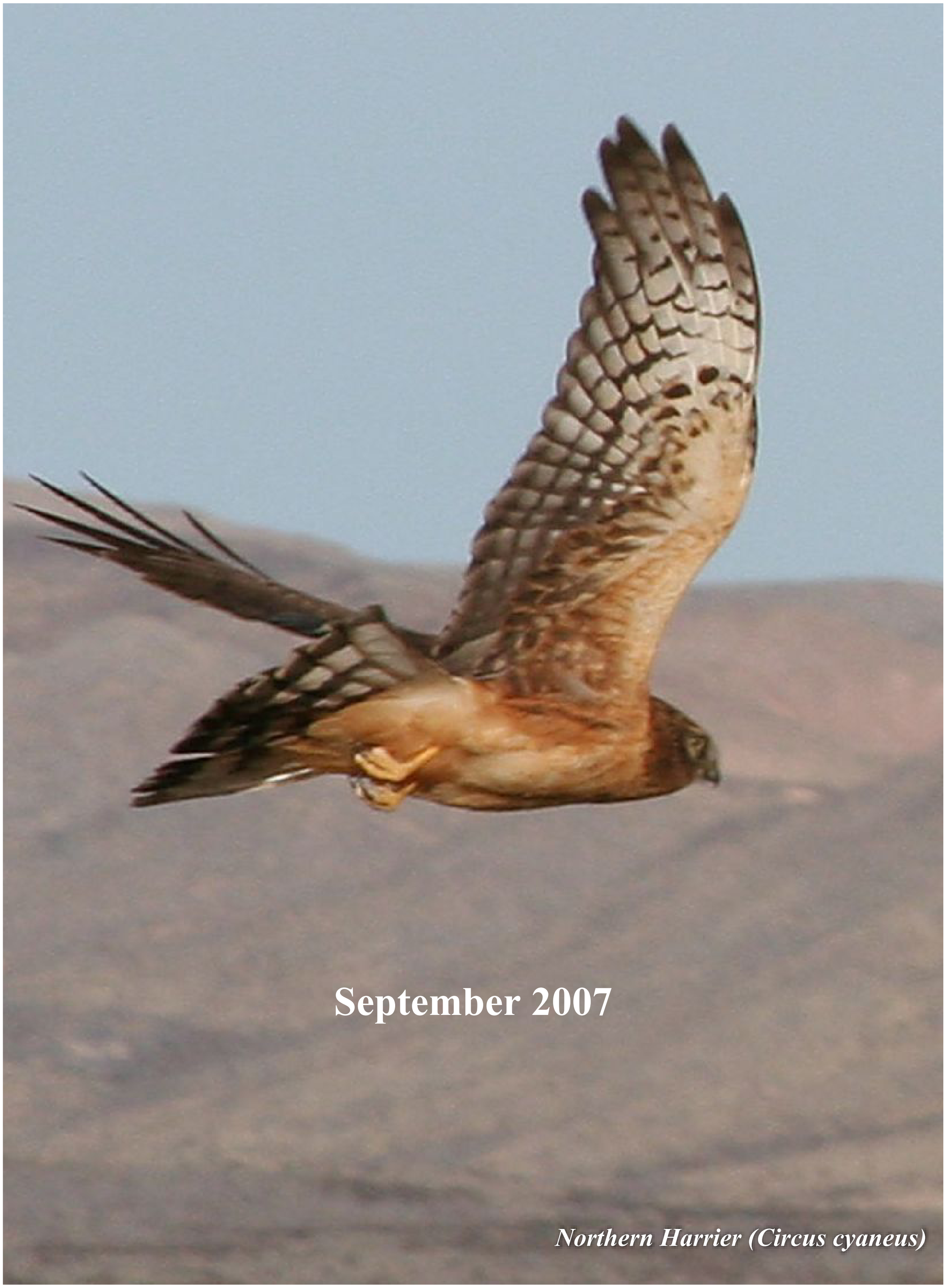
DOE/NV/25946--259

Nevada Test Site Environmental Report Summary 2006



September 2007

Northern Harrier (Circus cyaneus)

National Security Technologies LLC
Vision • Service • Partnership

National Nuclear Security Administration

Disclaimer

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by:

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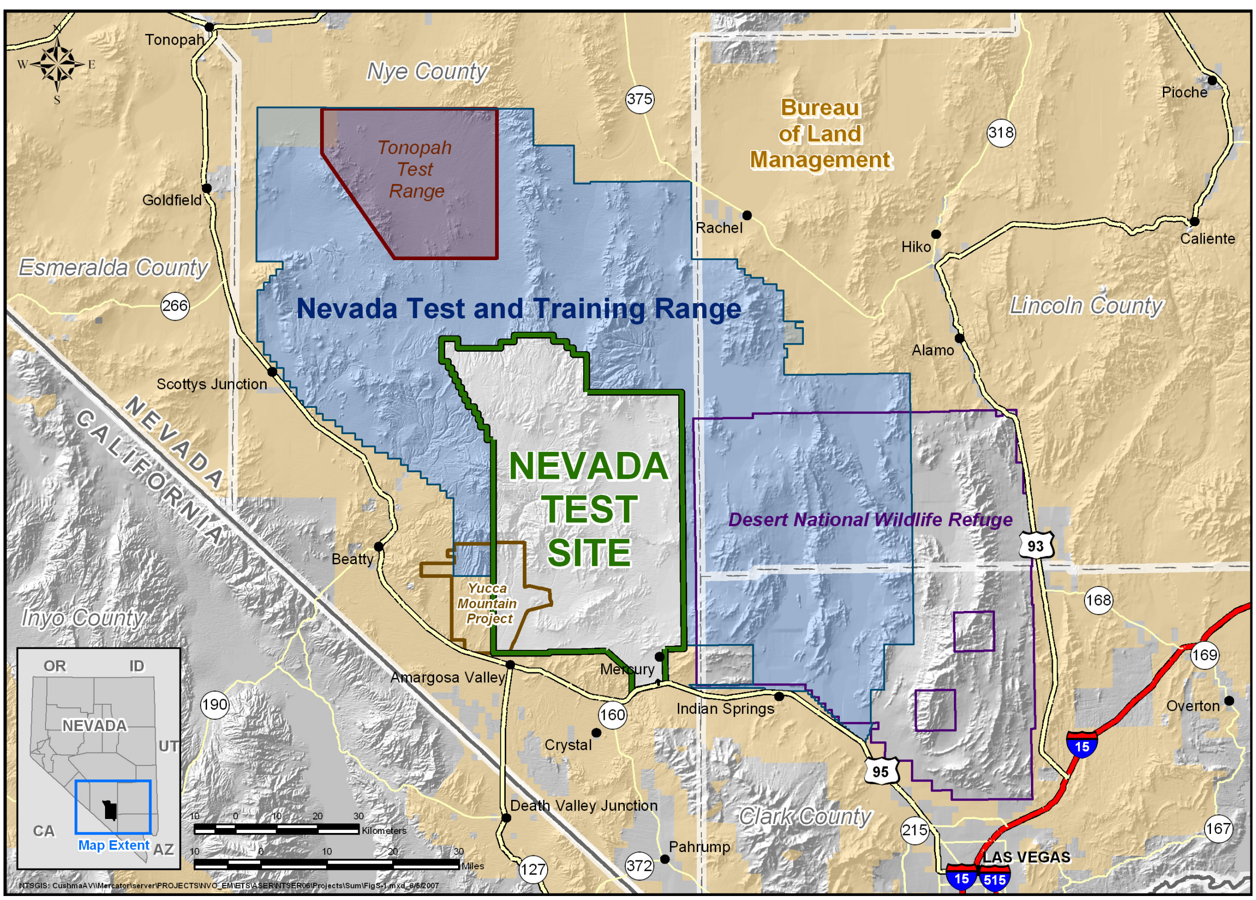
The information presented in this document is explained in greater detail in the Nevada Test Site Environmental Report 2006 (DOE/NV/25946--259). A compact disc of this document is included on the back inside cover. It can also be downloaded from the NNSA/NSO Web site at http://www.nv.doe.gov/library/publications/environmental.aspx or from the U.S. Department of Energy Office of Scientific and Technical Information at http://www.osti.gov/bridge.

If you would like a hard copy of the full report, please contact B.W. Hurley, NNSA/NSO Environmental Management, at (702) 295-1284 or send an e mail message to hurley@nv.doe.gov.

Nevada Test Site
Environmental Report Summary 2006

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) directs the management and operation of the Nevada Test Site (NTS). The NTS is the nation's historical testing site for nuclear weapons from 1951 through 1992 and is currently the nation's unique site for ongoing national-security-related missions and high-risk operations. NNSA/NSO strives to provide to the public an understanding of the current activities on the NTS, including environmental monitoring and compliance activities aimed at protecting the public and the environment from radiation hazards and from nonradiological impacts. This document is a summary of the Nevada Test Site Environmental Report (NTSER) for calendar year 2006 (see attached compact disc on inside back cover). The NTSER is a comprehensive report of environmental activities performed at the NTS and its satellite 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. To provide an abbreviated and more readable version of the NTSER, this summary report is produced. This summary does not include detailed data tables, monitoring methods or design, a description of the NTS environment, or a discussion of all environmental program activities performed throughout the year. The reader may obtain a hard copy of the full NTSER as directed on the inside front cover of this summary report.

The NTS is located about 65 miles northwest of Las Vegas. The approximately 1,375-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.



NTS History

Between 1940 and 1950, the area now known as the NTS was part of the Las Vegas Bombing and Gunnery Range. In 1950, the NTS 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 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 NTS 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*.[1]

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. Since late 1962, nearly all tests have been 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 NTS. Approximately one-third of these tests were detonated near or below the water table.

Five earth-cratering (shallow-burial) tests were conducted over the period of 1962 through 1968 as part of the Plowshare Program that 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 NTS. The second highest yield crater test was Schooner, located in the northwest corner of the NTS. 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 NTS 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 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 were conducted in Area 25, and a series of tests with a nuclear ramjet engine was conducted in Area 26. The test released mostly gaseous radioactivity (radio-iodines, radio-xenons, radio-kryptons) and some fuel particles due to erosion of the metal cladding on the reactor fuel; these releases resulted in negligible deposition on the ground.

NTS - 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 is called the Nevada Proving Ground.

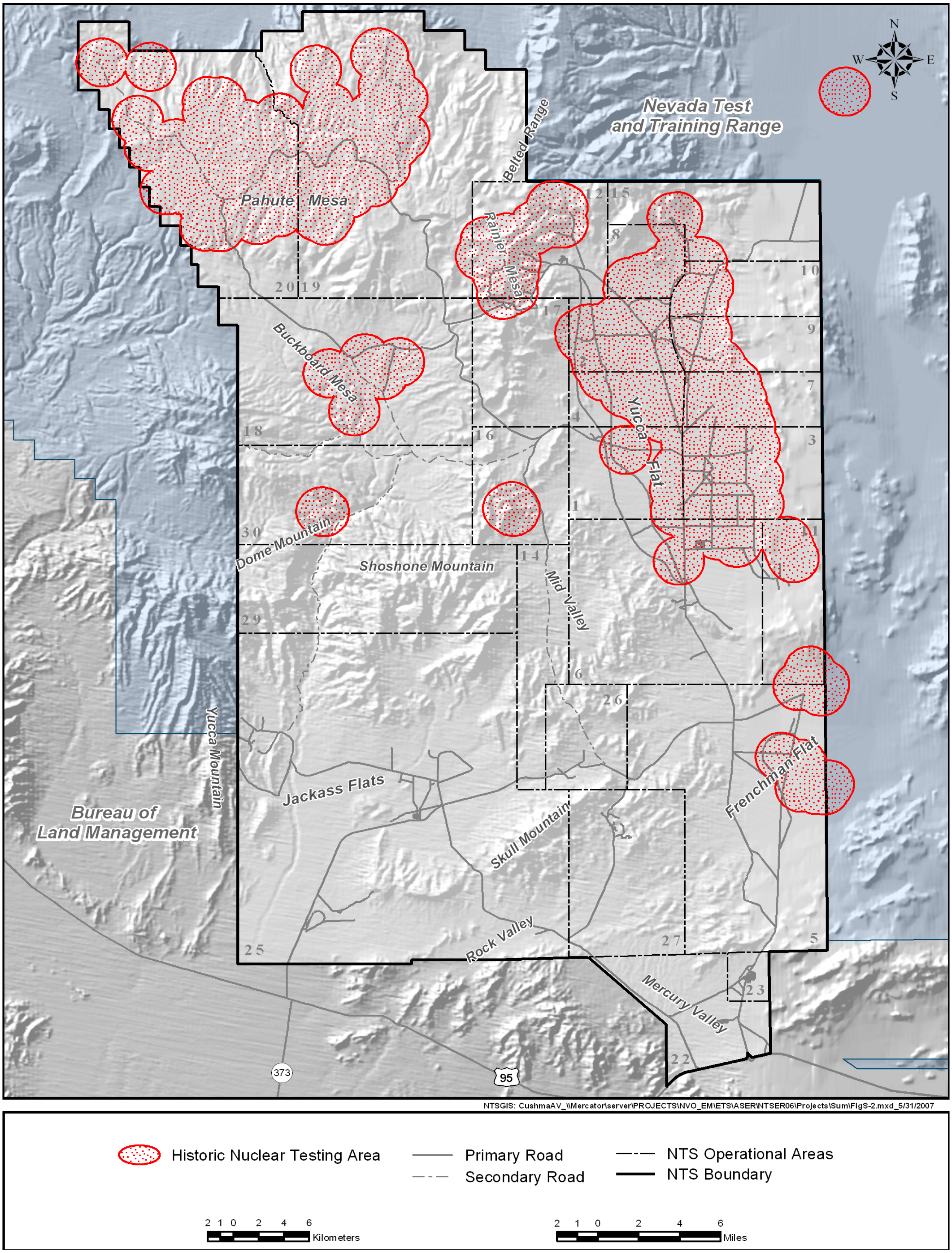
On Saturday, January 27, 1951, an Air Force B-50D bomber dropped a one-kiloton yield nuclear bomb over Frenchman Flat. It was the world's tenth nuclear detonation and was the first NTS test.

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 were conducted at the NTS.

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.

[1] U.S. Department of Energy, 2000. Report No. DOE/NV-209 (Rev. 15).

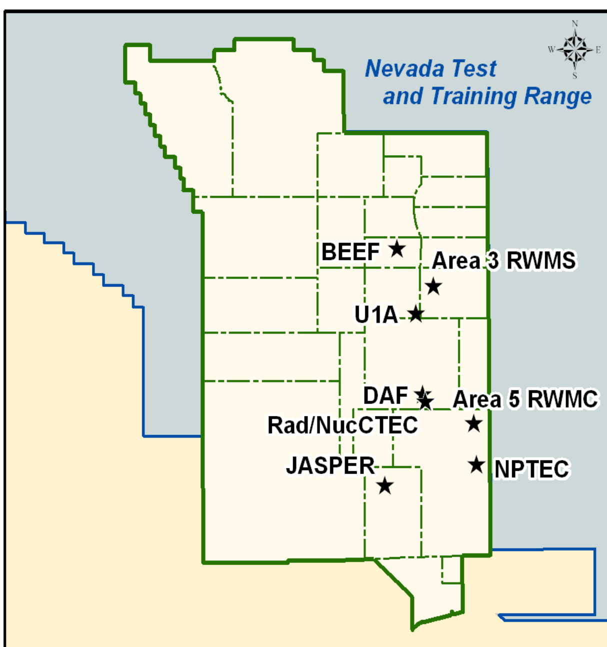


Historic Nuclear Testing Areas

The NTS Now

Los Alamos, Lawrence Livermore, and Sandia National Laboratories are the principal organizations that sponsor and implement experimental programs at the NTS. In 2006, 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. The three major NTS missions include National Security, Environmental Management, and Stewardship of the NTS. 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 NTS as a unique and valuable national resource.

NTS activities in 2006 continued to be diverse, with the primary goal being to ensure that the existing U.S. stockpile of nuclear weapons remains safe and reliable. Facilities that support this mission include the U1a Facility, the Big Explosives Experimental Facility (BEEF), the Device Assembly Facility (DAF), and the Joint Actinide Shock Physics Experimental Research (JASPER) Facility. Facilities that support the Homeland Security program include the new Radiological/Nuclear Countermeasures Test and Evaluation Complex (Rad/NucCTEC), which was expected to be operational in October 2006, but is currently on hold. Facilities that support the Waste Management Program include the Area 5 Radioactive Waste Management Complex (RWMC) and the Area 3 Radioactive Waste Management Site (RWMS). Other NTS activities include demilitarization activities; controlled spills of hazardous material at the Non-Proliferation Test and Evaluation Complex (NPTEC) (formerly known as the Hazardous Materials Spill Center); remediation of industrial sites; processing 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.



NTS Missions and Their Programs

National Security

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

Homeland Security Program - Provides support facilities, training facilities, and capabilities for government agencies involved in counterterrorism activities, emergency response, first responders, national security technology development, and nonproliferation technology development.

Test Readiness Program - Maintains the capability to resume underground nuclear weapons testing, if directed.

Environmental Management

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

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

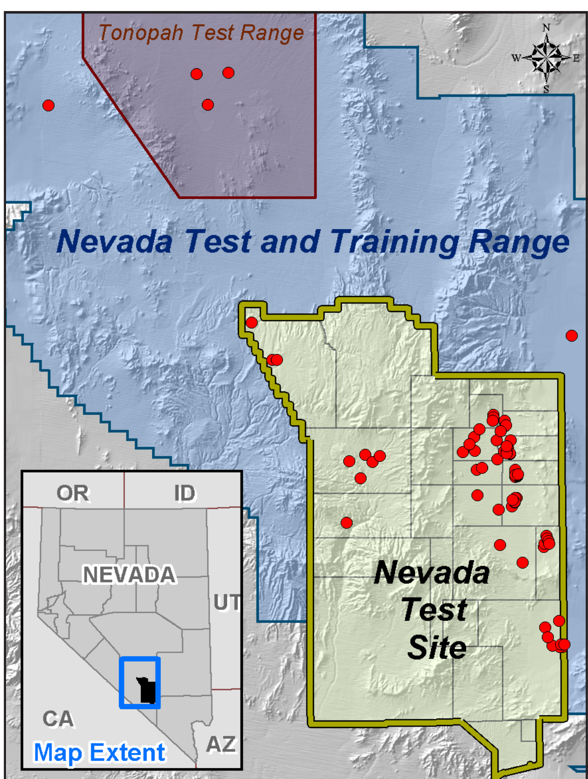
Stewardship of the NTS

Facilities and Infrastructure - Maintains the buildings, roads, utilities, and facilities required to support all NTS programs and to provide a safe environment for NTS workers.

The Legacy of NTS Nuclear Testing

Approximately one-third of the 828 underground nuclear tests on the NTS were detonated near or below the water table resulting in the contamination of groundwater in some areas. In addition, the 100 atmospheric nuclear tests conducted on the NTS and numerous nuclear-related experiments resulted in the contamination of surface soils, materials, equipment, and structures, mainly on the NTS. 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 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 U.S. Department of Defense. 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 provides opportunity for public input via the Community Advisory Board comprised of 15-20 citizen volunteers from Nevada.



Areas of Soil Contamination on and off the NTS

Legacy Contamination

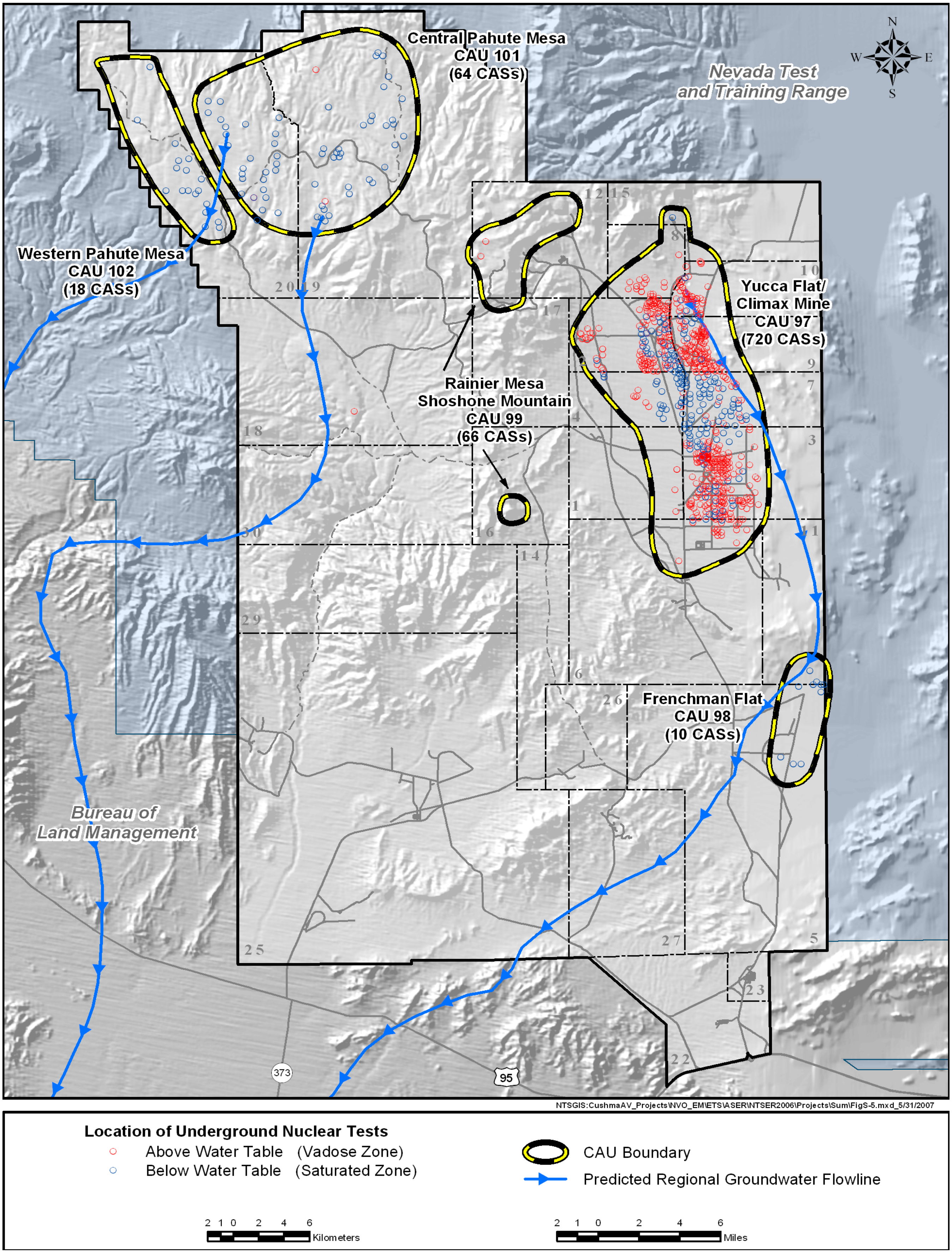
Groundwater - Areas of known and potential groundwater contamination on the NTS due to underground nuclear testing are called Underground Test Area (UGTA) CAUs. It is estimated that 300 million curies (Ci) of radiation were released underground. The total amount of radiation deposited below the groundwater table is approximately 60 million Ci, based on the last decay-corrected calculation from 1992. Since there is no feasible technology available that would allow for the cleanup of deep, extensive groundwater contamination, the strategy of the Environmental Management Program is to identify contaminant boundaries and implement an effective long-term monitoring system.

Soil - Radioactively-contaminated surface soils occur at approximately 100 sites on and around the NTS. Closure of these sites is conducted in accordance with the FFACO and upon approval of 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.

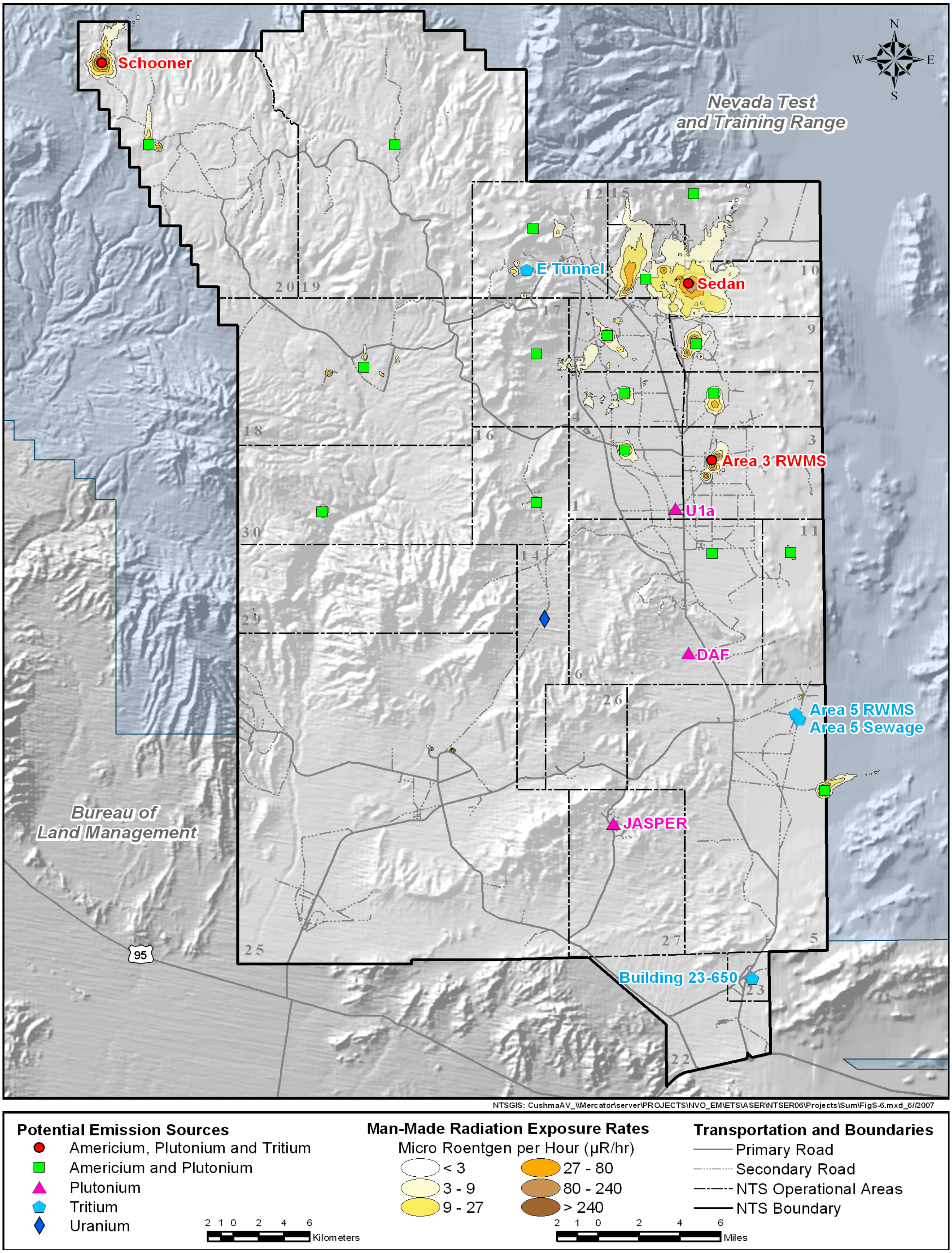
Air - Airborne radioactive contamination from the resuspension of contaminated soils at legacy sites and from current activities (such as waste management) is monitored continuously on and off the NTS. Since the cessation of above-ground nuclear testing, the annual amounts of radiation released into the air from the NTS 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. These emissions cannot be distinguished from the background airborne radiation measured in communities surrounding the NTS.

Structures/Materials - There are approximately 1,850 sites where facilities, equipment, structures, or debris were contaminated by historic nuclear research, development, and testing activities. The responsibility for remediating these Industrial Sites belongs to the Environmental Restoration Project. As of July 2007, 1,630 sites have been remediated and closed in accordance with the FFACO and approved by the state of Nevada.

Waste Disposal - Low-level and mixed low-level radioactive waste have been generated by historic nuclear research, development and testing activities and the resulting environmental cleanup activities. More than 1.1 million cubic yards of this waste has been safely disposed at the Area 3 and Area 5 Radioactive Waste Management Sites. It is estimated that a total of 9.3 million Ci of radiation is contained within this disposed waste. The average concentration of radioactivity in the disposed waste is about 8.8 Ci per cubic yard.



Areas of Potential Groundwater Contamination on the NTS



Potential Sources of Radiological Air Emissions on the NTS

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 are 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. Exposures to man-made radiation in our everyday life come from smoking cigarettes, traveling on airplanes, and having medical X rays. For the public surrounding the NTS, less than 1 percent of their total radiation exposure is now attributable to past or current NTS activities.

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.

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 which they strike, but 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.

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 biologic risk of the energy deposited is the dose equivalent. The units of dose equivalent are called rems or sieverts. In this report, 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 300 mrem each year from natural sources and an additional 60 mrem from medical procedures, consumer products, and activities. Whether or not there is a “safe” radiation

Radionuclides Detected on the NTS

	Name*	Abbreviation	Primary Type(s) of Radiation	Major NTS Source
Man-Made	Americium- 241	^{241}Am	Alpha, gamma	In soil at and near legacy sites of above-ground nuclear testing. Detected in soil and air.
	Cesium-137	^{137}Cs	Beta, gamma	
	Plutonium-238	^{238}Pu	Alpha	
	Strontium-90	^{90}Sr	Beta	
	Plutonium-239+240	$^{239+240}Pu$	Alpha	In soil at and near legacy sites of plutonium dispersal experiments. Detected in soil and air.
	Tritium	^{3}H	Beta	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.
Naturally-Occurring	Be-7	^{7}Be	Gamma	Produced by interactions between cosmic radiation from the sun and the earth's upper atmosphere. Detected in air.
	Potasium-40	^{40}K	Beta, gamma	Naturally occurring in the earth's crust. Detected in groundwater, soil, and air.
	Radium-226	^{226}Ra	Alpha, gamma	
	Thorium-232	^{232}Th	Alpha**	
	Uranium-234	^{234}U	Alpha**	
	Uranium -235	^{235}U	Alpha, gamma**	
	Uranium -238	^{238}U	Alpha**	

*The number given with the name of the radionuclide is the atomic mass number and is the number of protons and neutrons together in the nucleus of the atom. Radionuclides with the same number of protons are the same element and radionuclides of the same element are called isotopes of one another. Plutonium and uranium each have several radioactive isotopes that are detected on the NTS.

**These radionuclides decay to other radionuclides (called progeny or daughters) which emit alpha, beta, and gamma 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, and it is assumed that the risk of developing an adverse health effect (such as cancer) is proportionate to the amount of radiation dose. Many human activities increase our exposure to radiation over and above the average background radiation dose of 300 mrem per year. These activities include, for example, uranium mining, airline travel, and operating nuclear power plants. Regulators balance the benefit of these activities to the risk of increasing radiation exposures above background, and as a result, set dose limits for the public and workers specific to these activities. The DOE has set the dose limit to the public from exposure to DOE-related nuclear activities to 100 mrem/yr (1 mSv/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 rem/yr (50 mSv/yr). There is no regulatory standard for radiation dose limits to workers or the public across industries, states, or countries.

Common Doses to the Public

Source/Activity	Average Dose/Year (or as noted)
Five-hour jet plane ride	3 mrem
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>, accessed on 6/26/2007

Monitoring NTS Radiation and Pathways of Exposure to the Public

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

Public Dose Limits for NTS 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).

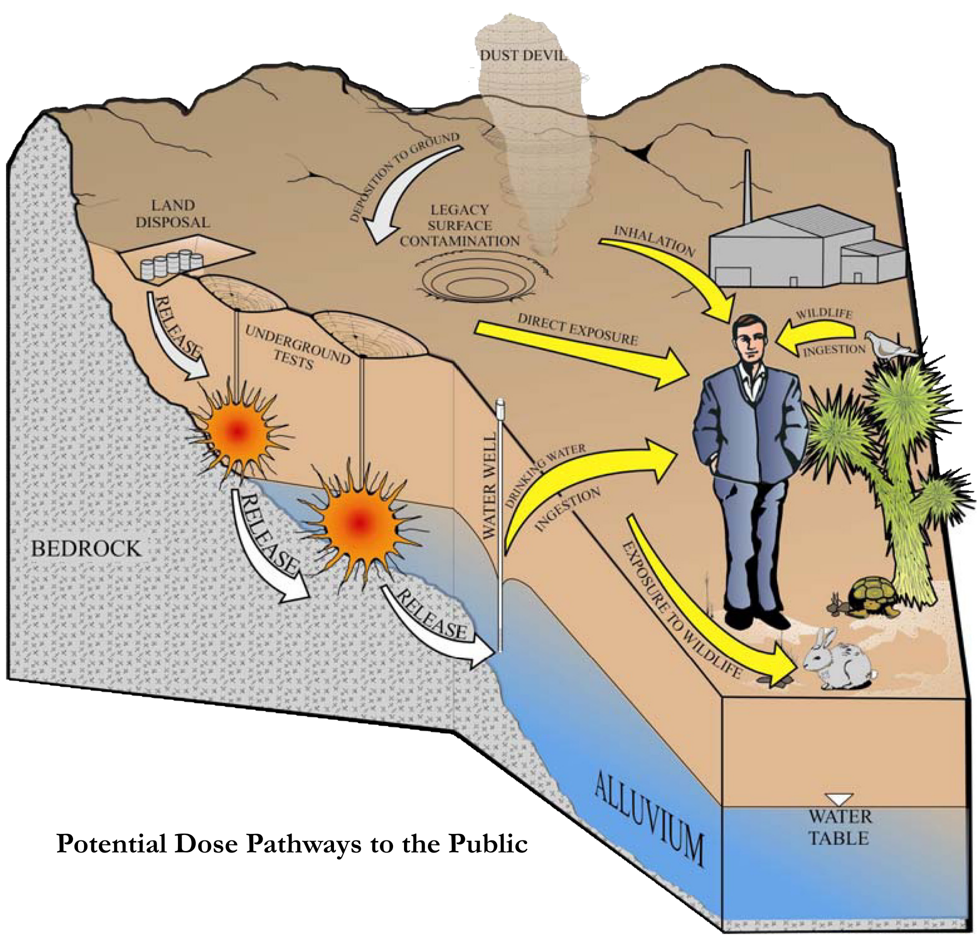
100 mrem/yr - This is the dose limit to the public (above natural background) from all possible pathways combined, as specified by DOE Order 5400.5, Radiation Protection of the Public and the Environment.

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

Air Transport Pathway - Members of the public may inhale or ingest radionuclides that are resuspended by the wind from known contaminated sites on the NTS. However, such resuspended radiation measured off and on the NTS 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 NTS, have moved off the NTS, and have then been hunted.

Groundwater Pathway - Drinking contaminated groundwater is currently not a possible pathway for public exposure given the restricted public access to the NTS and the location of known contaminated groundwater on the NTS. No man-made radionuclides occur in drinking water sources monitored off the NTS and no drinking water wells on the NTS have measurable levels of man-made radionuclides. Only the groundwater from monitoring wells drilled near underground tests on the NTS show radioactive contamination.



Potential Dose Pathways to the Public

Estimated 2006 Radiation Dose to the Public from All Possible Pathways

The radiation dose to the general public by just the air transport pathway was estimated using air sampling results from six onsite "critical receptor" sampling stations. The radionuclides detected at three or more of the NTS critical receptor samplers (see map on page 14) were ^{241}Am, ^{238}Pu, $^{239+240}$Pu, $^{233+234}$U, $^{235+236}$U, ^{238}U, and tritium. The uranium isotopes are attributed to naturally-occurring uranium. As in previous years, the 2006 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 NTS, had the highest concentrations of radioactive air emissions, yet an individual residing at this station would experience a dose from air emissions of only 2.5 mrem/yr. This annual dose is 2.5 percent of the background radiation dose estimated for an individual residing at Indian Springs. No one resides at the Schooner station, and the dose at offsite populated locations 12 – 50 miles from the Schooner station would be much lower due to wind dispersion, probably a fraction of 1 mrem, similar to dose estimates generated by computer models in previous years.

There is no NTS radiation dose to the public from the groundwater pathway. Annual monitoring continues to verify that no contaminated groundwater has migrated beyond the NTS boundaries into surrounding water supplies used by the public.

Dose to the Public from the Air Transport Pathway Based on 2006 Sample Data

2.5 mrem/yr – This is the estimated dose to an individual if they lived year-round on the NTS at the Schooner air sampling station. The offsite public 12 – 50 miles away would only receive a fraction of 1 mrem/yr.

NTS game animals include pronghorn antelope, mule deer, chukar, Gambel's quail, mourning doves, cottontail rabbits, and jackrabbits. Small game animals from different contaminated NTS 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 NTS. In 2006, jackrabbits were sampled at the T2 site located in Area 2 where four nuclear weapons tests were conducted on the surface of the T2 site from 1952 to 1957. Based on these samples, the highest dose to a member of the public was estimated to be 0.12 mrem if this person consumed 20 jackrabbits from the T2 site.

The maximum dose to the public from all pathways (air and ingestion) during 2006 is estimated to be 0.32 mrem/yr. This assumes that an individual who resides in a community surrounding the NTS will receive an air pathway dose no greater that 0.20 mrem/yr, as dose estimates from 1992 – 2004 suggest. It also assumes that this individual consumes an additional 0.12 mrem from game animals.

Dose to the Public from Ingestion of Game Animals Based on 2006 Sample Data

0.12 mrem/yr – This is the estimated dose from ingestion of NTS game animals assuming one consumed 20 jackrabbits from the T2 site, a known site of legacy soil contamination.

2006 Dose to the Public from All Pathways

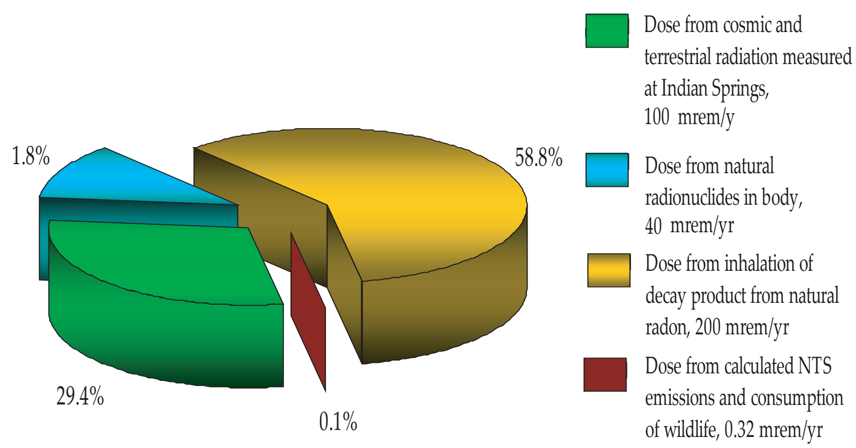
0.32 mrem/yr – This estimated dose combines 0.2 mrem/yr (based on past year's computer model estimates) and the 0.12 mrem/yr from ingestion of NTS game animals. This total dose estimate is indistinguishable from natural background radiation experienced by the public residing in Las Vegas or other communities surrounding the NTS.

Dose to the Public fom the Air Transport Pathway Based on Computer Modeling[a]

<0.2 mrem/yr – This is the estimated dose to an individual who resides in one of the many communities surrounding the NTS based on the use of soil resuspension models, wind models, and historical NTS soil sample data. From 1992 to 2004, these models were used to estimate the dose to the maximally exposed individual (MEI) and to identify the probable community surrounding the NTS in which they lived. Since 1992, the estimated dose to the MEI has been <0.2 mrem/yr, and the MEI has been identified as residing in either Springdale or Cactus Springs, Nevada.

[a] The U.S. Environmental Protection Agency (EPA) and the DOE no longer require NTS to use these models to confirm that the annual dose to the public from NTS is below the NESHAP limit of 10 mrem/yr. Data collected onsite each year from the six critical receptor air sampling stations will be used from now on to document NESHAP compliance, and 0.2 mrem will be assumed to be the maximum possible annual dose to the offsite public.

This total dose is well below the dose limit of 100 mrem/yr established by DOE Order 5400.5 for radiation exposure to the public from all pathways combined. This dose is so small it cannot be distinguished from the dose from background radiation (it is ~0.1 percent of the total dose from naturally-occurring sources).



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

Monitoring Onsite Radionuclide Air Emissions

Each year, the total quantity of radioactive emissions from the NTS (in Ci) and their sources are identified. In 2006, total tritium (^3H) emissions from all sources was estimated to be 245 Ci. Over the previous 6 years, total tritium emissions have ranged from 170 to 564 Ci. Total $^{239+240}Pu$ and ^{241}Am emissions for 2006 were estimated to be 0.29 and 0.047 Ci, respectively.

No radioactivity was detected above minimum detectable concentrations (MDCs) in any of the samples collected from the JASPER Facility. No radiological releases occurred at U-1a, BEEF, or DAF.

Estimated NTS Tritium Air Emissions by Source in 2006 (in Curies)

Equipment Calibration:	
Area 23 Building 650	0.0000225
Evaporation from Water Sources:	
Area 12 E Tunnel Ponds	9.8
Area 5 Sewage Lagoon	0.0003
Evaporation/Transpiration from Soil/Vegetation:	
Area 3 RWMS	54
Area 5 RWMS	19
Area 10 Sedan	85
Area 20 Schooner	77
Total	**245**

To monitor the diffuse onsite NTS radioactive emissions, a network of 19 air sampling stations and a network of 109 thermoluminescent dosimeters (TLDs) were used (see map on page 14). Air sampling stations and TLDs are located throughout the NTS, mainly within those numbered Operational Areas where historic nuclear testing has occurred or where current radiological operations occur.

Total Estimated NTS Radiological Air Emissions in 2006 (in Curies)		
Tritium (^{3}H)	**Plutonium ($^{239+240}Pu$)**	**Americium (^{241}Am)**
245	0.29	0.047

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

Several human-made radionuclides were measured at air sampling stations at levels above their MDCs in 2006: ^{241}Am, ^{3}H, ^{238}Pu, and $^{239+240}Pu$. The highest mean level of ^{241}Am was detected at Bunker 9-300 in Area 9, a vacant building located within an area of known soil contamination from past nuclear tests. The highest mean level of tritium was detected at Schooner, site of the second-highest-yield Plowshare cratering experiment on the NTS where tritium-infused ejecta surrounds the crater. The highest mean levels of plutonium isotopes in air were at Bunker 9-300. Uranium isotopes were also detected in air samples collected in areas where depleted uranium ordnance has been used or tested. However, the samples' isotopic ratios were what one would expect from naturally-occurring uranium in soil and not from either man-made depleted or enriched uranium.

Highest Average Concentrations of Man-Made Radionuclides in Air Samples on the NTS

Radionuclide	CL (a) (10^{-15} µCi/mL)	Highest Average Concentration (10^{-15} µCi/mL)(b)	Sampler Location
^{241}Am	1.9	0.179	Bunker 9-300
^{3}H	1,500,000	360,310	Schooner
^{238}Pu	2.1	0.018	Bunker 9-300
$^{239+240}Pu$	2.0	12.02	Bunker 9-300

(a) Concentration limits established by NESHAP, in microcuries per milliliter (µCi/mL).

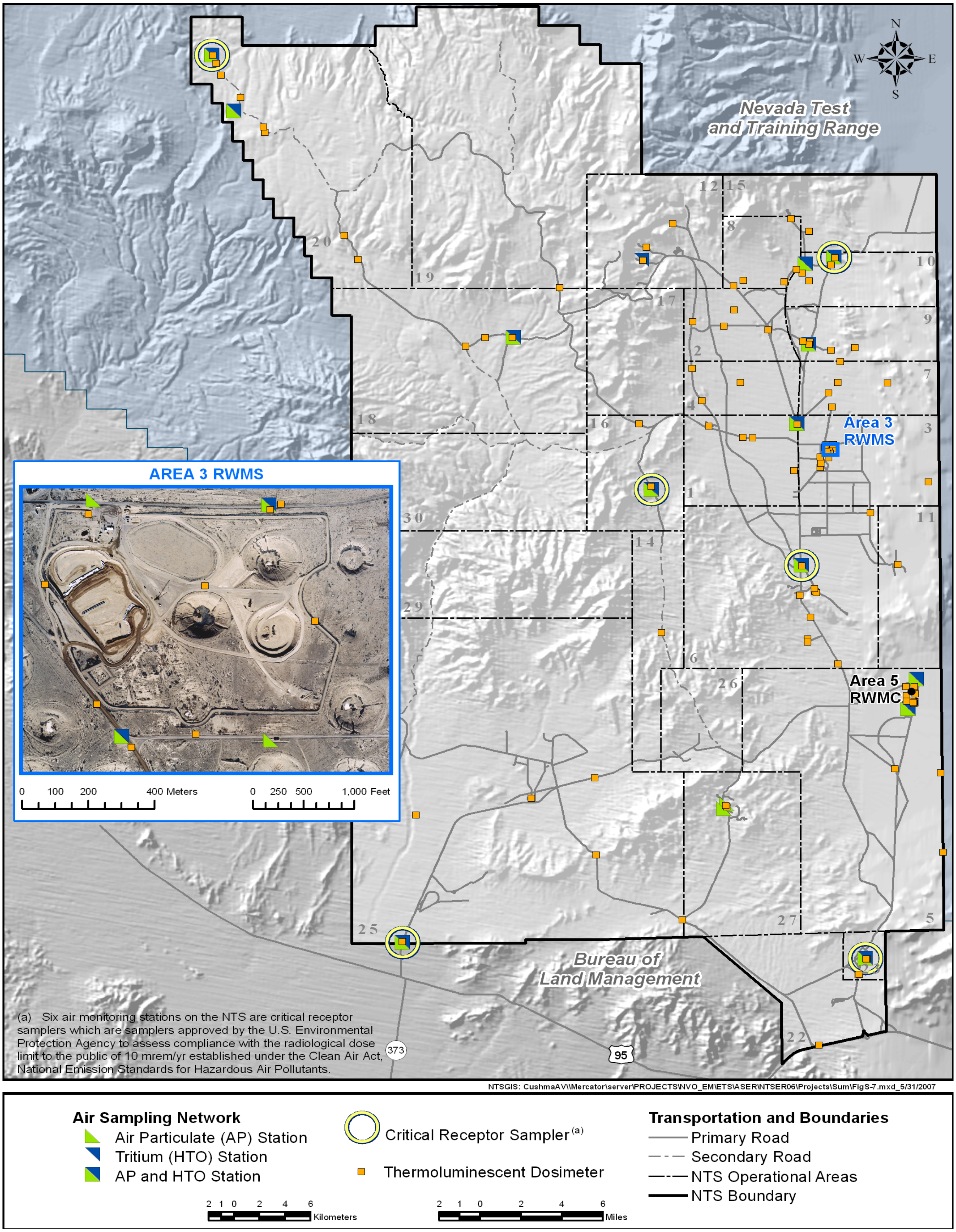
(b) The scale of concentration units for radionuclides shown in the table have been standardized to 10^{-15} µCi/mL. This scale may differ from those reported in detailed radionuclide-specific data tables in the NTSER.

Both $^{239+240}Pu$ and tritium concentrations in NTS air samples continue to decline. Tritium concentrations have decreased since the cessation of testing in 1992. The average decline rate of tritium air concentrations is around 19 percent per year across all locations.

$^{239+240}Pu$ concentrations have likewise decreased; the average decline since 1992 ranges from 3.4 percent for Areas 1 and 3 to 17.2 percent for Areas 18, 19, and 20. The downward trends in plutonium concentrations are attributed to its dispersal by the wind and weathering in the soil, where it becomes bound to less mobile particles.

Gross alpha and beta radioactivity was detected at all stations on the NTS. The average gross alpha activities ranged from 17.72 to 60.26 x 10^{-16}; µCi/mL; the highest seen at Bunker 9-300. The average gross beta activities ranged from 17.76 to 21.33 x 10^{-15} µCi/mL; the highest seen at Sugar Bunker N, an unoccupied structure used during past nuclear testing, located about 1 kilometer (0.6 miles) south-southwest of the Area 5 RWMC.

Direct exposure to gamma radiation is measured at 109 TLD stations on the NTS. Exposure is reported in units called milliroentgens (mR). The TLD detectors can measure gamma radiation from all sources, both natural background radiation from cosmic and terrestrial sources and radiation from man-made sources. Ten of the NTS TLD stations measure natural background levels. The mean level was well within average background levels observed in other parts of the United States 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.



2006 NTS Air Sampling Network

The highest estimated mean annual gamma exposure measured at a TLD station on the NTS was 771 milliroentgens per year (mR/yr) at Schooner, one of the legacy Plowshare sites on Pahute Mesa. The lowest was 59 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 143 mR. At the 35 TLD locations near known legacy sites (including Schooner), it was 268 mR.

NTS Background Gamma Radiation

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

Average Direct Background Radiation of Selected U.S. Cities (Excluding Radon)

City	Elevation Above Sea Level (feet)	Radiation Exposure (mR/yr)[(a)]
Denver, Colorado	5,280	164.6
Wheeling, West Virginia	656	111.9
Rochester, New York	505	88.1
St. Louis, Missouri	465	87.9
Portland, Oregon	39	86.7
Los Angeles, California	292	73.6
Fort Worth, Texas	650	68.7
Richmond, Virginia	210	64.1
Tampa, Florida	3	63.7
New Orleans, Louisiana	0	63.7

(a) Source: < http://www.wrcc.dri.edu/cemp/Radiation.html>
"Radiation in Perspective," August 1990, as accessed on 06/27/2007

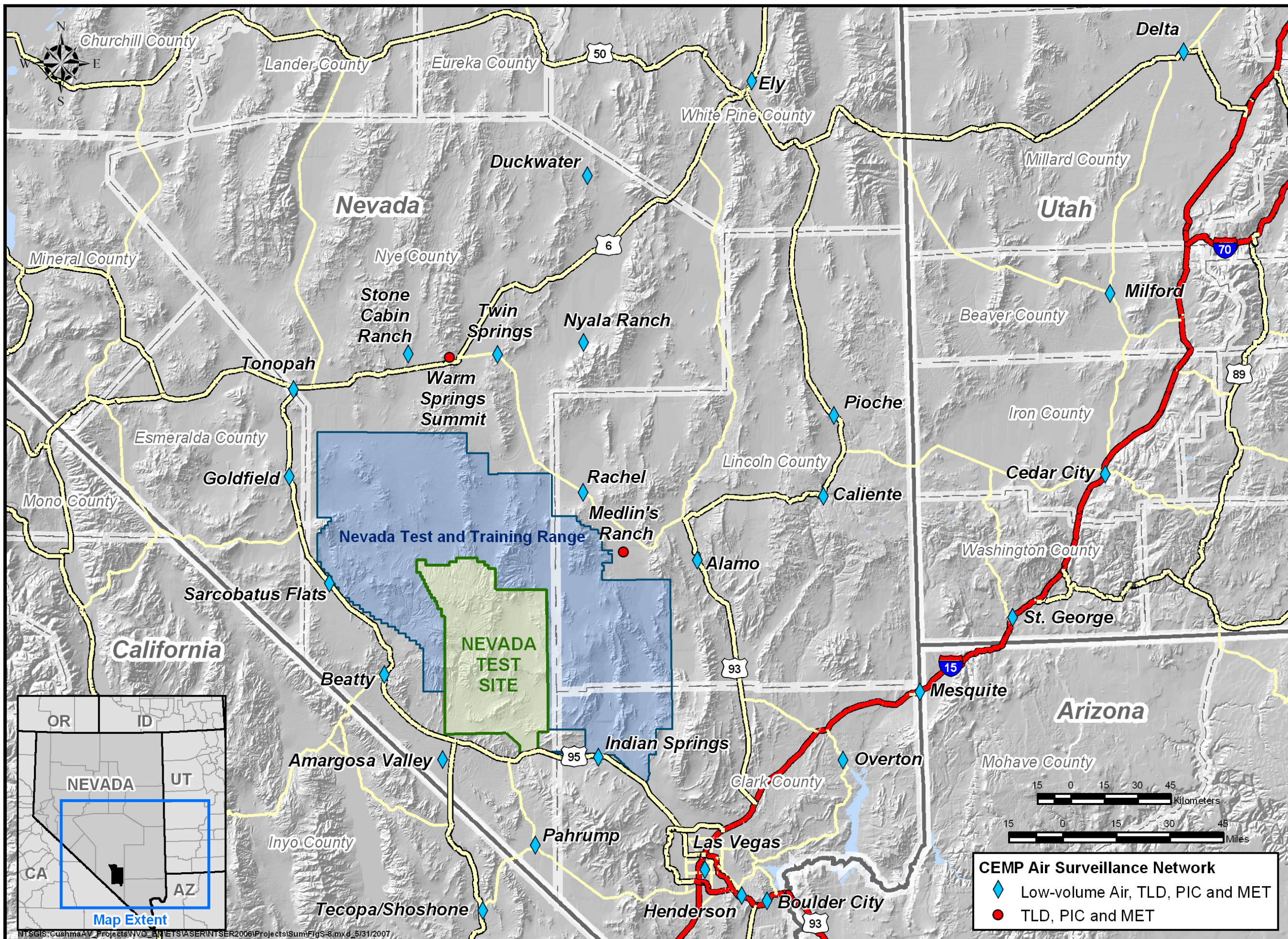
Monitoring Offsite NTS Radiological Air Emissions by the Community Environmental Monitoring Program(CEMP)

An important component of the NTS radiological monitoring program is the oversight program run by the CEMP which is coordinated by the Desert Research Institute (DRI) of the Nevada System of Higher Education under contract with NNSA/NSO. It can independently confirm NTS compliance with radiological air emission and water quality standards offsite. Its purpose is to provide monitoring for radionuclides which may be released from the NTS. A network of 27 CEMP stations located in selected towns and communities of Nevada, California, and Utah near the NTS was operated continuously during 2006. The CEMP stations monitored gross alpha and beta radioactivity in airborne particulates using low-volume particulate air samplers, penetrating gamma radiation using TLDs, gamma radiation exposure rates using PIC detectors, and meteorological parameters using automated weather instrumentation (MET stations).

No airborne radioactivity related to any NTS operations was detected in any of the CEMP samples during 2006. Gross alpha and gross beta radioactivity was detected at all CEMP stations at levels consistent with previous years, which reflect radioactivity from background radiation. No man-made gamma-emitting radionuclides were detected. Naturally-occurring radioactive beryllium (^{7}Be) was detected in most air particulate samples.

Range in Radioactivity/Radiation Levels Measured at Offsite and Onsite Air Sampling Stations

	Average Gross Alpha ($\times 10^{-16}$ μCi/mL)		Average Gross Beta ($\times 10^{-15}$ μCi/mL)	
	Offsite (CEMP)	Onsite (NSTec)	Offsite (CEMP)	Onsite (NSTec)
Highest Average Value	2.78 (*Duckwater*)	60.26 (*Bunker 9-300*)	2.78 (*Duckwater*)	21.33 (*Sugar Bunker N*)
Lowest Average Value	0.87 (*Nyala Ranch*)	17.72 (*ABLE Site*)	1.95 (*Nyala Ranch*)	17.76 (*Little Feller 2N*)



2006 CEMP Air Surveillance Network

The offsite TLD and PIC results remained consistent with previous years' background radiation levels and are well within average background levels observed in other parts of the United States and with the 125 mR/yr level measured on the NTS. The highest total annual gamma exposure measured offsite, based on the PIC detectors, was 183.08 mR/yr at Milford, Utah (at 4,957 feet elevation). The lowest offsite rate, based on the PIC detectors, was 72.27 mR/yr at Pahrump, Nevada (at 2,675 feet elevation).

Average Direct Radiation Measured in 2006

Location	Elevation Above Sea Level (feet)	Radiation Exposure (mR/yr)
NTS - Schooner TLD station	5,660	771
NTS - 35 Legacy Site TLD stations	3,077 – 5,938	268
Milford, Utah PIC station	4,900	183
Twin Springs, Nevada PIC station	5,055	171
NTS - 17 Waste Operation TLD stations	3,176 – 4,021	143
NTS - 10 Background TLD stations	2,755 – 5,938	125
St. George, Utah PIC station	2,600	81
Pahrump, Nevada PIC station	2,550	72
NTS Mercury Fitness Track TLD station	3,769	59

Offsite Radiological Monitoring of Groundwater

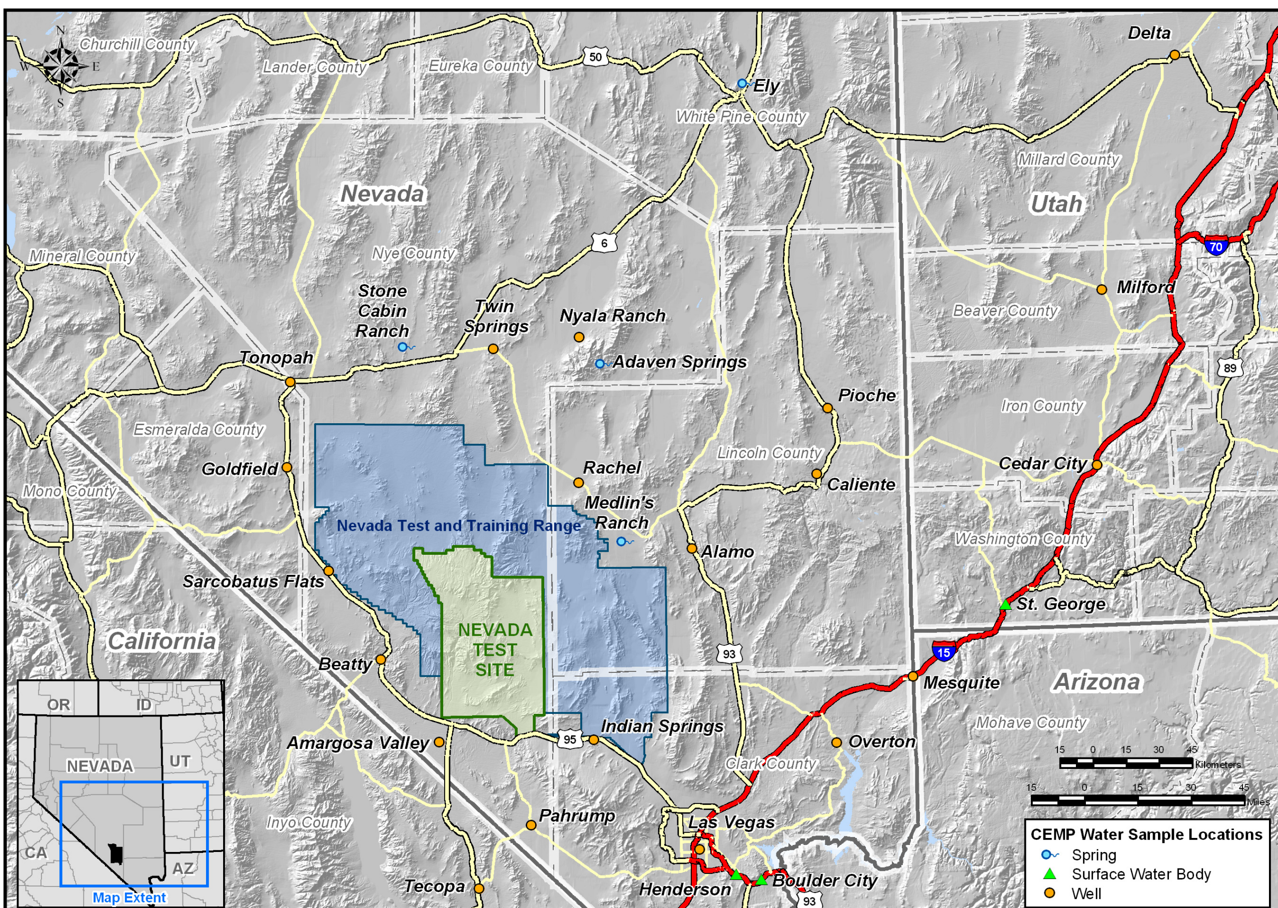
The comprehensive radiological environmental monitoring program off the NTS includes sampling and analysis of groundwater and natural springs to determine if groundwater contamination from past nuclear testing poses a current threat to public health and the environment.

In 2006, NSTec conducted radiological monitoring of 16 offsite wells and 7 offsite springs. The wells included 3 private domestic wells, 3 local community wells, and 10 NNSA/NSO wells drilled for hydrogeologic investigations including groundwater flow modeling. All of the NSTec-sampled wells and springs are in Nevada within 35 miles from the western and southern borders of the NTS (see map on page 18).

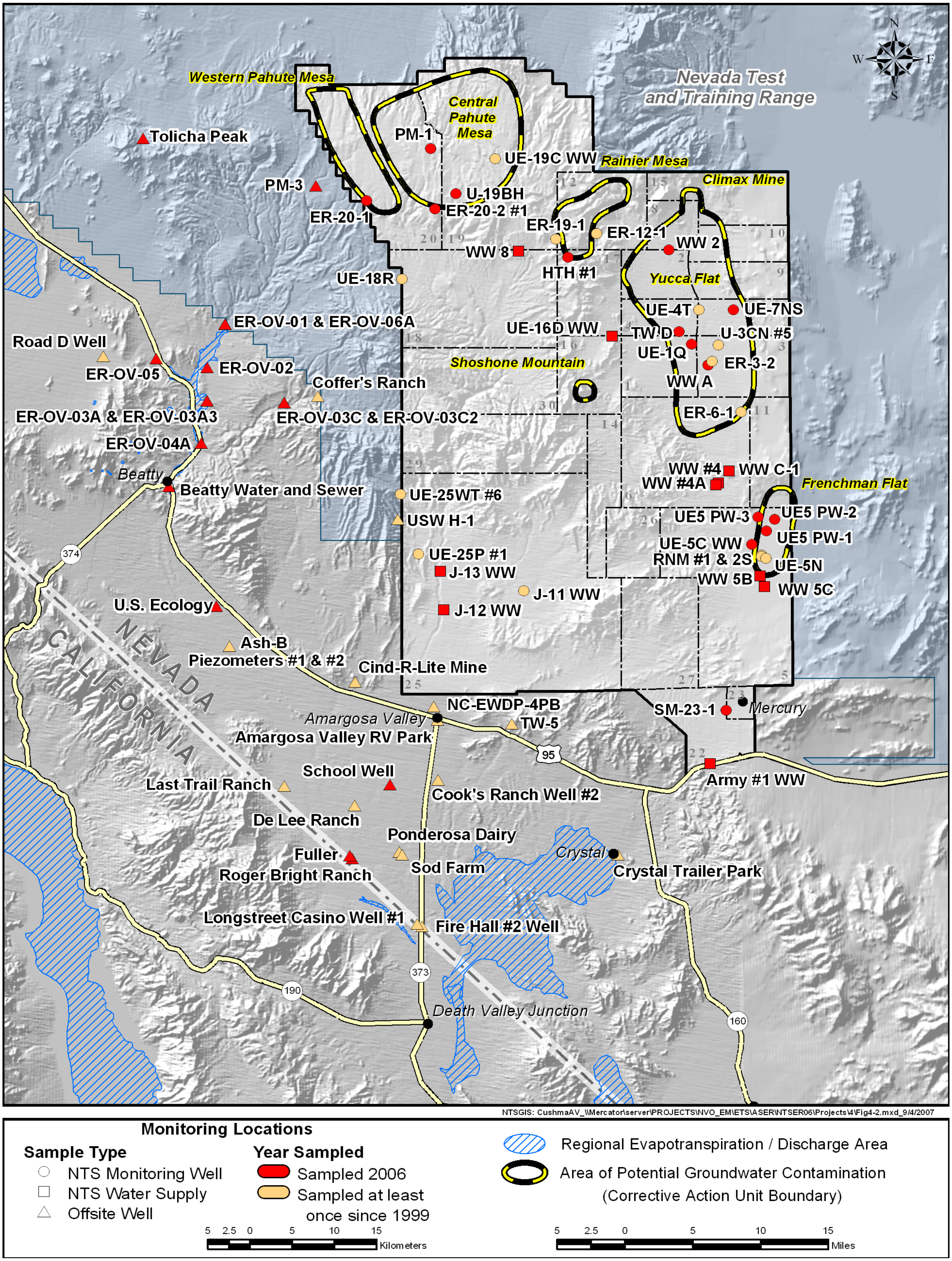
The DRI, through the CEMP, is tasked by NNSA/NSO to provide independent verification of the tritium concentrations in some of the offsite groundwater wells, municipal water supply systems, and springs used for water supplies in areas surrounding the NTS. Samples collected by DRI provide a comparison to the results obtained by NSTec. In 2006, the CEMP offsite water sampling locations included 20 wells, 3 surface water supply systems, and 4 springs located in selected towns and communities within 240 miles from the NTS. Only one site, the Beatty Water and Sewer well, was sampled by both NSTec and CEMP.

Tritium is the sole radionuclide for which CEMP water sample analyses are run. Tritium is the radionuclide created in the greatest quantities in underground nuclear tests and is widely believed to be the most mobile. NSTec offsite water samples were also analyzed for man-made gamma-emitting radionuclides which, if found, would signify contamination from nuclear testing. NSTec also monitored gross alpha and gross beta activity to determine if they are increasing over time at any well or spring.

> ***20,000 pCi/L – This is the EPA-established maximum concentration limit for tritium in drinking water.***



2006 CEMP Water Monitoring Locations



2006 NSTec Water Monitoring Locations

None of the offsite springs or the offsite public or domestic water supply systems/wells monitored by NSTec or the CEMP had levels of tritium significantly above detection limits. Measured tritium levels from the CEMP-monitored wells ranged from -12.9 to 12.9 picocuries per liter (pCi/L). For the CEMP-monitored springs and surface waters, they ranged from 0 to 35.4 pCi/L. As in previous years, samples from Boulder City and Henderson municipal water supplies contained tritium at levels above detection. These two municipal water systems obtain water from Lake Mead, which has documented levels of residual tritium persisting in the environment that originated from global atmospheric nuclear testing.

No offsite springs, surface water supplies, or wells had levels of tritium significantly above detection levels.

35 pCi/L – This was the highest level of tritium measured in any offsite water sample.

Measured tritium levels in the NSTec-monitored drinking water wells ranged from -24 to 13 pCi/L. For the seven offsite springs they ranged from 2.0 to 16 pCi/L. None of the offsite public or domestic water supply wells had levels of tritium above their detection limits, except the School Well in Amargosa Valley. This well had one duplicate sample for tritium of 23 pCi/L which was above detection limits, but a duplicate sample collected on the same date had 13 pCi/L of tritium which was below detection limits.

No gamma-emitting radionuclides were detected in any of the NSTec-monitored offsite wells or springs.

Gross alpha and gross beta radioactivity was below drinking water standards in all potable water sources. The radioactivity is most likely from natural sources and the levels show no increasing trend.

Most all of the NSTec-monitored offsite well and spring samples contained detectable gross alpha and gross beta radioactivity. All but one of the samples were less than the EPA drinking water limit for gross alpha. This exception was the spring at Spicer Ranch where the measured gross alpha activity was 16 pCi/L, slightly above the EPA limit of 15 pCi/L. None of the gross beta measures exceeded the EPA drinking water levels of concern. The measurable gross alpha and gross beta radioactivity is likely from natural sources.

Onsite Radiological Monitoring of Water

Radioactivity in onsite groundwater and surface waters of the NTS is monitored annually in order to (1) ensure that NTS drinking water is safe, (2) determine if permitted facilities on the NTS 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 2006, the onsite water monitoring network included 3 natural springs, 10 water supply wells (6 drinking water wells and 4 non-potable water wells), 18 monitoring wells, 1 tritiated water containment pond system, and 2 sewage lagoons (see map on page 18).

Water Supply Wells

The 2006 data continue to indicate that underground nuclear testing has not impacted the NTS water supply network. None of the drinking water wells had non-detectable concentrations of tritium. Wells UE-16D and WW C1 (both non-potable water supply wells) had water samples that measured 13 and 14 pCi/L, respectively, both slightly above their MDCs, yet the duplicate water samples collected at the same time from these wells had undetectable levels of tritium. All of the water samples from the ten supply wells had non-detectable concentrations of man-made gamma-emitting radionuclides. Gross alpha and beta radioactivity was detected in most all of the water supply wells and is attributed to the presence of naturally-occurring radionuclides, and all levels were below drinking water limits.

Monitoring Wells

Nuclear testing has not impacted NTS drinking water wells.

Some migration of radionuclides from the underground test areas to monitoring wells sampled annually on the NTS has probably occurred, although the migration distances appear to be very short. Four of the 15 onsite monitoring wells sampled in 2006 (PM-1, UE-7NS, WW A, and ER-20-2 #1) had detectable concentrations of tritium ranging from 12 to 484 pCi/L, all well below the drinking water limit of 20,000 pCi/L. The first three wells are all located within 0.6 miles of an historical underground nuclear test; all have consistently had detectable levels of tritium in past years, and no trend of rising tritium concentrations in these wells have been observed since 2000. Well ER-20-2 #1 had 12 pCi/L, just above its MDC and it is not near an historical underground nuclear test.

No man-made radionuclides were detected by gamma spectroscopy analyses at concentrations above detection limits in any of the NTS monitoring wells in 2006. Most onsite monitoring wells had gross alpha and gross beta levels above detection limits. One onsite monitoring well (U-19BH) had gross alpha levels above the EPA drinking water limit, but this well does not supply drinking water. The radioactivity is most likely from natural sources.

Monitoring Results for E Tunnel Effluent Waters Pertaining to Water Pollution Control Permit NEV 96021

Parameter	State Water Pollution Control Permit Limit (pCi/L)	Average Measured Concentration (pCi/L)
Tritium	1,000,000	604,000
Gross Alpha	35	16.8
Gross Beta	100	50.8

Containment Ponds

Five constructed basins 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 nonradiological contaminants exceed the allowable contaminant levels regulated under a state water pollution control permit. Tritium concentrations in tunnel effluent waters in 2006 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 were sampled 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.

Tritiated water is also pumped into lined sumps during studies conducted by the UGTA Project. To characterize the groundwater regime under the NTS, suitable additional wells are being drilled and existing wells recompleted in the vicinity of certain underground tests and at other locations on the NTS. If the tritium level exceeds 200,000 pCi/L during these drilling operations, contaminated water is pumped from the wells and diverted to lined containment ponds, as required by the state. In 2006, the UGTA Project did not conduct any studies of wells with high tritium concentrations and no lined sumps were needed.

Permitted Sewage Lagoons

Two permitted sewage lagoons (Area 6 Yucca and Area 23 Mercury) are sampled annually and analyzed for tritium. As during previous years, no tritium was detected in the lagoon water samples and no man-made gamma-emitting radionuclides were detected during 2006.

Nonradiological Air Emissions at the NTS

Air quality was monitored on the NTS throughout the year as required by state of Nevada permits for operations that release criteria air pollutants, hazardous air pollutants (HAPs), or toxic and hazardous chemicals. Common sources of air emissions on the NTS include particulates from construction, aggregate production, surface disturbances, fugitive dust from driving on unpaved roads, fuel-burning equipment, open burning, fuel storage facilities, detonations conducted at the BEEF, and chemical release tests conducted at the NPTEC on Frenchman Flat playa in Area 5. The NTS has been issued a Class II air permit by the state of Nevada. Class II permits are issued to facilities which emit small quantities of air pollutants within a year (less than 100 tons of each criteria air pollutant, or 10 tons of any one HAP, or 25 tons of any combination of HAPs).

There were no discharges of nonradiological hazardous materials in air or water from the NTS to offsite areas in 2006.

An estimated 4.57 tons of criteria air pollutants were released on the NTS in 2006. The majority of these emissions (2.02 tons) were from NOx. Total air emissions of lead, also a criteria pollutant, were 13.32 pounds. The quantity of HAPs released in 2006 was 1.87 tons. No emission limits for any criteria air pollutants or HAPs were exceeded. In 2006, performance emission tests were conducted for four NTS generators. One of the generators (the JASPER generator) exceeded its emission limits set by the air permit and was shut down.

Calculated Tons of Emissions

Criteria Air Pollutant	Actual	PTE[(b)]
Particulate Matter (PM10)[(a)]	0.69	23.98
Carbon Monoxide (CO)	0.43	14.04
Nitrogen Oxides (NOx)	2.02	20.96
Sulfur Dioxide (SO_2)	0.03	6.13
Volatile Organic Compounds (VOC)	1.40	16.11
Totals	**4.57**	**81.22**

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

(b) Potential to Emit - the quantity of criteria pollutant that each facility piece of equipment would emit annually if it were operated for the maximum number of hours at the maximum production rate specified in the air permit

In 2006, 4 chemical tests consisting of 40 releases were conducted at the Area 5 NPTEC. One chemical test that included nine releases was conducted at the Area 26 Port Gaston facility under the NTS air permit site-wide releases system. In accordance with the requirements of the NTS air quality operating permit for the NPTEC, an annual report of the types and amounts of chemicals released and the test plans and final analysis reports for each chemical release were submitted to the state. Based on the low level of risk each test posed to the environment and biota, no test-specific ecological monitoring was performed.

Nonradiological Drinking Water Quality at the NTS

NNSA/NSO operates a network of six permitted wells that comprise three permitted public water systems on the NTS which supply the potable water needs of NTS workers and visitors. For work locations at the NTS that are not part of a public water system, NNSA/NSO hauls potable water for use in decontamination and sanitation. Monitoring results for 2006 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 with one exception. The Area 12 water system exceeded the action level for lead (0.037 milligrams per liter [mg/L]; with action level of 0.015 mg/L). The high level is attributed to the camp's inactivity and resultant lack of flushing within the service lines. In September 2006, this public water system was reclassified to a non-community transient system.

Nonradiological Discharges into Water at the NTS

In 2006, industrial discharges on the NTS were limited to two operating sewage lagoon systems: Area 6 Yucca Lake and Area 23 Mercury systems. Under the conditions of state of Nevada operating permits, liquid discharges to these sewage lagoons are tested quarterly for biochemical oxygen demand, pH, and total suspended solids. Sewage lagoon pond waters are sampled annually for a suite of toxic chemicals. Quarterly and annual analyses of sewage influent and of pond waters, respectively, showed that all water measurements were within permit limits (often below detection levels) with one exception. One measure of 5-day Biological Oxygen Demand (BOD_5) Mean Daily Load was exceeded at the Area 23 Mercury lagoons in the second quarter. The lagoon waters were resampled and BOD_5 levels were found to be below permit limits and remained so for the remainder of the calendar year.

There are no liquid discharges from the NTS into navigable waters, offsite surface water drainage systems, or publicly owned treatment works.

Nonradiological Emissions into Air and Discharges into Water at Satellite Facilities

Like the NTS, the North Las Vegas Facility (NLVF) and Remote Sensing Laboratory (RSL)-Nellis are regulated for the emission of criteria pollutants and HAPs. Air quality operating permits are maintained for a variety of equipment at these facilities. There are no monitoring requirements associated with these permits. The combined quantity of criteria air pollutants and HAPs emitted at the NLVF in 2006 was 0.351 tons, ranging from 0.001 tons for HAPS to 0.237 tons for nitrogen oxides. At RSL-Nellis, the total estimated quantities of criteria air pollutants and HAPs emitted in 2006 is 0.383 tons. Natural gas consumption at RSL-Nellis in 2006 was 3,213,100 cubic feet. Natural gas consumption is reported as a requirement of the RSL-Nellis air permit.

Water discharges at the NLVF were regulated in 2006 by a permit with the City of North Las Vegas (CNLV) for sewer discharges, two temporary state-issued National Pollution Discharge Elimination System (NPDES) discharge permits, and an EPA-issued NPDES discharge permit which replaced the temporary permits. The final EPA NPDES authorizes the discharge of pumped groundwater into the Las Vegas Wash via the CNLV storm drain system. The NPDES permits were obtained for a groundwater characterization and dewatering project at the facility. Self-monitoring and reporting of the levels of nonradiological contaminants in sewage and industrial outfalls are conducted. At the NLVF in 2006, contaminant measurements were below permit limits except in water samples from two outfalls where total dissolved solids (TDS) exceeded permit limits. In response, a Salinity Control Plan was written and submitted to the CNLV. The CNLV conducted an annual inspection in November 2006 that resulted in no findings or corrective actions. Discharges of wastewater from RSL-Nellis are required to meet permit limits set by the Clark County Water Reclamation District. All wastewater outfall samples at RSL-Nellis in 2006 were below permit limits.

Accidental or Unplanned Environmental Releases or Occurrences

In 2006, there were no reportable accidental or unplanned environmental releases or occurrence on the NTS or at any of the NTS satellite facilities.

North Las Vegas Facilty (source: NSTec Facility Data Warehouse, September 2006)

Overall Compliance with Environmental Laws, Regulations, and Policies

The 2006 NTSER lists and discusses the many applicable environmental drivers (laws, regulations, and policies) which govern the protection of the public and the environment during the conduct of NTS missions. The compliance status with these federal laws, state laws, regulations, and policies are reported in Chapter 2 of the NTSER in detail. For this summary report, the major categories of these drivers are listed below. Where compliance for a category is not 100 percent, the noncompliance incidents are noted.

Environmental Compliance Summary for the NTS in 2006

Category	Noncompliance Incidents
Air Quality	Three pieces of equipment failed their performance emissions test and were shut down.
Water Quality and Protection	Limits for lead were exceeded in Area 12 public water system. Limits for TDS were exceeded in sewage outfalls at NLVF.
Radiation Dose Protection	None
Radioactive and Nonradioactive Waste Management and Environmental Restoration	None
Hazardous Materials Control and Management	None
Pollution Prevention and Waste Minimization	One Executive Order 13101 goal, to have 100 percent of purchases of items from the EPA-designated list contain recycled materials at the specified minimum content, was not met. The percentage of such purchases in 2006 was 73 percent.
Historic Preservation and Cultural Resource Protection	None
Conservation and Protection of Biota and Wildlife Habitat	Four accidental bird deaths attributable to NTS activities (e.g., roadkill); deaths included 3 species protected as migratory birds.

Other Significant 2006 Environmental Accomplishments

Environmental Restoration

The cleanup of sites contaminated by past DOE operations and the hydrogeological investigations supporting characterization of underground nuclear contamination areas are the most significant environmental work performed by NNSA/NSO each year. The DOE, U.S. Department of Defense, and the State of Nevada Division of Environmental Protection identify a work scope and milestone schedule for the cleanup and safe closure of the contaminated above-ground sites and for the field investigations and model development necessary to characterize the underground sites. A total of 339 contaminated above-ground sites was closed safely in 2006. These above-ground sites consist of facilities and land, such as the Test Cell A Facility, and are referred to as Industrial Sites. In addition to the Industrial Sites closures, extensive progress was made toward the development of hydrologic models describing groundwater flow and possible radionuclide transport from the primary underground sites into the groundwater underlying public lands outside the boundaries of the NTS. This involved the completion of groundwater flow models for CAU 98 (Frenchman Flat) and CAUs 101 and 102 (central and western Pahute Mesa) (see figure on page 6).

Pollution Prevention and Waste Minimization

Pollution prevention and waste minimization (P2/WM) activities on the NTS result in reductions to the volume and/or toxicity of waste generated onsite. A reduction of 164 tons of hazardous wastes was realized in 2006. The largest volume of hazardous waste reduction came from shipments of bulk used oil (108 tons) and lead acid batteries (38 tons) to offsite vendors for recycling. In 2006, NSTec bought three refrigerant recycling machines and recycled 0.6 mtons (0.66 tons) of refrigerant.

A reduction of 883 tons of solid wastes was realized in 2006. The largest proportion of solid waste reductions came from offsite shipments of 593 tons of scrap ferrous metal and 170 tons of mixed paper and cardboard to offsite vendors for recycling and shipment of 74 tons of food wastes from the NTS cafeterias to a local pig farm.

NNSA/NSO received two NNSA Environmental Stewardship Awards (ESAs) and two NNSA Best-In-Class Awards for pollution prevention (P2) activities in 2006. The BEEF, operated by the Lawrence Livermore National Laboratory, won an ESA for incorporating P2/WM practices into the facility design and daily operating procedures. NSTec's Information Services Personal Computer Leasing Group was awarded the second ESA for developing an electronics stewardship program that promotes environmentally responsible management of leased computers (from Dell Corporation) and company-owned computers. One NNSA Best-In-Class Award recognized the efforts of Stoller-Navarro Joint Venture for fully integrating EMS into their infrastructure and culture. The second NNSA Best-In-Class Award went to the NSTec Advanced Monitoring Systems Initiative Program for developing an automated, universal platform for using analytical sensors in the field to monitor environmental contaminants, which is cost-efficient and energy-efficient.

Waste Management

In 2006, the secondary sewage lagoon in Area 23 was lined with a geosynthetic clay and high-density polyethylene liners. The Area 23 sewage lagoon system is now a fully contained basin.

Ecological Monitoring

In 2006, biologists conducted surveys for 21 NTS projects within habitat of the threatened desert tortoise (*Gopherus agassizii*). No tortoises were accidentally injured or killed, nor were any found, captured, or displaced from project sites. Numerous field surveys for important plants and animals were conducted on the NTS in 2006. They include species protected or managed under state or federal regulations, those listed on the Nevada Natural Heritage Program's Nevada At-Risk Plant and Lichen Tracking List and the At-Risk Animal Tracking List, and bats listed as being at risk under the Nevada Bat Conservation Plan. One new plant population of rock purpusia (*Ivesia arizonica* var. *saxosa*) was found. The western red-tailed skink (*Eumeces gilberti rubricaudatus*) was trapped from six new locations. Western burrowing owls (*Athene cunicularia hypugaea*) were also trapped at six new locations. A common black-hawk (*Buteogallus anthracinus*) was observed for the first time on the NTS.

Desert Tortoise (*Gopherus agassizii*), protected as a threatened species by the Endangered Species Act (photo by Paul Greger, June 1994)

A West Nile Virus sampling program on the NTS continued in 2006 with guidance from the Clark County Health District. Biologists conducted 14 trapping sessions at 8 sites on the NTS. A total of 111 mosquitoes representing 6 species was collected. One *Culiseta inornata* mosquito tested positive for the virus, but the test result is suspected to be false. Six injured hawks from the NTS tested negative for the virus.

Historic Preservation and Cultural Resources Management

The National Historic Preservation Act requires federal agencies to identify and maintain the integrity of historic properties under their jurisdiction. Historic properties are cultural resources that have been determined eligible to the National Register of Historic Places (NRHP) through consultation between the NNSA/NSO and the Nevada State Historic Preservation Office. DRI archeologists conducted two field projects in 2006 to meet this requirement. One project focused on 10 sites that were temporary American Indian camps and lithic tool manufacturing areas. The second was at Cane Spring. All of the sites were in a very good state of preservation.

DRI archeologists examined a total of 140.2 hectares (346.7 acres) on the NTS in 2006 and found three prehistoric sites, two isolated features, and seven isolated artifacts. None of the sites, however, met the criteria for eligibility of the NRHP. Evaluations of three NTS historic structures were conducted in 2006 and one structure, the U12b Tunnel complex, has been determined eligible to the NRHP; the review and determinations for the other two are pending.

The NTS Archaeological Collection currently contains over 400,000 artifacts. Any new additions to the NTS collection continue to be inventoried and the inventory list is provided to the NTS-affiliated American Indian tribes. All artifacts which the tribes have requested have been repatriated to them. Known locations of American Indian human remains at the NTS continued to be protected from NTS activities in 2006.

All consultations between NNSA/NSO and the tribes occurs through the Consolidated Group of Tribes and Organizations (CGTO) comprised of 16 groups of Southern Paiute, Western Shoshone, and Owens Valley Paiute-Shoshone, along with the Las Vegas Indian Center, a Pan-Indian organization. In 2006, the CGTO tribal groups were consulted regarding the proposed Divine Strake test, and work with the CGTO continued on the American Indian exhibit at the Atomic Testing Museum in Las Vegas.

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