rays are waves of pure energy similar to X-rays, light, microwaves, and radio waves. Gamma rays are emitted by certain radionuclides when their nuclei transition from a higher to a lower energy state. They can readily pass into the human body. They can be almost completely blocked by about 40 inches of concrete, 40 feet of water, or a few inches of lead. Gamma rays can be both an external and internal hazard.

X-rays are a more familiar form of electromagnetic radiation, usually with a limited penetrating power, typically used in medical or dental examinations. Television sets, especially color, give off soft (low-energy) X-rays; thus, they are shielded to greatly reduce the risk of radiation exposure.

Neutrons are uncharged heavy particles contained in the nucleus of every atom heavier than ordinary hydrogen. They induce ionization only indirectly in atoms that they strike, but they can damage body tissues. Neutrons are released, for example, during the fission (splitting) of uranium atoms in the fuel of nuclear power plants. They can also be very penetrating. In general, efficient shielding against neutrons can be provided by materials containing hydrogen, such as water. Like gamma rays, neutrons are both an external and internal hazard.

Curie (Ci) is the traditional measure of radioactivity based on the observed decay rate of 1 gram of radium. One curie of radioactive material will have 37 billion disintegrations in 1 second.

Understanding Radiation Dose

Dose is a generic term to describe the amount of radiation a person receives. The energy deposited indicates the number of molecules disrupted. The energy the radiation deposits in tissue is called the absorbed dose. The units of measure of absorbed dose are the rad or the gray. The biological effect of radiation depends on the type of radiation (alpha, beta, gamma, or X-ray) and the tissues exposed. A measure of the biological risk of the energy deposited is the dose equivalent. The units of dose equivalent are called rems or sieverts. In the NNSSER, the term dose is used to mean dose equivalent measured in rems. A thousandth of a rem is called a millirem, abbreviated as mrem. An average person in the United States receives about 310 mrem each year from natural sources and an additional 310 mrem from medical procedures and consumer products. Whether or not there is a "safe" radiation dose equivalent is a controversial subject. Because the topic has yet to be settled scientifically, regulators take a conservative approach and assume that there is no such thing as a 100 percent safe dose equivalent. It is believed that the risk of developing an adverse health effect (such as cancer) is proportionate to the amount of radiation dose received. Many human activities increase our exposure to radiation over and above the average background radiation dose of 310 mrem per year. These activities include, for example, uranium mining, airline travel, and operating nuclear power plants. Regulators balance the benefit of these activities with the risk of increasing radiation exposures above background and, as a result, set dose limits for the public and workers specific to these activities. DOE has set the dose limit to the public from exposure to DOE-related nuclear activities to 100 mrem/yr. This is the same public dose limit set by the U.S. Nuclear Regulatory Commission (NRC) and recommended by the International Commission on Radiological Protection and the National Commission on Radiological Protection and Measurements. The NRC has set the dose limit for radiation workers to 5,000 mrem/yr. There are no common or agreed-upon dose limits for workers or the public across industries, states, or countries.

Common Doses to the Average American

Source/Activity	**Average Dose/Year** (or as noted)
5-hour jet plane ride	3 mrem/5 hours
Building materials	4 mrem
Chest X-ray	8 mrem
Cosmic	30 mrem
Soil	35 mrem
Internal to our body	40 mrem
Mammogram	138 mrem
Radon gas	200 mrem
CT scan	2,500 mrem
Smoking 20 cigarettes/day	5,300 mrem to a smoker's lung
One cancer treatment	5,000,000 mrem to the tumor

Source: http://hss.energy.gov/HealthSafety/WSHP/radiation/Radiation-final-6-20.pdf, as accessed on March 25, 2010

Radionuclides Detected on the NNSS

<table>
<tr><th></th><th>Name*</th><th>Abbreviation</th><th>Primary Type(s) of Radiation</th><th>Major NNSS Source</th></tr>
<tr><td rowspan="9">Man-Made</td><td>Americium-241</td><td>^{241}Am</td><td>Alpha, gamma</td><td rowspan="4">In soil at and near legacy sites of aboveground nuclear testing. Detected in soil and air.</td></tr>
<tr><td>Cesium-137</td><td>^{137}Cs</td><td>Beta, gamma</td></tr>
<tr><td>Plutonium-238</td><td>^{238}Pu</td><td>Alpha</td></tr>
<tr><td>Strontium-90</td><td>^{90}Sr</td><td>Beta</td></tr>
<tr><td>Cobalt-60</td><td>^{60}Co</td><td>Gamma</td><td rowspan="3">In soil at and near legacy sites of aboveground nuclear testing. Detected in soil.</td></tr>
<tr><td>Europium-152</td><td>^{152}Eu</td><td>Gamma</td></tr>
<tr><td>Europium-155</td><td>^{155}Eu</td><td>Gamma</td></tr>
<tr><td>Plutonium-239+240</td><td>$^{239+240}$Pu</td><td>Alpha</td><td>In soil at and near legacy sites of plutonium dispersal experiments. Detected in soil and air.</td></tr>
<tr><td>Tritium</td><td>^{3}H</td><td>Beta</td><td>In groundwater in areas of underground nuclear tests, in surface ponds used to contain contaminated groundwater, in soil at nuclear test locations, in waste packages buried in pits at waste management sites. Detected in groundwater and air.</td></tr>
<tr><td rowspan="7">Naturally Occurring</td><td>Beryllium-7</td><td>^{7}Be</td><td>Gamma</td><td>Produced by interactions between cosmic radiation from the sun and the earth's upper atmosphere. Detected in air.</td></tr>
<tr><td>Potassium-40</td><td>^{40}K</td><td>Beta, gamma</td><td rowspan="6">Naturally occurring in the earth's crust. Detected in groundwater, soil, and air.</td></tr>
<tr><td>Radium-226</td><td>^{226}Ra</td><td>Alpha, gamma**</td></tr>
<tr><td>Thorium-232</td><td>^{232}Th</td><td>Alpha**</td></tr>
<tr><td>Uranium-234</td><td>^{234}U</td><td>Alpha**</td></tr>
<tr><td>Uranium-235</td><td>^{235}U</td><td>Alpha, gamma**</td></tr>
<tr><td>Uranium-238</td><td>^{238}U</td><td>Alpha**</td></tr>
</table>

*The number given with the name of the radionuclide is the atomic mass number, which is the total number of protons and neutrons in the nucleus of the atom. Atoms with the same number of protons are the same element; atoms of the same element with different mass numbers are called isotopes of one another. Plutonium and uranium each have several radioactive isotopes that are detected on the NNSS.

**Some progeny or daughter radionuclides produced by the natural decay of this radionuclide would emit alpha, beta, or gamma radiation as well as alpha.

Monitoring NNSS Radiation and Pathways of Exposure to the Public

The release of man-made radionuclides from the NNSS has been monitored since the first decade of atmospheric testing. After 1962, nuclear tests were conducted only underground, greatly reducing the radiation exposure in the areas surrounding the NNSS. Underground nuclear testing nearly eliminated atmospheric releases of radiation but resulted in the contamination of groundwater in some areas of the NNSS. After the 1992 moratorium on nuclear testing, radiation monitoring focused on detecting airborne radionuclides that are resuspended with historically contaminated soils on the NNSS and on detecting man-made radionuclides in groundwater.

There are three pathways in this dry desert environment by which man-made radionuclides from the NNSS might reach the surrounding public:

Air Transport Pathway – Members of the public may inhale or ingest radionuclides that are resuspended by the wind from contaminated sites on the NNSS. However, such resuspended radiation measured off and on the NNSS is much lower than natural background radiation in all areas accessible to the public.

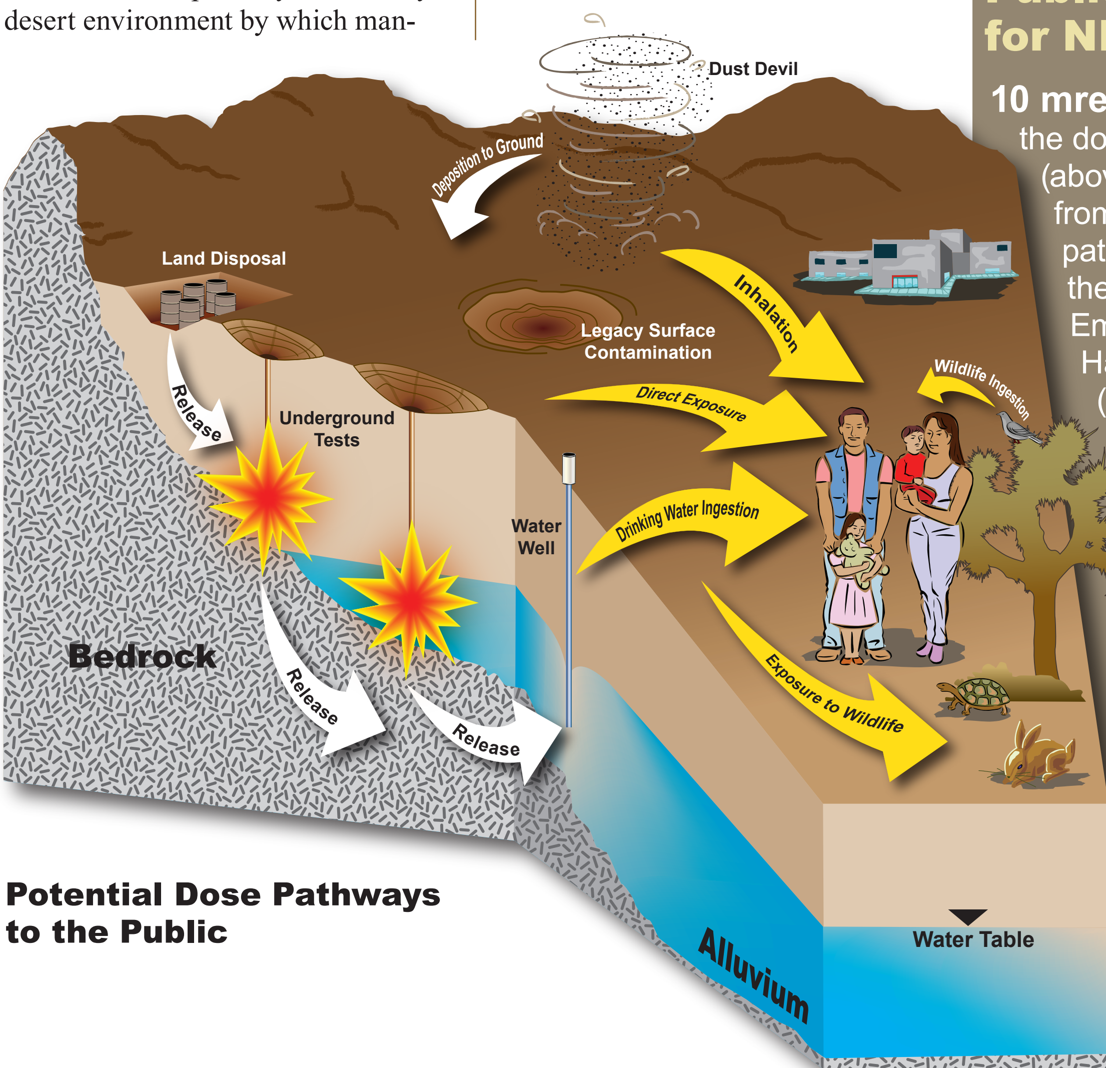
Ingestion Pathway – Members of the public may ingest game animals that have been exposed to contaminated soil or water on the NNSS, have moved off the NNSS, and have then been hunted.

Groundwater Pathway – Based on monitoring data, drinking contaminated groundwater is currently not a possible pathway for public exposure given the restricted public access to the NNSS and the location of known contaminated groundwater on and off the NNSS. No manmade radionuclides have been detected in drinking water sources monitored off the NNSS, and no drinking water wells on the NNSS have measurable levels of manmade radionuclides. In 2009, radioactively contaminated groundwater was discovered in a characterization well on NTTR just west of the NNSS boundary *(see Pages 20 and 21)*. This well is not a source of drinking water.

Public Dose Limits for NNSS Radiation

10 mrem/yr — This is the dose limit to the public (above natural background) from just the air transport pathway, as specified by the Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAP).

100 mrem/yr — This is the dose limit to the public (above natural background) from all possible pathways combined, as specified by DOE O 5400.5, "Radiation Protection of the Public and the Environment."



Potential Dose Pathways to the Public

Estimated 2010 Radiation Dose to the Public from NNSS Operations

Inhalation – Compliance with radiation dose limits to the general public from the air transport pathway is demonstrated using air sampling results from six onsite "critical receptor" sampling stations. The radionuclides detected at four or more of the NNSS critical receptor samplers were ^{241}Am, ^{238}Pu, $^{239+240}$Pu, $^{233+234}$U, $^{235+236}$U, ^{238}U, and ^{3}H. Uranium in NNSS surface soils has generally been attributed to naturally occurring uranium. As in previous years, the 2010 data from the six critical receptor samplers show that the NESHAP dose limit to the public of 10 mrem/yr was not exceeded. The Schooner critical receptor station, in the far northwest corner of the NNSS, had the highest concentrations of radioactive air emissions; an individual residing at this station would experience a dose from air emissions of 1.69 mrem/yr. A more realistic estimate of the maximum dose to a member of the offsite public would be to use the air sampling results from the Gate 510 sampler in the far southwest corner of the NNSS, which is closest to the nearest populated place, Amargosa Valley. A person residing at the Gate 500 station would experience a dose from air emissions of 0.04 mrem/yr.

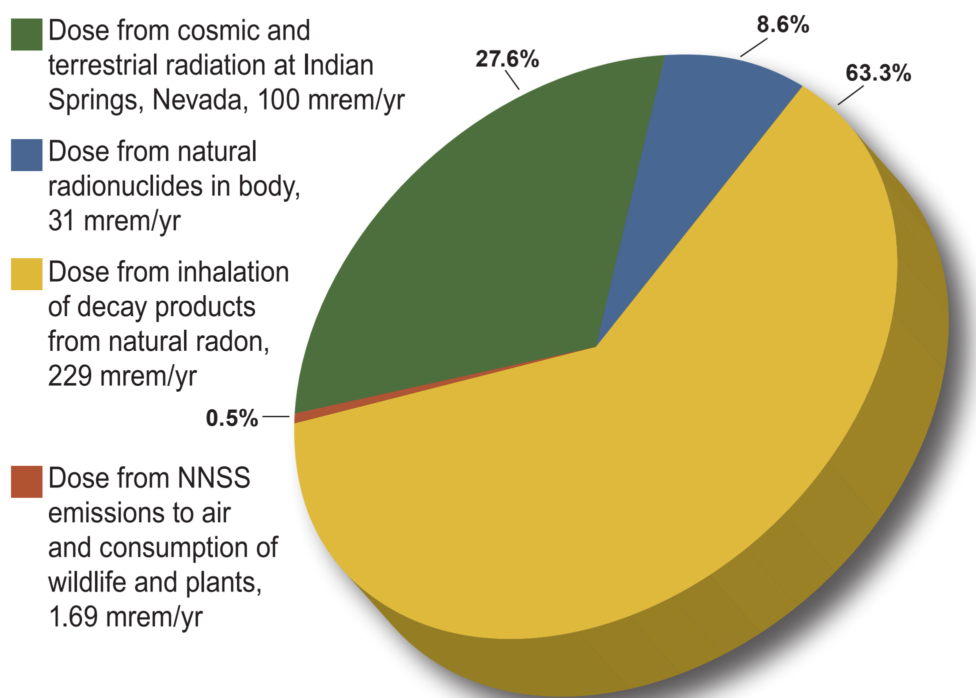
Ingestion – NNSS game animals include pronghorn antelope, mule deer, chukar, Gambel's quail, mourning doves, cottontail rabbits, and jackrabbits. Small game animals from different contaminated NNSS sites are trapped each year and analyzed for their radionuclide content. These results are used to construct worst-case scenarios for the dose to hunters who might consume these animals if the animals moved off the NNSS. In 2010, two jackrabbits were trapped near Sedan Crater in Area 10, and muscle tissues from a pronghorn antelope and a mountain lion, both accidentally killed by vehicles, were analyzed for the presence of man-made radionuclides. The blood samples from two live mountain lions being studied *(see Ecological Monitoring on Page 24)* were also analyzed. Pine nuts from pinyon pine trees were collected in 2010 near the E Tunnel Ponds in Area 12 *(see Containment Ponds on Page 19)* and in Area 15, downwind of the historical underground Baneberry nuclear test conducted in 1970, which vented fission products from a ground fissure. Based on these samples, the highest dose to a member of the public from ingestion was estimated to be 1.65 mrem/yr. It was assumed that this hypothetical person consumed in a year 20 jackrabbits from Sedan Crater, one mountain lion from the NNSS, and one pound of pine nuts from near the E Tunnel Ponds, where the pine nuts had the highest concentration of radionuclides.

Direct Exposure – No members of the public are expected to receive direct gamma radiation that is above background levels as a result of NNSS operations. Areas accessible to the public, such as the main entrance gate, had direct gamma radiation exposure rates comparable to natural background rates from cosmic and terrestrial radiation.

2010 Dose to the Public from All Pathways

1.69 mrem/yr — This is the maximum dose to the public from inhalation, ingestion, and direct exposure pathways that is attributable to NNSS operations. It is well below the dose limit of 100 mrem/yr established by DOE O 5400.5 for radiation exposure to the public from all pathways combined. This total dose estimate is indistinguishable from natural background radiation experienced by the public residing in communities near the NNSS.

Percents of Total Dose to the Public from Natural Background Sources and from the NNSS



Monitoring Radioactive Air Emissions and Direct Radiation

NNSS radioactive emissions are monitored to determine the public dose from inhalation *(shown on Page 11)* and to ensure compliance with the NESHAP under the Clean Air Act. A network of 19 air sampling stations and a network of 109 thermoluminescent dosimeters (TLDs) are located throughout the NNSS *(see map on Page 13)*. NNSS air sampling stations monitor tritium in water vapor, man-made radionuclides, and gross alpha and beta radioactivity in airborne particulates. The TLD stations monitor direct gamma radiation exposure.

Radioactive emissions are also monitored at stations in selected towns and communities within 240 miles of the NNSS by the independent Community Environmental Monitoring Program (CEMP), which is coordinated by the Desert Research Institute (DRI) of the Nevada System of Higher Education under contract with NNSA/NSO. Its purpose is to provide monitoring for radionuclides that may be released from the NNSS. A network of 29 CEMP stations is used *(see map on Page 14)*. The CEMP stations monitor gross alpha and beta radioactivity in airborne particulates using low-volume particulate air samplers, penetrating gamma radiation using TLDs, gamma radiation exposure rates using pressurized ion chamber (PIC) detectors, and meteorological (MET) parameters using automated weather instrumentation.

Man-Made Radionuclides at NNSS Air Sampling Stations

Several man-made radionuclides were detected at NNSS air sampling stations in 2010: ^{241}Am, ^{3}H, ^{238}Pu, and $^{239+240}$Pu. None, however, exceeded concentration limits established by the Clean Air Act. The highest average level of ^{241}Am, ^{238}Pu, and $^{239+240}$Pu was detected at Bunker 9-300 in Area 9, located within an area of known soil contamination from past nuclear tests. The highest average level of tritium was detected at Schooner, site of the second-highest yield Plowshare cratering experiment on the NNSS, where tritium-infused ejecta surrounds the crater.

The total amounts (measured in Ci) of man-made radionuclides that were emitted to the air from all sources on the NNSS in 2010 was estimated to be 625.387 Ci. In 2010, these sources included stack releases from the Dense Plasma Focus experiment at the Los Alamos Technical Facility in Area 11; contaminated soils at legacy sites, Area 3 and Area 5 RWMSs, and Sedan and Schooner craters; and contaminated groundwater held in containment ponds or lagoons. Over the past 10 years, total emissions have ranged from 160 to 625 Ci for tritium, 0.039 to 0.049 Ci for ^{241}Am, and 0.24 to 0.39 Ci for $^{239+240}$Pu. Emissions of ^{238}Pu are estimated to have remained consistent at about 0.050 Ci over the same time frame.

Range in Average Concentrations of Man-Made Radionuclides in Air Samples on the NNSS in 2010

	Concentration (10^{-15} µCi/mL)[a]		
Radionuclide	Limit[b]	Lowest Average	Highest Average
^{241}Am	1.9	0.0015	9.044
^{3}H	1,500,000	-40	241,780
^{238}Pu	2.1	0.00024	0.0056
$^{239+240}$Pu	2.0	0.00174	0.29

(a) The scale of concentration units for radionuclides shown in the table has been standardized to 10^{-15} microcuries per milliliter (µCi/mL). This scale may differ from those reported in detailed radionuclide-specific data tables in the NNSSER.

(b) The concentration established by NESHAP as the compliance limit.

Estimated Quantity of Man-Made Radionuclides Released into the Air from the NNSS in 2010 (in Curies)

Tritium (^{3}H)	Americium (^{241}Am)	Plutonium (^{238}Pu)	Plutonium ($^{239+240}$Pu)
625	0.047	0.050	0.29

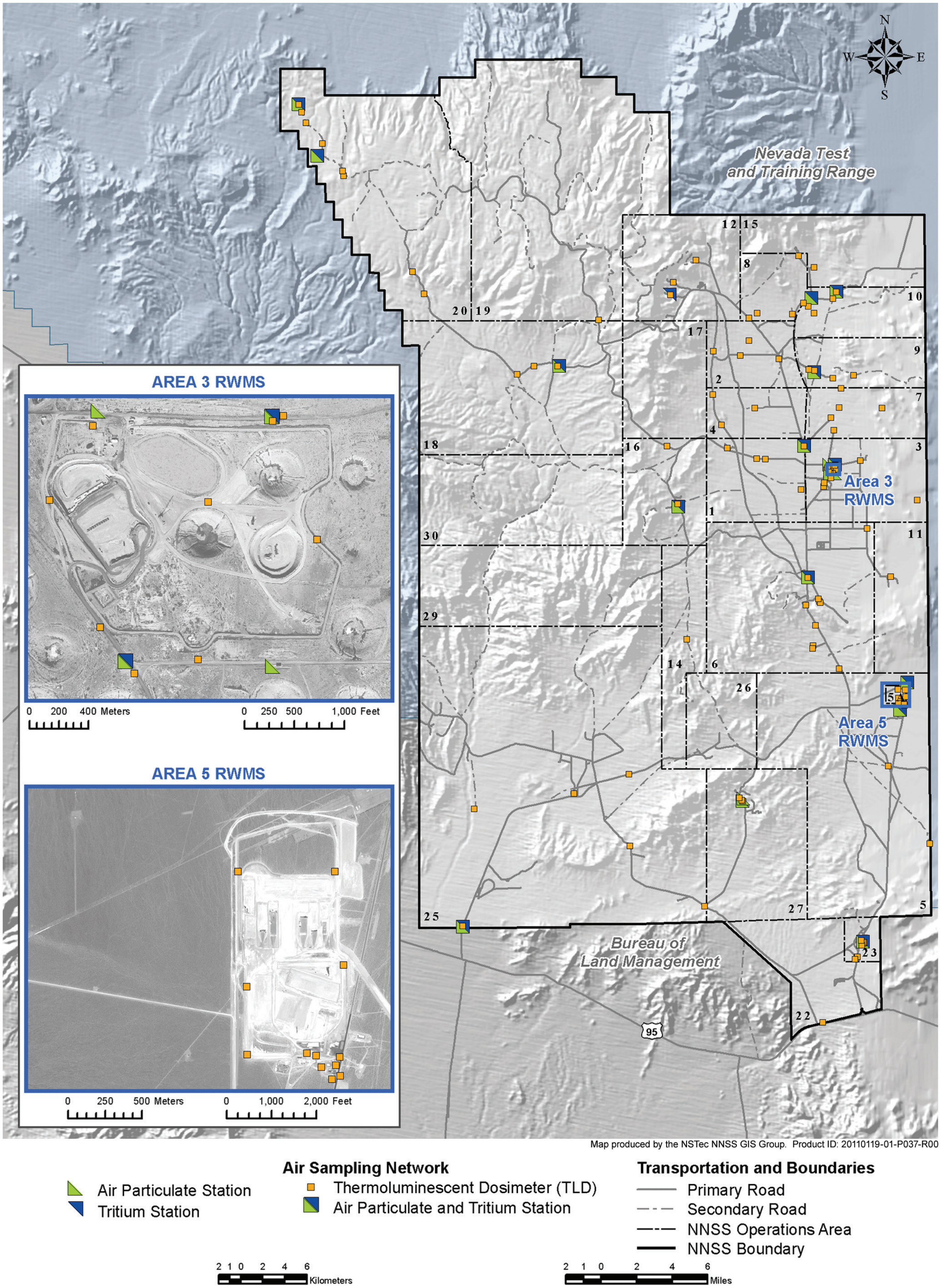
Plutonium and americium sources are legacy sites of past nuclear testing on the NNSS where these radionuclides are in surface soils that can become re-suspended by wind.

Man-Made Radionuclides at Offsite Air Sampling Stations

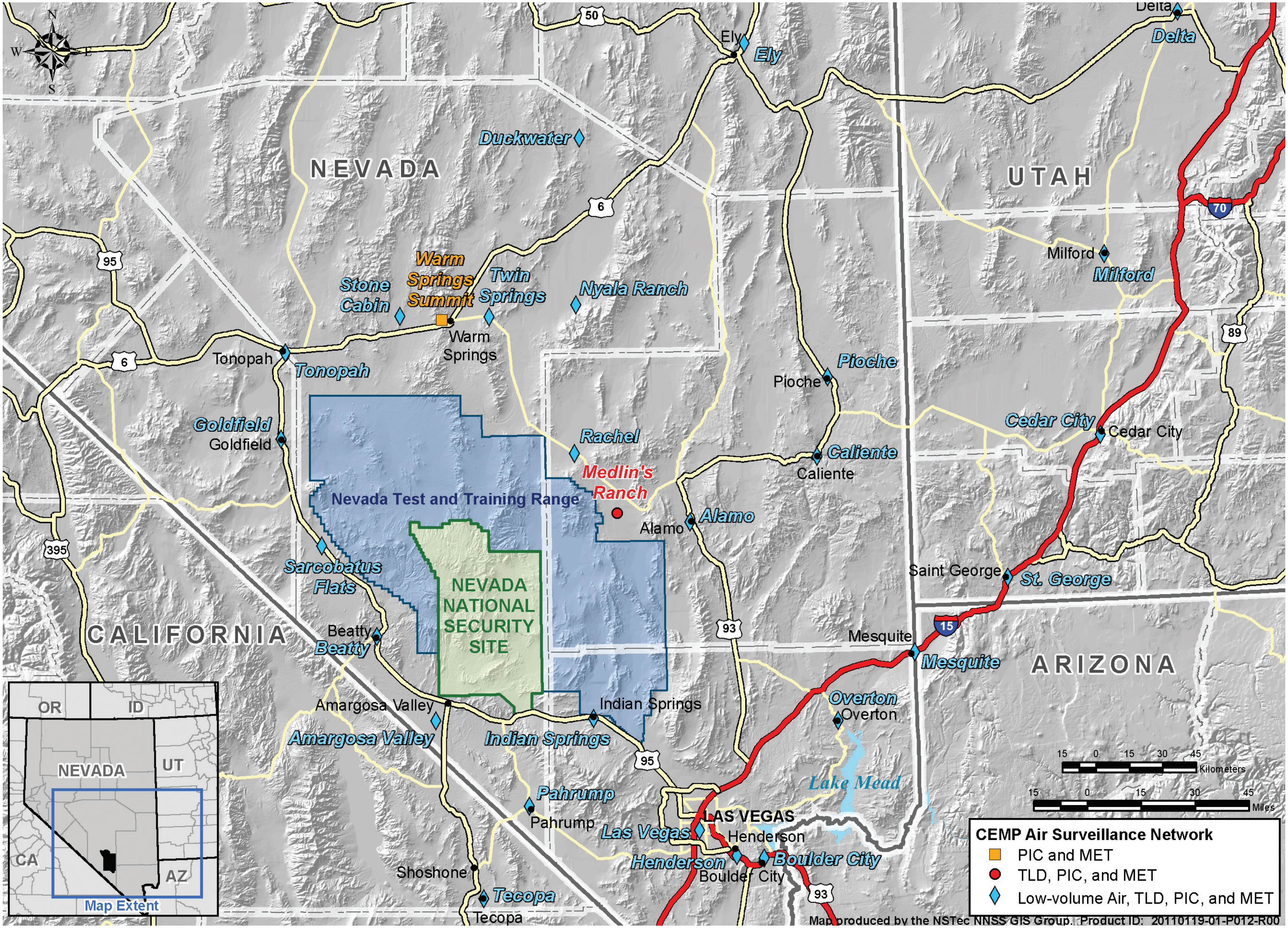
No airborne radioactivity related to any NNSS operations was detected at the CEMP stations during 2010. No man-made gamma-emitting radionuclides were detected.

Air Monitoring in Response to Japan's Nuclear Reactor Accident

On March 11, 2011, during the preparation of this report, a large earthquake and resulting tsunami damaged the Fukushima Nuclear Power Plant in Japan, resulting in the atmospheric release of radiological materials from the reactor site. On March 21, 2011, the CEMP installed air samplers at the Las Vegas and Henderson sampling stations to determine if radiological materials from the accident could be detected. Samples were collected every 2 to 3 days and submitted for gamma spectroscopy analysis. Analysis results can be accessed at http://www.cemp.dri.edu/japan_response.html and will be reported in the 2011 NNSSER.



2010 NNSS Air Sampling Network



2010 CEMP Air Surveillance Network

Range in Average Direct Radiation Measured in 2010 On and Off the NNSS		
Location	**Elevation Above Sea Level** (feet)	**Radiation Exposure** (mR/yr)
NNSS - Schooner TLD station	5,660	639
NNSS - 35 Legacy Site TLD stations (includes Schooner)	3,077–5,938	242
Warm Springs Summit, Nevada CEMP PIC station	7,570	174
Twin Springs, Nevada CEMP PIC station	5,146	170
NNSS - 17 Waste Operation TLD stations	3,176–4,021	135
NNSS - 10 Background TLD stations	2,755–5,938	116
St. George, Utah CEMP PIC station	2,688	92
Pahrump, Nevada CEMP PIC station	2,639	73
NNSS Mercury Fitness Track TLD station	3,769	58

Gamma Radiation Exposure

Ten of the NNSS TLD stations are located where radiation effects from past or present NNSS operations are negligible, and therefore measure only natural background levels of gamma radiation from cosmic and terrestrial sources. In 2010, the mean measured background level from the ten stations was 116 milliroentgens per year (mR/yr). This is well within the range of variation in background levels observed in other parts of the U.S. of similar elevation above sea level. Background radiation varies not only by elevation but by the amounts of natural radioactive materials in soil and rock in different geographic regions.

The highest estimated mean annual gamma exposure measured at a TLD station on the NNSS was 639 mR/yr at Schooner, one of the legacy Plowshare sites on Pahute Mesa. The lowest was 58 mR/yr in Mercury at the fitness track. The mean annual gamma exposure at 17 TLD locations near the Area 3 and Area 5 RWMSs was 135 mR/yr, and at the 35 TLD locations near known legacy sites (including Schooner), it was 242 mR/yr.

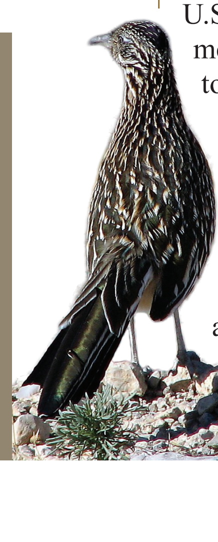
Average Background Radiation of Selected U.S. Cities (Excluding Radon)		
City	**Elevation Above Sea Level** (feet)	**Radiation** (mR/yr)
Denver, CO	5,280	164.6
Wheeling, WV	656	111.9
Rochester, NY	505	88.1
St. Louis, MO	465	87.9
Portland, OR	39	86.7
Los Angeles, CA	292	73.6
Fort Worth, TX	650	68.7
Richmond, VA	210	64.1
New Orleans, LA	39	63.7
Tampa, FL	0	63.7

Source: http://www.wrcc.dri.edu/cemp/Radiation.html, "Radiation in Perspective," August 1990, as accessed on May 15, 2011

The CEMP offsite TLD and PIC results remained consistent with previous years' background radiation levels and are also well within the range of variation in background levels observed in other parts of the U.S. and with the 116 mR/yr level measured on the NNSS. The highest total annual gamma exposure measured off site, based on the PIC detectors, was 174.3 mR/yr at Warm Springs Summit, Nevada (at 6,290 feet elevation). The lowest offsite rate, based on the PIC detectors, was 73 mR/yr at Pahrump, Nevada (at 2,639 feet elevation).

2010 NNSS Background Gamma Radiation

116 mR/yr — This is the mean background radiation measured at 10 TLD stations in areas isolated from past and present nuclear activities.



Greater Roadrunner
(Geococcyx californianus)

Offsite Radiological Monitoring of Groundwater

NNSA/NSO's comprehensive Routine Radiological Environmental Monitoring Plan (RREMP) includes sampling and analysis of groundwater and natural springs off of the NNSS to determine if groundwater contamination from past nuclear testing poses a current threat to public health and the environment. In 2010, NSTec sampled for the presence of tritium in five offsite private/community water supply wells, ten offsite non-potable NNSA/NSO wells, and three offsite springs used as water supplies. NSTec also sampled for man-made gamma-emitting radionuclides and gross alpha and gross beta radioactivity in five of the non-potable NNSA/NSO wells in Oasis Valley and in one of the private drinking water wells (EW-4 Well) *(see map on Page 17)*.

The DRI, through the CEMP, also monitors offsite water supplies for the presence of tritium and provides the public with these data as part of a non-regulatory public informational and outreach program. In 2010, the CEMP offsite water sampling locations included 21 wells, 3 surface water supply systems, and 4 springs located in selected towns and communities within 240 miles of the NNSS *(see map on Page 18)*.

Offsite water supply samples collected by NSTec and the CEMP had levels of tritium either below laboratory background levels or at very low detectable levels (<30 picocuries per liter [pCi/L]). The very low detectable levels were in CEMP surface water samples from Boulder City and Henderson, Nevada, which originated from Lake Mead. The detectable levels represent residual tritium persisting in the environment that originated from global atmospheric nuclear testing.

In the offsite non-potable wells, tritium was detected only in the sample from the shallow depth of the NSTec monitoring well, PM-3, at 48.3 pCi/L. This concentration is far lower than the U.S. Environmental Protection Agency (EPA) limit for drinking water of 20,000 pCi/L. RREMP monitoring of PM-3 will continue in 2011, and the UGTA Sub-Project will collect and test additional samples to confirm the presence of tritium in the well. Sampling results will be considered in future data collection decisions and UGTA groundwater model evaluations *(see Page 20)*.

Range in Groundwater Tritium Levels Measured Off the NNSS in 2010	
Offsite Supply Wells (CEMP)	-0.3 to 4.7 pCi/L
Offsite Springs/ Surface Waters (CEMP)	0.6 to 23.5 pCi/L
Offsite NNSA/NSO Monitoring Wells (NSTec)	-6.4 to 48.3 pCi/L

No samples from offsite springs or wells contained any man-made gamma-emitting radionuclides.

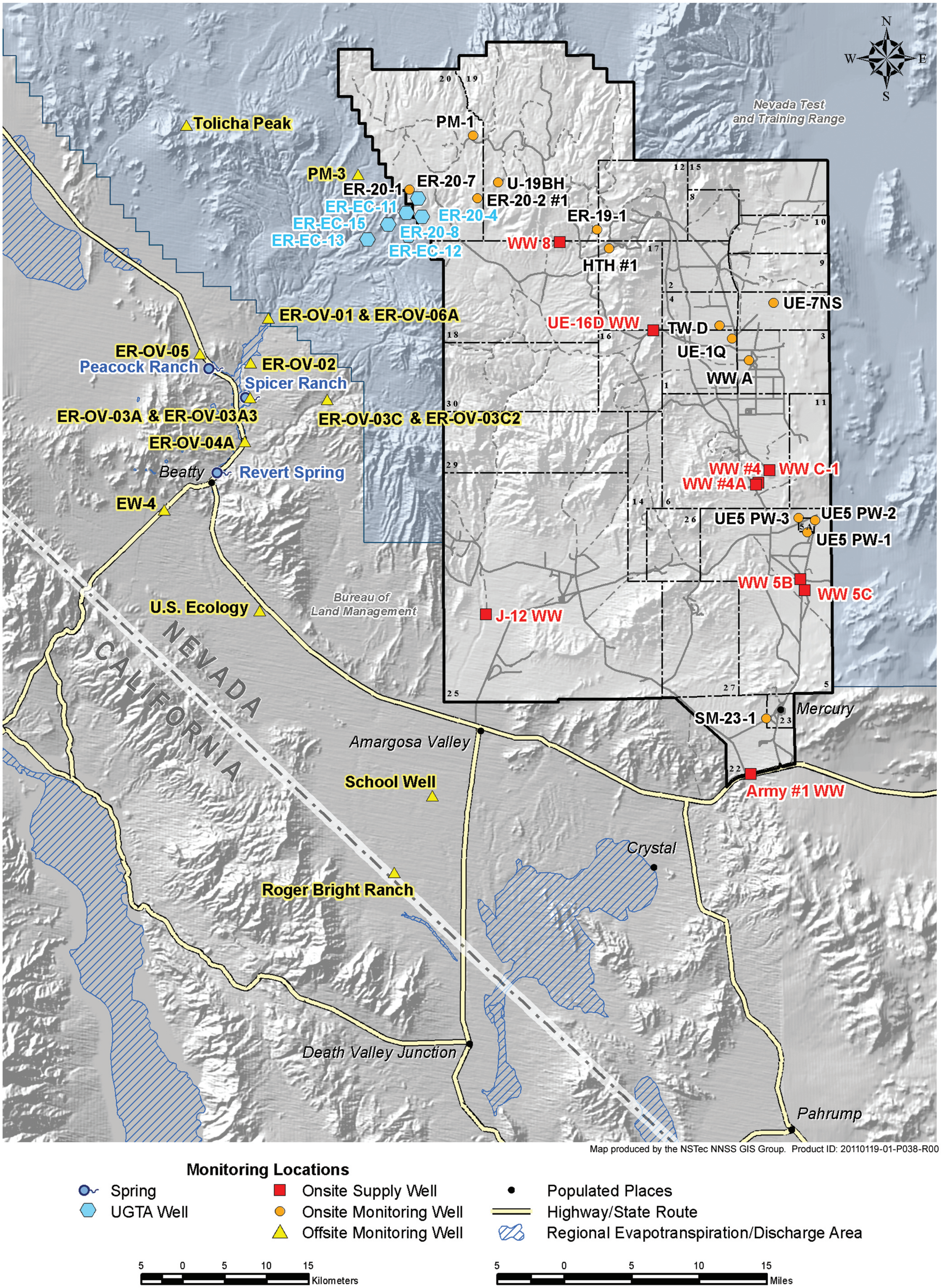
The Oasis Valley monitoring wells and EW-4 Well, which NSTec sampled for gross alpha and gross beta radioactivity, all had detectable gross alpha and/or gross beta activity consistent with levels anticipated from natural sources. All levels were less than the EPA limits set for drinking water (15 pCi/L for gross alpha and 50 pCi/L for gross beta).

Onsite Radiological Monitoring of Groundwater

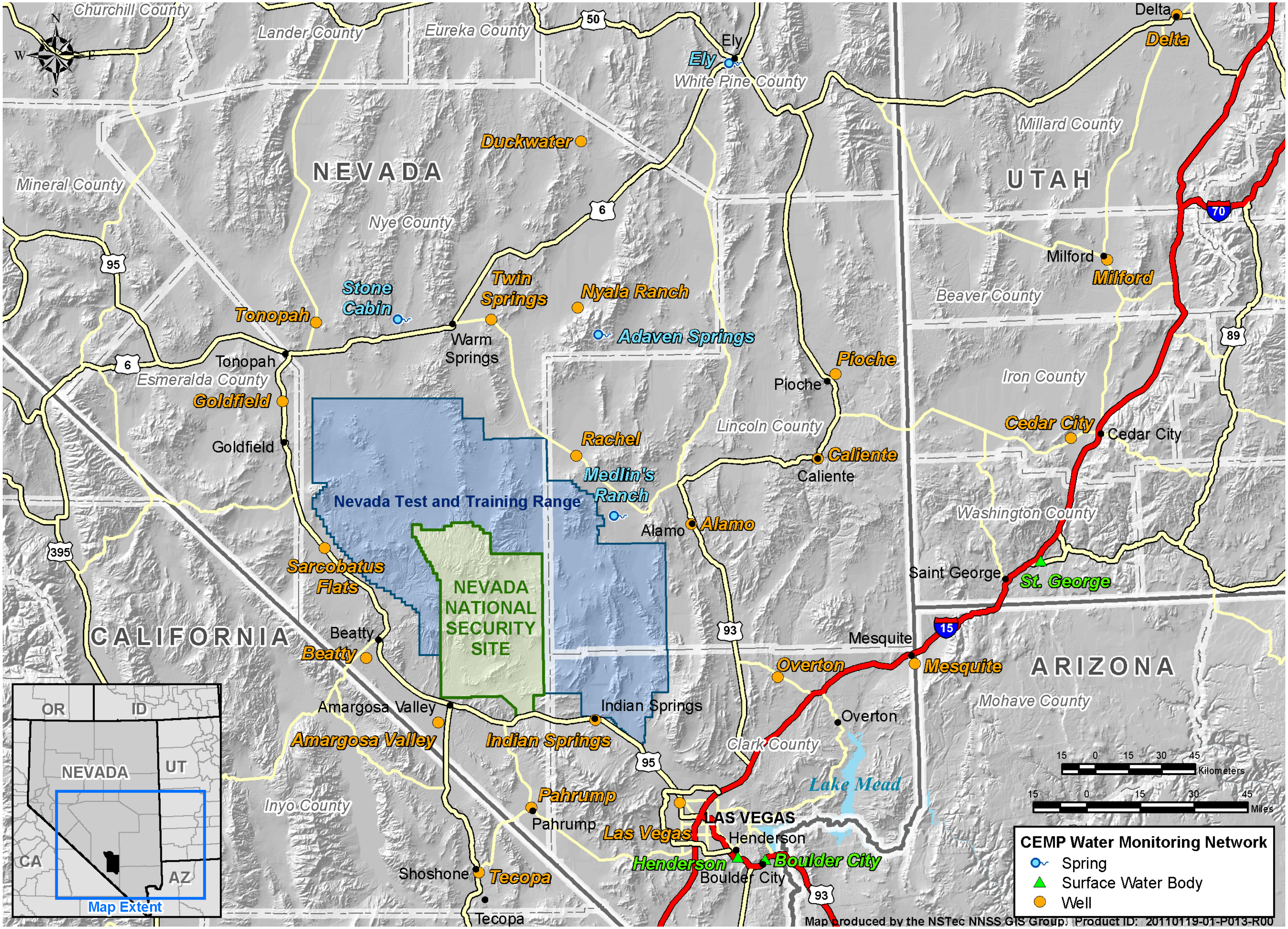
Radioactivity in onsite groundwater and surface waters of the NNSS is monitored annually in order to (1) ensure that NNSS drinking water is safe, (2) determine if permitted facilities on the NNSS are in compliance with permit discharge limits for radionuclides, (3) estimate radiological dose to onsite wildlife using natural and man-made water sources, and (4) determine if groundwater is being protected from disposed radioactive wastes at the Area 3 and Area 5 RWMSs. In 2010, NSTec sampled 5 potable water supply wells, 4 non-potable/inactive water supply wells, 14 monitoring wells, and 1 tritiated water containment pond system *(see map on Page 17)*. All samples were monitoried for tritium. All water supply wells and 7 of the 14 onsite monitoring wells were also monitored for gross alpha and gross beta radioactivity and for man-made gamma-emitting radionuclides.

NNSS Water Supply Wells

The 2010 data continue to indicate that underground nuclear testing has not impacted the NNSS drinking water supply network. None of the onsite water supply wells had concentrations of tritium or any man-made gamma-emitting radionuclides above their minimum detectable concentrations (MDCs). The gross alpha and gross beta radioactivity detected in potable water supply wells represent the presence of naturally occurring radionuclides and did not exceed EPA



2010 NSTec Water Monitoring Locations



2010 CEMP Water Monitoring Locations

Range in Groundwater Tritium Levels Measured On the NNSS in 2010	
Onsite Supply Wells	-17.1 to 4.1 pCi/L
Onsite Monitoring Wells	-31.2 to 342* pCi/L

*Four onsite monitoring wells had tritium levels above MDCs; all four are within 1 kilometer (0.6 miles) of underground nuclear tests.

beta all had detectable levels, which are likely from natural sources. One of the monitoring wells (U-19BH) had gross alpha activity above the EPA drinking water limits in any of the five active potable supply wells. One quarterly sample from each of two non-potable water supply wells (WW 5C and WW C-1) had gross alpha values slightly above the EPA MCL of 15 pCi/L.

NNSS Monitoring Wells

Some migration of radionuclides from the underground test areas to NNSS monitoring wells has occurred, although the migration distances appear to be very short. Four onsite monitoring wells (PM-1, UE-7NS, U-19BH, and WW A) had detectable concentrations of tritium ranging from 34.8 to 342 pCi/L, all well below the drinking water limit of 20,000 pCi/L. Each of these wells is located within 0.6 miles of a historical underground test. Tritium concentrations in these wells have been decreasing in recent years; the estimated rates of decrease since 1999 range from 5.4 to 12.8 percent and are consistent with the natural decay rate of tritium. In 2010, all the other onsite monitoring wells sampled had tritium levels below detection.

No man-made gamma-emitting radionuclides were detected in the seven monitoring wells sampled in 2010. Those monitoring well samples measured for gross alpha and gross beta all had detectable levels, which are likely from natural sources. One of the monitoring wells (U-19BH) had gross alpha activity above the EPA drinking water limit; this activity is likely from man-made radionuclides.

Containment Ponds

A series of five constructed ponds collect and hold water discharged from E Tunnel in Area 12 where nuclear testing was conducted in the past. The water is perched groundwater that has percolated through fractures in the tunnel system. Monitoring of the effluent waters from E Tunnel is conducted to determine if radionuclides or other contaminants exceed the allowable contaminant levels regulated under a state water pollution control permit. Tritium concentrations in tunnel effluent waters in 2010 were lower than the permit limit. The E Tunnel containment ponds are fenced and posted with radiological warning signs. Given that the ponds are available to wildlife, game animals are periodically sampled by NSTec to assess the potential radiological dose to humans via ingestion of game animals exposed to these ponds and to evaluate the radiological impacts to wildlife.

No drinking water wells on the NNSS contained detectable tritium or man-made gamma-emitting radionuclides.

Great Basin collared lizard *(Crotaphytus bicinctores)*

Tritiated water is also pumped into lined sumps during studies conducted by the Environmental Management's UGTA Sub-Project *(see Page 20)*. During the studies, suitable wells are drilled and existing drill holes are re-completed in the vicinity of some underground tests. If the tritium level exceeds 200,000 pCi/L in water that is purged from a well during drilling and completion, or sampling operations, the contaminated water is pumped from the wells and diverted to lined sumps (containment ponds) for evaporation, as required by the State. During 2010, water containing tritium was pumped from four drill holes. Water from one of the wells, ER-20-7, was contained in a sump and had a tritium concentration of 19,100,000 pCi/L. Well ER-20-7 intercepts a contaminant plume consisting almost entirely of tritium believed to originate from the TYBO and BENHAM underground test areas, which are about 3,100 feet and 4,300 feet away from ER-20-7, respectively.

Ring-necked snake *(Diadophis punctatus)*

2010 Monitoring Results for E Tunnel Effluent Waters

Parameter	Permit Limit (pCi/L)	Average Measured Concentration (pCi/L)
Tritium	1,000,000	505,000
Gross Alpha	35	8.0
Gross Beta	100	37.7

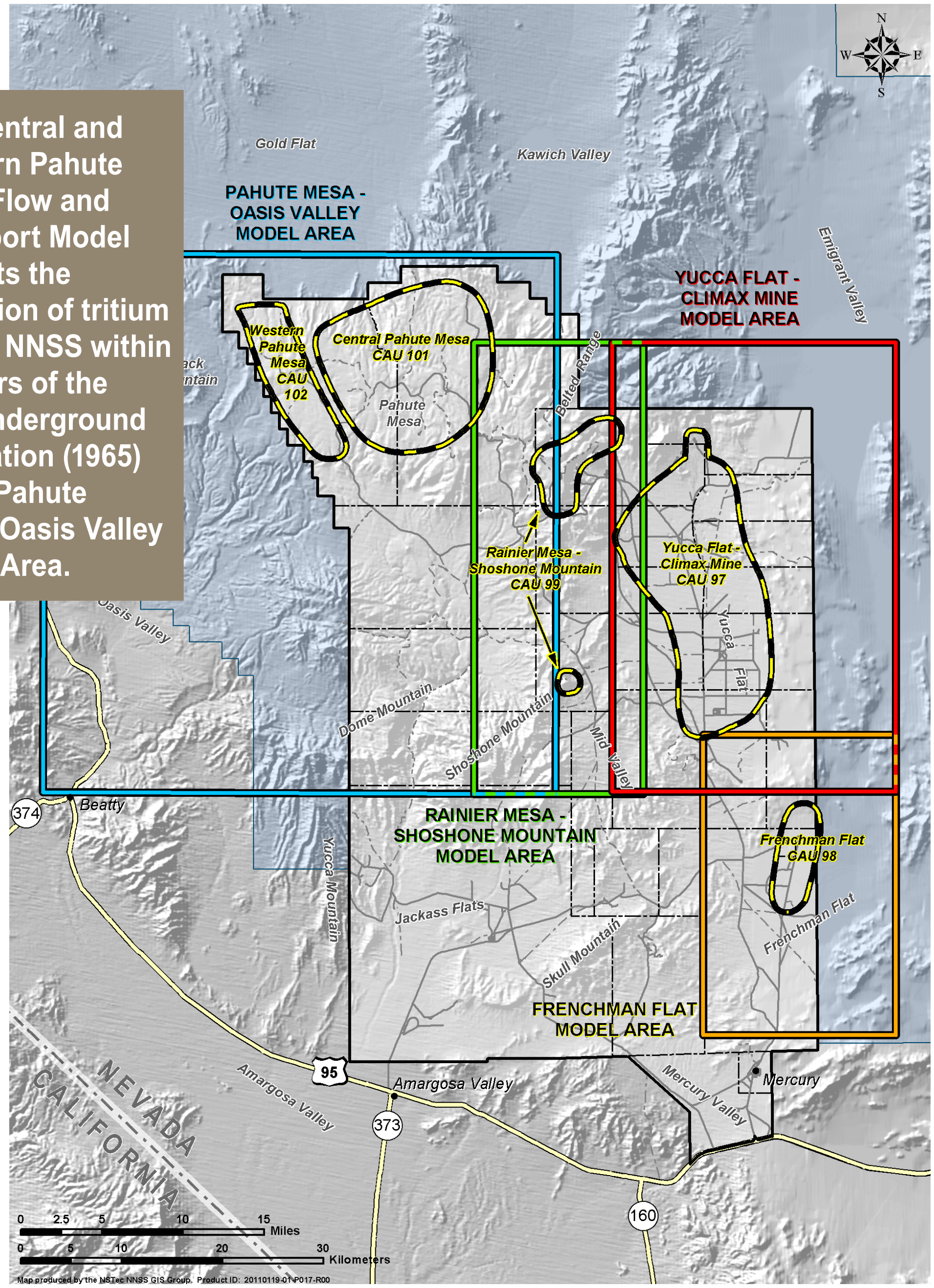
UGTA Sub-Project Investigations and Modeling

The areas of known and potential groundwater contamination on the NNSS due to underground nuclear testing are called UGTA CAUs. The mission of the UGTA Sub-Project is to identify contaminant boundaries for these CAUs and then implement an effective long-term monitoring system. The FFACO identifies a work scope and milestone schedule for the field investigations and the development of flow and transport models necessary to characterize the UGTA CAUs. Closure of the UGTA CAUs under the FFACO will involve monitoring groundwater in perpetuity because cost-effective technologies have not been developed to effectively remove or stabilize the radiological contaminants produced during historical underground nuclear testing.

The UGTA Sub-Project gathers information regarding the hydrology and geology of each CAU to produce hydrogeologic models for specific UGTA model areas that will be used to predict groundwater flow and contaminant transport. A Phase II hydrogeologic field investigation for the Pahute Mesa–Oasis Valley Model Area was started in 2009. Twelve proposed sites for new Pahute Mesa Phase II wells were identified. Four wells were drilled in 2009, and four more were drilled in 2010: ER-20-4 in Area 20 of the NNSS, and ER-EC-12, ER-EC-13, and ER-EC-15, all on the NTTR. Proposed Pahute Mesa Phase II wells are selected to provide the maximum amount of information to support groundwater flow and contaminant transport modeling. Some of the new wells drilled for this investigation may also be used as long-term monitoring wells.

The Central and Western Pahute Mesa CAUs Phase I Flow and Transport Model, published in 2009, predicts that tritium contamination above the Safe Drinking Water Act limit of 20,000 pCi/L should be present off the NNSS *(see figure on next page)*. The NTTR Well ER-EC-11 was found to have tritium, as predicted by the flow and transport model. The tritium concentration was 13,180 pCi/L when the well was sampled in October 2009. In 2010, a deeper zone of Well ER-EC-11 was sampled, and no tritium was detected. This was not unexpected, as the aquifer sampled in 2010 is isolated from the overlying contaminated aquifer by a confining unit, which does not readily conduct water.

The Central and Western Pahute Mesa Flow and Transport Model predicts the migration of tritium off the NNSS within 50 years of the first underground detonation (1965) in the Pahute Mesa–Oasis Valley Model Area.



Location of UGTA Sub-Project CAUs and Model Areas

The schedule of FFACO corrective actions, particularly for UGTA CAUs, is among the highest mission priorities of NNSA/NSO.

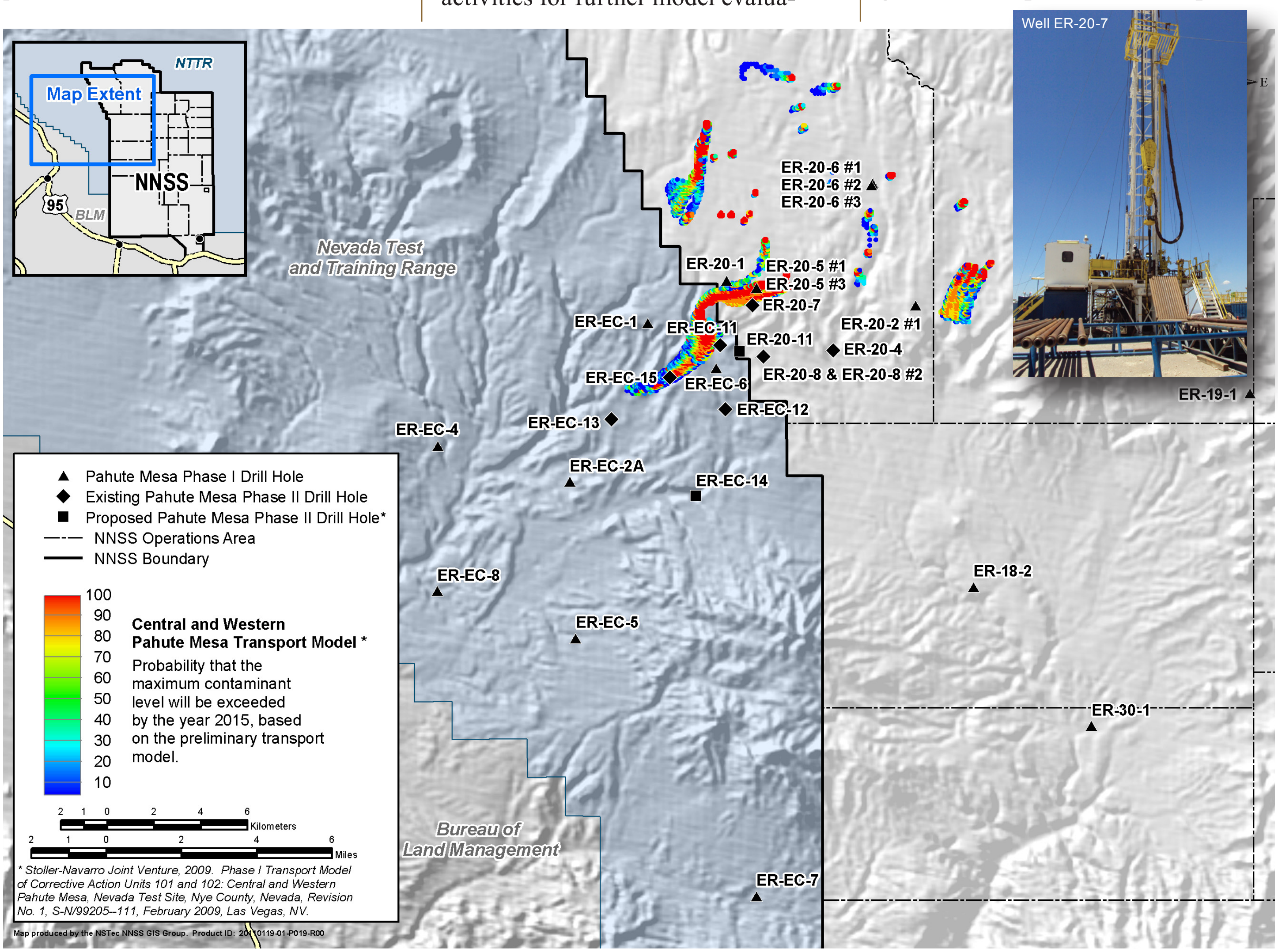
ER-EC-11 is the first offsite well in which radionuclides from underground nuclear testing activities at the NNSS have been detected. Well ER-EC-11 is located approximately 2,350 feet west of the NNSS boundary and approximately 2 miles from the nearest underground nuclear tests BENHAM and TYBO, which were conducted in 1968 and 1975, respectively. Well sample analyses to date have not detected the presence of man-made radionuclides farther downgradient of Pahute Mesa in any of the 11 nearby UGTA wells on the NTTR (ER-EC-1, -2A, -4, -5, -6, -7, -8, -12, -13, -15, and ER-20-4).

The NNSA/NSO monitoring well, PM-3, located 4.6 miles northwest of ER-EC-11 on the NTTR *(see Page 17)*, was sampled under the RREMP and tritium was detected (48.3 pCi/L) at the 1,560-foot sampling depth. The depth of the sample is within zeolitic nonwelded tuff, a confining unit. Hydrogeologic data west of the NNSS are sparse, and thus groundwater flow predictions at the location of PM-3 are uncertain. PM-3 will continue to be monitored under the RREMP and by the UGTA Sub-Project in 2011 to determine whether this is a one-time anomaly.

NNSA/NSO presented the flow and transport model predictions and the current sampling data from offsite UGTA characterization wells at open house events on February 18, 2010, and April 19, 2010, at the Beatty Community Center in Beatty, Nevada.

The Phase II Transport Model for the Frenchman Flat CAU was submitted to the Nevada Division of Environmental Protection (NDEP) and to a formal external peer review team in 2010. The review team provided technical evaluation of the studies and assessed the readiness of the UGTA Sub-Project to proceed to monitoring activities for further model evaluation. The review team recommended that the Sub-Project move forward and prepare a Corrective Action Decision Document and Corrective Action Plan. After full review and consideration, NDEP accepted the Frenchman Flat flow and transport models. A Model Evaluation Plan for the Frenchman Flat CAU was prepared, which describes a path forward and presents an evaluation of the flow and transport model forecasts. The objectives and criteria for the Frenchman Flat CAU long-term monitoring well network were also developed in 2010.

The FFACO web page sponsored by NDEP's Bureau of Federal Facilities is found at **http://ndep.nv.gov/BOFF/ffco.htm**. Current FFACO-related public notices can be found on the NNSA/NSO web page at **http://www.nv.doe.gov/outreach/publicnotices.aspx**.



Results of Phase I Central and Western Pahute Mesa Transport Modeling

Cleanup and Closure of Corrective Action Sites

The Environmental Restoration Project takes corrective actions at sites on the NNSS, the NTTR, and the TTR that have been impacted by atmospheric and underground nuclear tests conducted from 1951 to 1992. The project is responsible for nearly 3,000 CASs in Nevada. The CASs may be contaminated with radioactive and/or nonradioactive wastes. The FFACO, as amended (May 2011), describes the strategy that will be employed to plan, implement, and complete environmental corrective actions. The State of Nevada is a participant throughout the closure process, and the Nevada Site Specific Advisory Board (NSSAB) is kept informed of the progress made. The NSSAB is a formal volunteer group of interested citizens and representatives who provide informed recommendations to NNSA/NSO's EM Program.

Industrial Site CASs are facilities and land that may have become contaminated as a result of activities conducted in support of nuclear testing, and include disposal wells, inactive tanks, contaminated waste sites, inactive ponds, muck piles, spill sites, drains and sumps, and ordnance sites. In 2010, 12 Industrial Sites CASs were closed, and 60 CASs were investigated and/or remediated as progress towards closure. Only 72 CASs remain to be closed.

Soil Site CASs are where nuclear tests have resulted in extensive surface and/or shallow subsurface contamination. The soils may contain contaminants including radioactive materials, oils, solvents, heavy metals, as well as contaminated instruments and test structures used during testing activities. Corrective actions range from removal of soil to closure in place with restricted access controls. In 2010, two Soil Site CASs were closed on the NNSS. There are 110 CASs that remain to be closed.

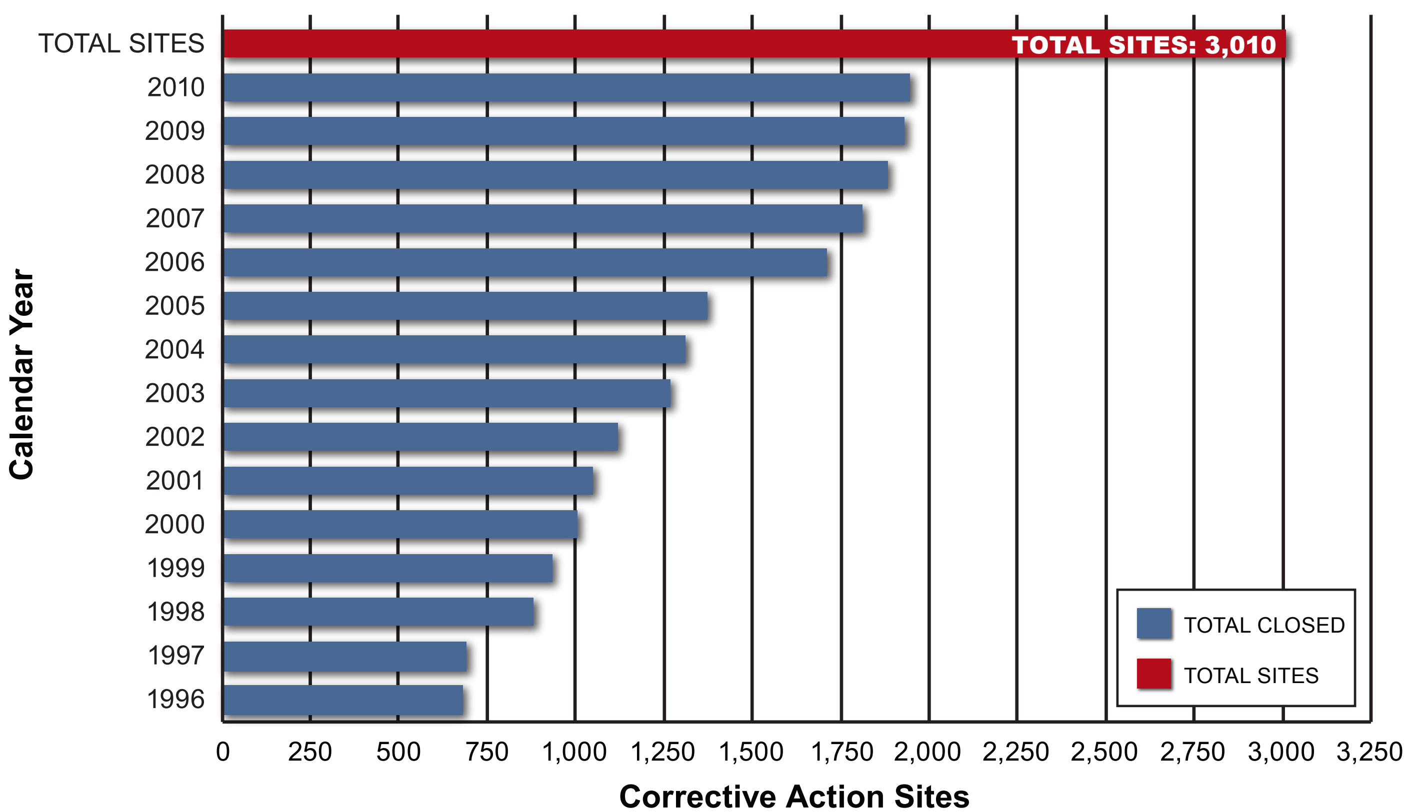
UGTA CASs include 879 sites of underground nuclear tests where the tests have resulted or might result in local or regional impacts to groundwater resources *(see Pages 20 and 21)*.

Restoration Progress under FFACO

In 2010, 14 CASs were closed and all 2010 FFACO cleanup and closure activity milestones were met. The majority of the remaining CASs are UGTA CASs, for which closure in place with monitoring in perpetuity, is the corrective action.

Nevada National Security Site

Corrective Action Site Closures



Nonradiological Monitoring of Air and Water

Great Basin skink *(Eumeces skiltonianus)*

Estimated Quantity of Pollutants Released into the Air from NNSS Operations in 2010

Criteria Air Pollutants:	Tons
Particulate Matter[(a)]	1.09
Carbon Monoxide	1.33
Nitrogen Oxides	6.09
Sulfur Dioxide	0.36
Volatile Organic Compounds	0.33
Hazardous Air Pollutants (HAPs)	0.02

(a) Particulate matter equal to or less than 10 microns in diameter

Nonradioactive Air Emissions

The release of air pollutants is regulated on the NNSS under a Class II air quality operating permit. Class II permits are issued for "minor" sources where annual emissions must not exceed 100 tons of any one "criteria pollutant" or 10 tons of any one of the 189 "hazardous air pollutants" (HAPs), or 25 tons of any combination of HAPs. Common sources of such air pollutants on the NNSS include particulates from construction, aggregate production, surface disturbances, fugitive dust from driving on unpaved roads, fuel-burning equipment, open burning, fuel storage facilities, and chemical release and detonation tests.

An estimated 9.20 tons of criteria air pollutants and 0.02 tons of HAPS were released on the NNSS in 2010. The majority of the emissions were nitrogen oxides from diesel generators. No emission limits for any air pollutants were exceeded.

Nonradiological Monitoring of Drinking Water and Wastewater

NNSA/NSO operates a network of six permitted wells that comprise three permitted public water systems on the NNSS that supply the drinking water needs of NNSS workers and visitors. NNSA/NSO also hauls potable water to work locations at the NNSS that are not part of a public water system. Monitoring results for 2010 indicated that water samples from the three public water systems and from the potable water hauling trucks met the National Primary and Secondary Drinking Water Standards.

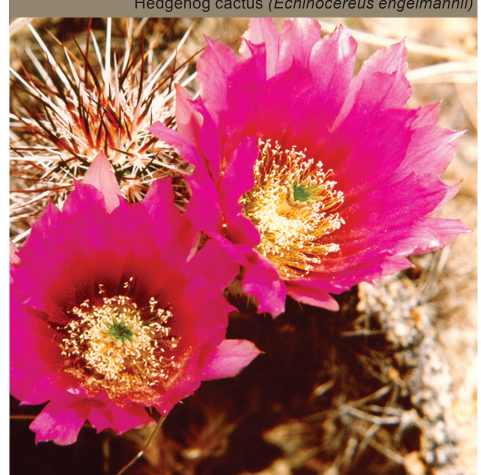
Industrial discharges on the NNSS are limited to the two operating sewage lagoon systems, Area 6 Yucca and Area 23 Mercury. Under the requirements of the state operating permit, liquid discharges to these sewage lagoons were tested quarterly in 2010 for biological oxygen demand, pH, and total suspended solids. All sewage lagoon water measurements were within permit limits.

The discharge water from the E Tunnel complex is sampled annually under a state water pollution control permit for 14 nonradiological contaminants, which are mainly metals. In 2010, no contaminants were detected at levels that exceeded permit limits.

NNSS Drinking Water

The public water systems that supply drinking water to NNSS workers and visitors meet all National Primary and Secondary Drinking Water Standards.

Hedgehog cactus *(Echinocereus engelmannii)*



Cultural Resources

The historic landscape of the NNSS contains archaeological sites, buildings, structures, and places of importance to American Indians and others. These are referred to as “cultural resources.” NNSA/NSO requires that NNSS activities and programs comply with all applicable cultural resources regulations and that such resources on the NNSS be monitored. The Cultural Resources Management (CRM) program is implemented by DRI to meet this requirement.

DRI archeologists completed archival research for 16 proposed projects in 2010 and completed surveys of 405 acres for 6 of the 16 projects. One cultural resource, a locomotive, was found to be eligible for the National Register of Historic Places (NRHP), and it was donated to the Nevada State Railroad Museum in Boulder City. Historical evaluations were completed for the U12t Tunnel Complex and the L 2 Locomotive. Historical studies were conducted for the vertical shafts U15a and U15e, the U16a Tunnel Complex, the Structural Response Structures, and the Pluto Compressor Building. Numerous field projects and assessments were also conducted. No mitigation actions to protect historic properties on the NNSS were required in 2010. DRI continued to maintain and manage the NNSS Archaeological Collection, which contains over 400,000 artifacts.

NNSA/NSO’s American Indian Program conducts consultations with NNSS-affiliated American Indian tribes through the Consolidated Group of Tribes and Organizations (CGTO). In 2010, the CGTO and NNSA/NSO worked together to provide American Indian text for inclusion in two major NNSA/NSO Environmental Impact Statements. NNSA/NSO hosted the annual Tribal Update Meeting with the CGTO in October 2010.

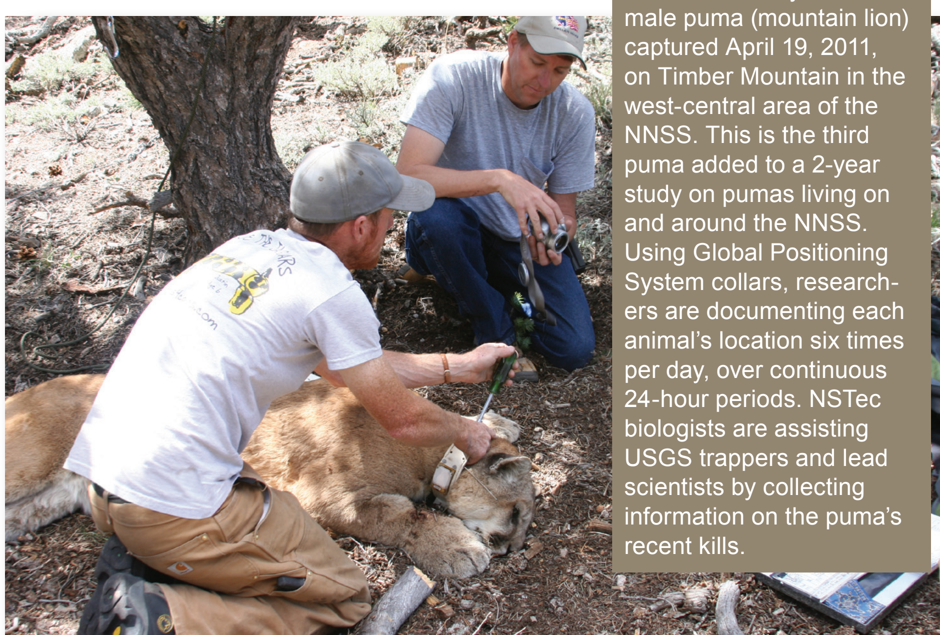
Ecological Monitoring and Endangered Species Protection

The Ecological Monitoring and Compliance (EMAC) Program provides ecological support for activities and programs conducted on the NNSS. Important species known to occur on the NNSS include 18 sensitive plants, 1 mollusk, 2 reptiles, over 250 birds, and 27 mammals. They are classified as important due to their sensitive, protected, and/or regulatory status with state or federal agencies.

The desert tortoise is the only resident species found on the NNSS that is listed as threatened under the Endangered Species Act. Habitat of the desert tortoise is in the southern third of the NNSS. Activities conducted in desert tortoise habitat must comply with the terms and conditions of a Biological Opinion issued to NNSA/NSO by the U.S. Fish and Wildlife Service. In 2010, no desert tortoises were accidentally injured or killed at a project site, nor were any found, captured, or displaced from project sites. Two desert tortoises were accidentally killed on roads in 2010, and 13 were moved out of harm’s way off of roads.

Desert tortoise *(Gopherus agassizii)*

In 2010, biologists continued to monitor important species and biological resources on the NNSS that included sensitive plants, migratory birds, wild horses, mule deer, sensitive bats, the western red-tailed skink, and natural and man-made water sources. A new collaborative effort with Dr. David Mattson of the U.S. Geological Survey (USGS) began in 2010 to study the movements, habitat use, and food habits of pumas (mountain lions) on and around the NNSS. The goal is to capture and collar four pumas and track them for a year. Since 2003, USGS researchers have been able to track more than 60 pumas from northwestern Arizona to southwestern Utah.



Biologists Brian Jansen and Derek Hall attach a tracking device onto a sedated 5–6-year-old male puma (mountain lion) captured April 19, 2011, on Timber Mountain in the west-central area of the NNSS. This is the third puma added to a 2-year study on pumas living on and around the NNSS. Using Global Positioning System collars, researchers are documenting each animal’s location six times per day, over continuous 24-hour periods. NSTec biologists are assisting USGS trappers and lead scientists by collecting information on the puma’s recent kills.

Summary of NNSA/NSO's Compliance with Major Federal Statutes in 2010

Environmental Statute or Order and What It Covers	2010 Status
Atomic Energy Act (through compliance with DOE O 435.1, "Radioactive Waste Management"): Management of low-level waste (LLW) and mixed low-level waste (MLLW) generated or disposed on site	69,905 cubic feet of radioactive wastes, which included LLW, MLLW, and asbestiform LLW, were received and disposed on site and were within permit limits for volume and weight; vadose zone and groundwater monitoring continued to verify that disposed LLW and MLLW are not migrating to groundwater or threatening biota or the environment.
Clean Air Act: Air quality and emissions into the air from facility operations	Onsite air sampling stations detected man-made radionuclides at levels comparable to previous years and well below the regulatory dose limit for air emissions to the public of 10 mrem/yr. The estimated dose from all 2010 NNSS air emissions to the maximally exposed individual (MEI) is 0.04 mrem/yr. Nonradiological air emissions from permitted equipment and facilities were all below emission and opacity limits; the North Las Vegas Facility (NLVF) received a Letter of Noncompliance from Clark County concerning the maintenance of log books for two diesel generators at Building B-7, which was rectified.
Clean Water Act: Water quality and effluent discharges from facility operations	All domestic and industrial wastewater systems and groundwater monitoring well samples were within permit limits for regulated water contaminants and water chemistry parameters.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Superfund Amendments and Reauthorization Act (SARA): Cleanup of waste sites containing hazardous substances	No NNSS cleanup operations are regulated under CERCLA or SARA; they are regulated under RCRA instead.
DOE O 5400.5, "Radiation Protection of the Public and the Environment": Measuring radioactivity in the environment and estimating radiological dose to the public due to NNSA/NSO activities	RREMP monitoring of air, water, and direct radiation was conducted. The total annual dose to the MEI from all exposure pathways due to NNSA/NSO activities was estimated to be 1.69 mrem/yr, well below the DOE limit of 100 mrem/yr.
Emergency Planning and Community Right to Know Act (EPCRA): The public's right to know about chemicals released into the community	90,327 pounds (lb) of lead and 2,931.25 lb of mercury were disposed on site; 10,683 lb of lead were released as spent ammunition and 6.4 lb of lead were released to the air from the Mercury Firing Range. Lead and mercury wastes shipped off site for disposal or recycling totaled 13,349.85 lb and 0.03 lb, respectively. No releases occurred that triggered state or federal reporting requirements.
Endangered Species Act (ESA): Threatened or endangered species of plants and animals	Field surveys for 20 proposed projects were conducted; 4.46 acres of tortoise habitat were disturbed, and no tortoises were harmed at or displaced from project sites; 2 tortoises were killed accidentally on roads and 13 were moved off roads to safety. All actions were in compliance with permit requirements.
Federal Facility Agreement and Consent Order (FFACO): Cleanup of waste sites containing hazardous substances	All 2010 corrective action milestones under the FFACO were met. A total of 14 CASs were closed in accordance with State-approved corrective action plans.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA): Storage and use of pesticides and herbicides	Both restricted-use and nonrestricted-use pesticides were applied by State-certified personnel. Storage and use of pesticides were in compliance with federal and state regulations.
Migratory Bird Treaty Act (MBTA): Protecting migratory birds, nests, and eggs from harm	Two raven chicks in a nest were found at a project site; NNSS operations were postponed until the chicks had fledged. Two barn owls, three red-tailed hawks, and one raven were electrocuted by power lines; one barn owl was killed by a vehicle; and three cowbirds and five northern flickers were killed by accidental entrapment. Sites of entrapment were mitigated to avoid recurrence.
National Environmental Policy Act (NEPA): Evaluating projects for environmental impacts	NNSA/NSO continued preparation of the new *Site-Wide Environmental Impact Statement for the Nevada National Security Site and Offsite Locations in the State of Nevada*. It evaluates current and future NNSA/NSO operations in Nevada during the 10-year period beginning when the Record of Decision is published, scheduled for 2012.
National Historic Preservation Act (NHPA): Identifying and preserving historic properties	Archival research for 16 proposed projects was conducted; 405 acres were surveyed for 6 of the projects, 8 prehistoric/historical sites were identified, and 1 locomotive was determined eligible for the National Register of Historic Places.
Resource Conservation and Recovery Act (RCRA): Generation, management, disposal of hazardous waste (HW) and MLLW and cleanup of inactive, historical waste sites	1,266 tons of MLLW were received and disposed on site, and 8.95 tons of HW were stored prior to shipment off site for disposal, all in accordance with the state permit. Groundwater monitoring of wells at the Area 5 RWMS confirmed that buried MLLW remains contained, and vadose zone monitoring and post-closure inspections of historical RCRA closure sites confirmed that buried HW remains contained.
Safe Drinking Water Act: Quality of drinking water	All concentrations of regulated water contaminants in drinking water from the three permitted public water systems on the NNSS were below state and federal permit limits.
Toxic Substances Control Act (TSCA): Management and disposal of polychlorinated biphenyls (PCBs)	41 drums of fluorescent light ballasts containing PCBs and approximately 490 tons of PCB-contaminated soil and debris were shipped off site to permitted disposal and treatment facilities.

Environmental Management System

NNSA/NSO's Environmental Management System (EMS) is a business management practice that incorporates concern for environmental performance throughout the NNSS and its support facilities. The goal of the EMS is continual reduction of NNSA/NSO's impact on the environment. NSTec designed the EMS to meet the 17 requirements of the globally recognized International Organization for Standardization (ISO) 14001:2004 Environmental Management Standard. In 2008, the EMS obtained ISO 14001:2004 certification.

Each year, NSTec evaluates whether NNSA/NSO operations have an environmental aspect and implements the EMS to minimize or eliminate any potential impacts. An NSTec Environmental Working Group determines which EMS objectives and targets will be implemented each fiscal year (FY) (October 1 through September 30). The EMS objectives and targets for FY 2010 were met. Many of them were implemented and tracked under the Pollution Prevention and Waste Minimization Program and the Energy Management Program.

Pollution Prevention and Waste Minimization

Pollution prevention and waste minimization activities on the NNSS result in reductions to the volume and toxicity of waste generated on site that must be disposed. In 2010, 152.7 tons of hazardous wastes were diverted from disposal by recycling and reuse. The largest proportion of this reduction in wastes came from shipments of bulk used oil (90.5 tons), lead acid batteries (31.9 tons), and electronic equipment (18.3 tons) to offsite vendors.

A reduction of 713.3 tons of solid wastes was realized in 2010. The largest proportion of this reduction came from shipping 523.9 tons of mixed paper/cardboard/aluminum cans/plastic from the NLVF and 111.6 tons of mixed paper/cardboard from the NNSS to an offsite vendor for recycling.

EMS FY 2010 Status

Reduce Energy Use

- Reduced energy use by 5.6% from FY 2009, meeting the FY 2010 target to keep usage at or below the FY 2009 level.
- Conducted audits on 25.6% of enduring buildings (existing, occupied buildings larger than 5,000 gross square feet) to determine if they meet the Guiding Principles for Federal Leadership in High Performance Sustainable Buildings. This exceeded the target to audit 20% of enduring buildings.

Reduce Petroleum Fuel Use

- Reduced petroleum fuel use by 31.7% from FY 2009. This exceeded the target of a 2% reduction.
- E-85 fuel was 41.4% of the total quantity of fuels used at the NNSS. This exceeded the target of 35%.

Reduce Water Usage

- Reduced water usage by 0.6% from FY 2009, meeting the FY 2010 target to keep usage at or below the FY 2009 level.

Close/Remediate Historical Contaminated Sites Regulated under FFACO

- 12 Industrial Sites CASs and 2 Soil Sites CASs were closed on schedule or ahead of schedule, meeting the FY 2010 target.

Protect Groundwater Quality

- Prepared 60 boreholes for plugging and plugged 50 boreholes, meeting the FY 2010 target.

Reduce Risks of Potential Environmental Contamination at Work Sites

- Funding was provided to begin draining refrigerant containing ozone-depleting substances from 112 refrigerant tanks of 62 chillers no longer in use. By the end of FY 2010, 56 tanks had been drained. The project was completed in FY 2011.

Energy Management Program

The NNSA/NSO Energy Management Program was formed to implement projects to meet numerous sustainable environmental stewardship goals established by DOE. Its mission is to reduce the use of energy and water in NNSA/NSO facilities by advancing energy efficiency, water conservation, and the use of solar and other renewable energy sources. The program's goals are established, tracked, and reported on an FY basis.

In December 2010, the Energy Management Program developed the FY 2011 NNSA/NSO Site Sustainability Plan, which reports the current status and planned actions toward meeting the sustainability goals of DOE. Thus far, the Energy Management Program is exceeding the DOE long-term goals of reducing energy intensity, water intensity, and petroleum fuel use, and increasing alternate fuel use and the acquisition of alternative fuel vehicles.

New High Performance Sustainable Fire Stations

The grand opening of two new fire stations on the NNSS occurred in October 2010. Both Fire Station 1 in Mercury and Fire Station 2 in Area 6 received Leadership in Energy and Environmental Design (LEED) Gold Certification because of their many environmental sustainability features. LEED is an internationally recognized green building certification system.

The construction project for the stations was also recognized by DOE and was given an Environmental Stewardship Award in the category of Integrative Planning and Design. The stations will significantly improve firefighting services not only on the NNSS, but also for local agencies that rely on NNSS fire units for interagency assistance.

Fire Station 2 in Area 6 of the NNSS

Greenhouse Gas (GHG) emissions that are targeted for reduction are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. For setting and tracking federal emission reduction goals, they are classified as Scope 1, 2, or 3 GHG emissions depending on their source:

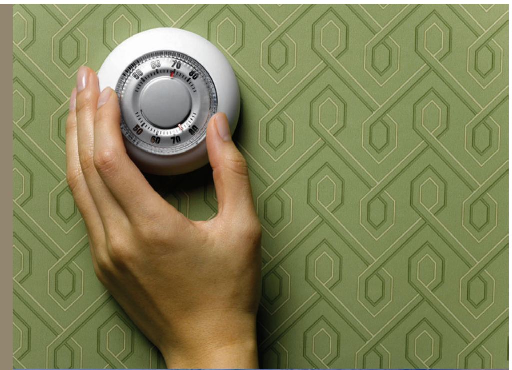
Scope 1–direct emissions from sources that are owned or controlled by a federal agency.

Scope 2–direct emissions resulting from the generation of electricity, heat, or steam purchased by a federal agency.

Scope 3–emissions from sources not owned or directly controlled by a federal agency but related to agency activities such as vendor supply chains, delivery services, employee business air and ground travel, employee commuting, contracted solid waste disposal, contracted wastewater discharge, and transmission and distribution losses related to purchased electricity.

NNSA/NSO Site Sustainability Goals – 2010 Status

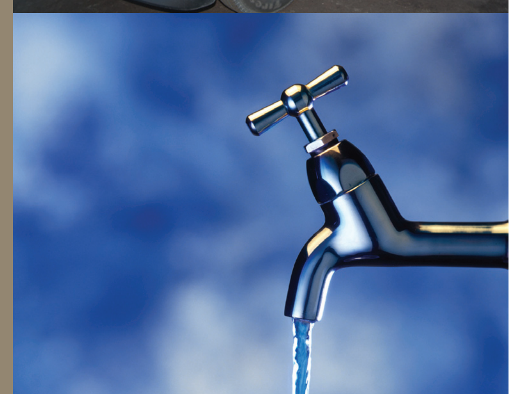
Increase Energy Efficiency – Energy intensity (energy consumption per gross square foot of building space) was reduced by 36.74% from the FY 2003 baseline, exceeding the goal of a 30% reduction by FY 2015.



Increase Use of Renewable Energy Sources – 9.6% of purchased electrical power for NNSA/NSO facilities came from renewable energy sources, exceeding the 2010 goal of 7.5%. Also, 0.05% of power produced on NNSS was from a combination of photovoltaic and wind turbine systems, meeting the goal of having at least one onsite renewable energy generating system by FY 2010.

Reduce Consumption of Petroleum Products – Consumption of alternative fuel by the NNSA/NSO fleet was 153% above the FY 2005 baseline, exceeding the 2010 goal of a 60% increase. Fleet petroleum consumption was 48% less than the FY 2005 baseline, exceeding the 2010 goal of a 10% reduction. All light duty vehicle acquisitions in 2010 were alternative fuel vehicles, exceeding the goal of 75% by FY 2015.

Conserve Water – Water production was reduced by 17.3% from the FY 2007 baseline, exceeding the goal of a 16% reduction by FY 2015. A new car wash was purchased and installed in Mercury to replace the car wash installed in 1962. It reclaims 85% of the water used, which represents 66% water savings per vehicle. A total of 22 water meters were installed at selected buildings at the NLVF.



Use High Performance Sustainable Buildings (HPSBs) – Two new fire stations at the NNSS were completed and received LEED certification. NNSA/NSO expects to meet the FY 2015 goal of having 15% of existing buildings larger than 5,000 gross square feet comply with the Guiding Principles (GPs) for the design of HPSBs; 5.6% of such buildings met the GPs in FY 2010.

Reduce Greenhouse Gas (GHG) Emissions – Scope 1 and 2 GHG emissions were reduced by 8.9% from the FY 2008 baseline, exceeding the 2010 goal of a 2.8% reduction. Scope 3 GHG emissions tracking systems were updated or established to include emissions from transmission and distribution losses, offsite wastewater treatment, and municipal waste disposal.

National Nuclear Security Administration

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