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Nevada Test Site Environmental Report 2004 Summary

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Bechtel Nevada
Strengthening national security through engineering and operational excellence

National Nuclear Security Administration

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The information presented in this document is explained in greater detail in the Nevada Test Site Environmental Report 2004 (DOE/NV/11718—1080). It can be downloaded from the NNSA/NSO website 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.

Nevada Test Site Environmental Report 2004 Summary

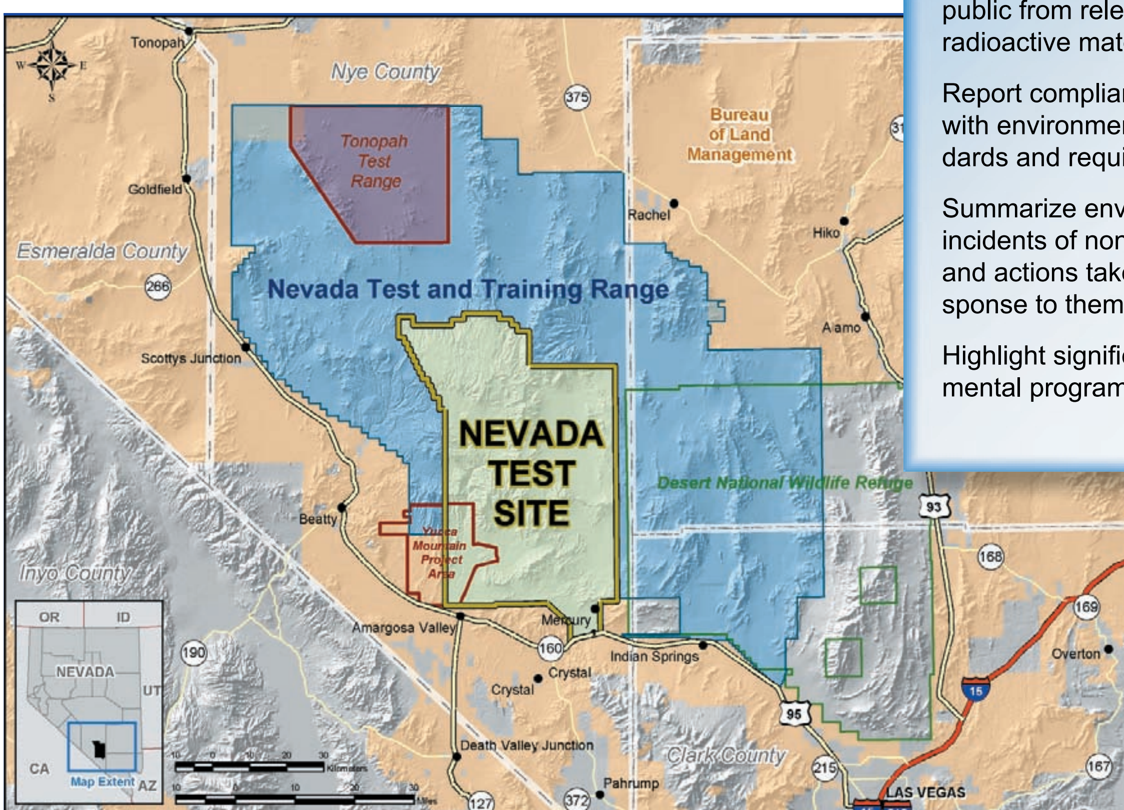
This document is a summary of the Nevada Test Site Environmental Report (NTSER) for calendar year 2004, a comprehensive presentation of environmental monitoring and compliance activities performed at the Nevada Test Site (NTS) throughout the previous calendar year. It is prepared annually to meet the requirements and guidelines of the U.S. Department of Energy (DOE) and the information needs of the public, including government officials, regulatory authorities, NTS contractors, and all others with an interest in the NTS.

This summary document satisfies the NTSER objectives but 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 hardcopy or compact disc of the full report as directed on the inside front cover of this summary.

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office (NNSA/NSO) directs the management and operation of the NTS. 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.

Report Objectives

- Present results of environmental monitoring of radiological and nonradiological effluents
- Report estimated potential radiological doses to the public from releases of radioactive material
- Report compliance status with environmental standards and requirements
- Summarize environmental incidents of noncompliance and actions taken in response to them
- Highlight significant environmental programs and efforts



NTS History

The history of the NTS and its current missions direct the focus and design of the environmental monitoring and surveillance activities on and near the site. Between 1940 and 1950, the area now known as the NTS was part of the Nellis Bombing and Gunnery Range. In 1950, the NTS was established to be the primary location for testing the nation's nuclear explosive devices, which took place from 1951 to 1992. The NTS currently conducts only subcritical nuclear experiments.

Detonation of Priscilla, June 24, 1957

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) (formerly known as the Nellis Air Force Range). 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]

Underground test location, Yucca Flat, 1987

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 and has resulted in the contamination of groundwater in some areas. In 1996, DOE, U.S. Department of Defense (DoD), and the state of Nevada entered into a Federal Facilities Agreement and Consent Order (FFACO) which established Corrective Action Units (CAUs) on the NTS that delineated and defined areas of concern for groundwater contamination.

Sedan, Plowshare Program, July 6, 1962

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. 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 were conducted in Area 26. Mostly gaseous radioactivity (radio-iodines, radio-xenons, radio-kryptons) and some fuel particles were released due to erosion of the metal cladding on the reactor fuel; these releases resulted in negligible deposition on the ground.

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

NTS Mission

Los Alamos, Lawrence Livermore, and Sandia National Laboratories are the principal organizations that sponsor and implement experimental programs at the NTS. Bechtel Nevada (BN) is the Management and Operations (M&O) contractor accountable for the successful execution of work and ensuring that work is 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 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

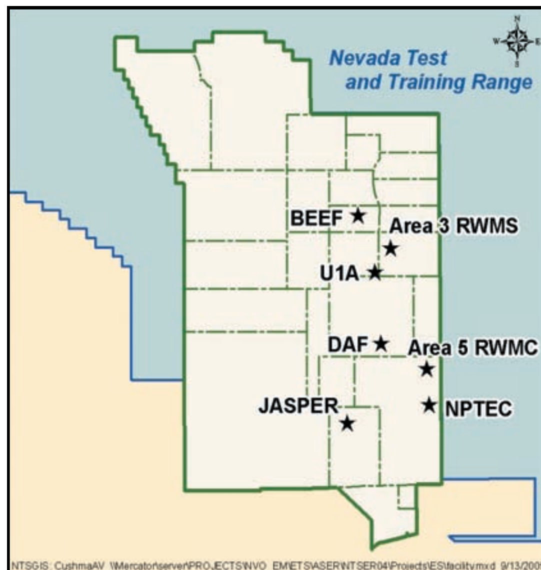
Environmental Restoration Program – Characterizes and remediates the environmental legacy of nuclear weapons and other testing at the NTS and offsite locations and develops and deploys technologies that enhance environmental restoration.

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

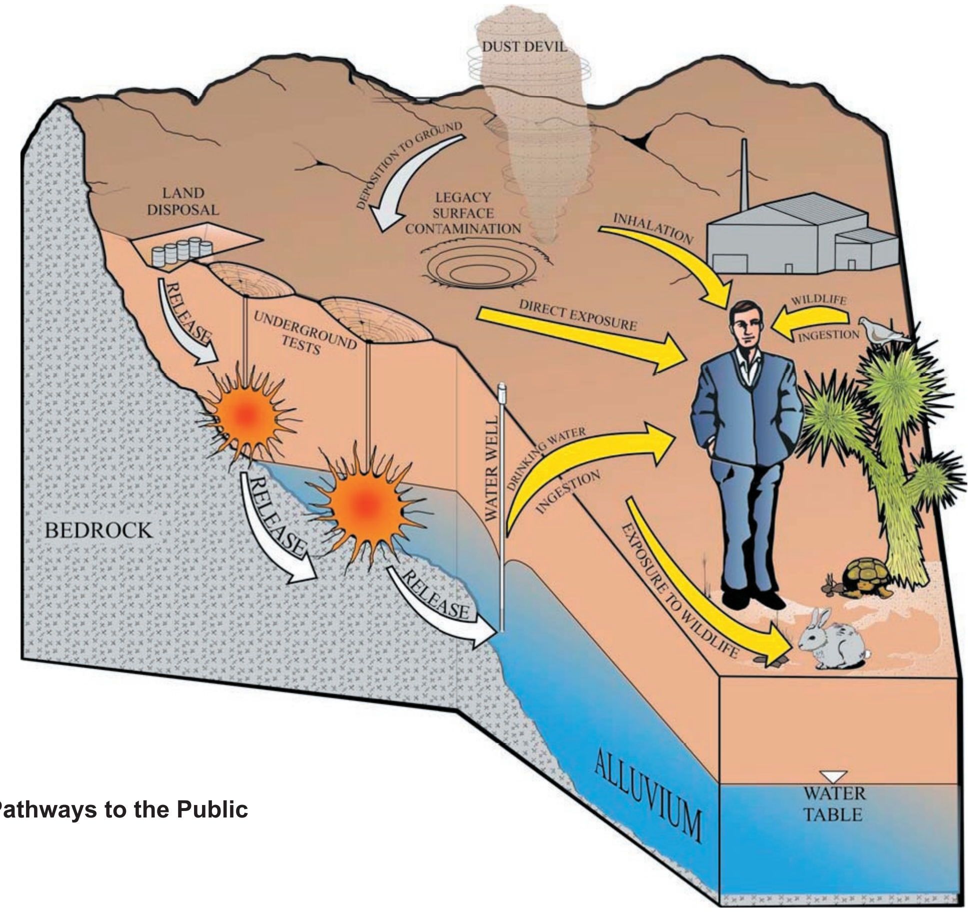
Facilities and Infrastructure – Maintains the buildings, roads, utilities, and facilities required to support all NTS programs and to provide a safe environment for NTS workers.

NTS activities in 2004 continue to be diverse, with the primary role being to help ensure that the existing United States 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. 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, disposal of radioactive and mixed waste, and environmental research.



Radiation Monitoring

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. Radionuclides produced on the NTS have never been detected in drinking water samples offsite, and resuspended soils from the NTS are indistinguishable from global fallout measured in air samples. Since 1992, radiation doses to the public from NTS activities were estimated to be less than 0.15% of doses from background radiation.



Potential Dose Pathways to the Public

Pathways of Radiation Exposure to the Public from NTS Activities

Radiation may be found everywhere. Almost all radiation exposure comes from natural sources (82% 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 every-day life come from smoking cigarettes, traveling on airplanes, and having medical x-rays. For the public surrounding the NTS, only a very small amount of their total radiation exposure may be attributable to past or current NTS activities.

There are three *pathways* in this dry desert environment by which man-made radionuclides from the NTS might reach the surrounding public. One is *inhalation* of particulates or water vapor containing radionuclides that are resuspended by the wind from known contaminated sites (legacy sites) on the NTS. Such resuspended radiation measured off and on the NTS is much lower than natural background radiation in all areas accessible to the public. The second possible, but unlikely, pathway is *ingestion* of game animals that have been exposed to contaminated soil or water on the NTS and then move off the NTS and are hunted. A third pathway of exposure, *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.

In 2004, the public dose from NTS activities from all pathways was estimated to be 0.51 mrem/yr. This is about 0.15 percent of the dose from natural background radiation. The remainder of this report summarizes the results of radiological monitoring conducted in 2004 (pages 5-16) and how the public radiation dose was calculated (pages 17-19). Non-radiological monitoring results and other environmental program activities in 2004 are summarized also (pages 20 – 24).

Forms of Radiation

Alpha – heavy, positively charged particles given off by atoms of elements such as uranium. These can simply be washed off the skin. They can be blocked by a sheet of paper. They enter the body through cuts, mouth, or nose.

Beta – consists of electrons or positrons (positively charged electrons). More penetrating than alpha radiation, beta electrons can pass through several millimeters of skin. A sheet of aluminum only a fraction of an inch thick will stop beta radiation.

Gamma – a very penetrating form of electromagnetic radiation, similar to x-rays, light, and radiowaves. These 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.

X-rays – 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 – 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 water.

Offsite Radiological Air Emissions

An important component of the NTS radiological monitoring program is an oversight monitoring program run by an organization independent of the M&O contractor. It can independently confirm compliance with radiological air emission and water quality standards offsite. This oversight monitoring is performed under the Community Environmental Monitoring Program (CEMP), which is coordinated by the Desert Research Institute (DRI) of the University and Community College System of Nevada under contract with NNSA/NSO. Its purpose is to provide monitoring for radionuclides which may be released from the NTS. A network of 26 CEMP stations located in selected towns and communities within 240 miles from the NTS was operated continuously during 2004 (see map on following page). The CEMP stations monitored gross alpha and beta radioactivity in airborne particulates using low-volume particulate air samplers, penetrating gamma radiation using thermoluminescent dosimeters (TLDs), gamma radiation exposure rates using pressurized ion chamber (PIC) detectors, and meteorological parameters using automated weather instrumentation (MET stations).

Las Vegas CEMP Air Monitoring Station
(photo by Lynn Karr, October 2004)

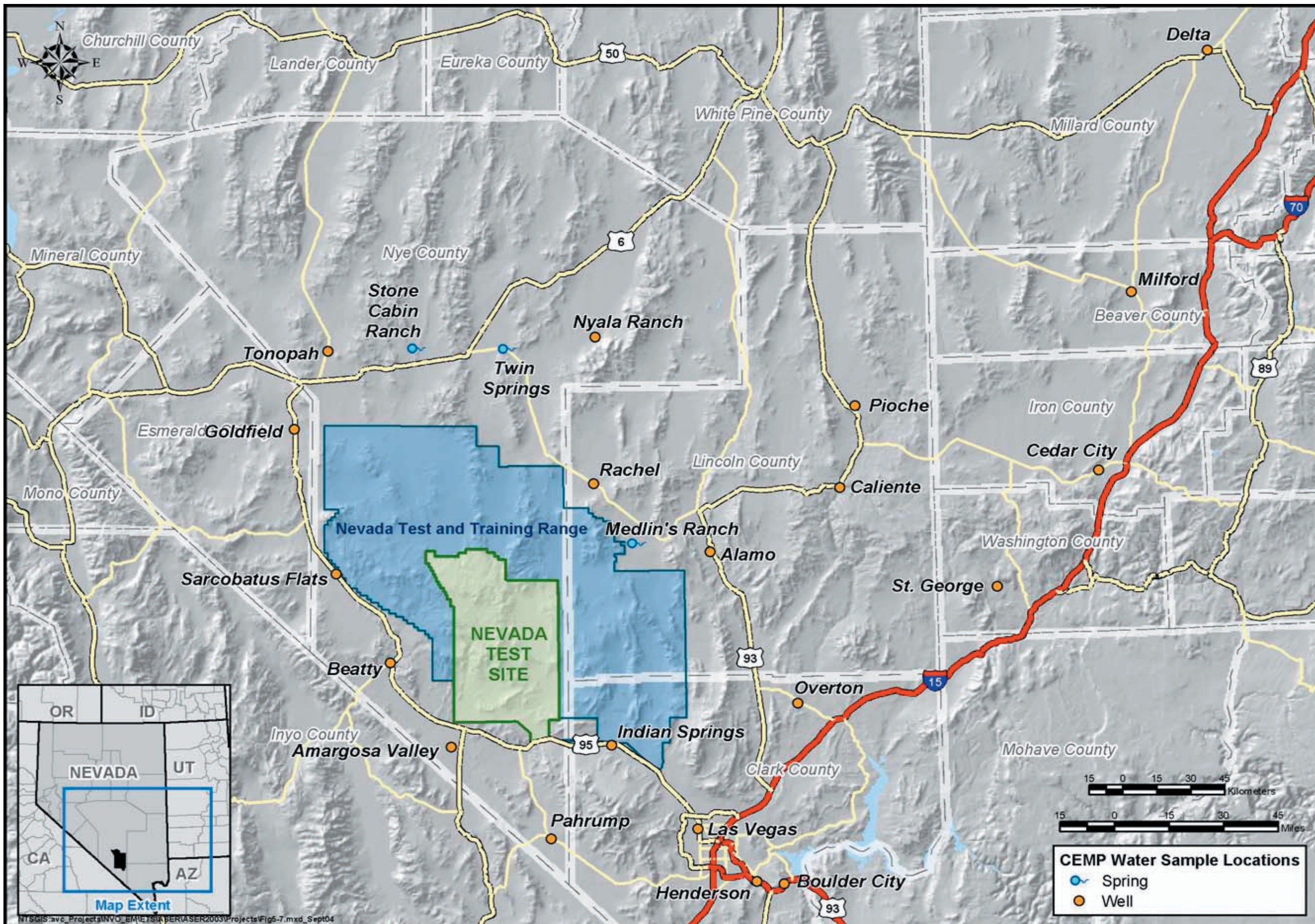
No airborne radioactivity related to any NTS operations was detected in any of the CEMP samples during 2004. Gross alpha and gross beta radioactivity was detected at all CEMP stations at levels consistent with previous years, which reflect radioactivity from background radiation. No man-made gamma-emitting radionuclides were detected. Naturally-occurring radioactive beryllium (^{7}Be) was detected in most air particulate samples.

The TLD and PIC detectors can measure gamma radiation from all sources, both natural background radiation from cosmic and terrestrial sources and radiation from man-made sources. The offsite TLD and PIC results remained consistent with previous years' background levels and are well within average background levels observed in other parts of the United States. The highest total annual gamma exposure measured offsite, based on the PIC detectors, was 178 milliroentgen (mR) at Milford, Utah (at 4,957 feet above seal level; compare with Denver, Colorado at 5,193 feet above sea level, with an annual exposure of 165 mR). The lowest offsite

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

City	Radiation Exposure (mR/yr)
Denver, Colorado	164.6
Fort Worth, Texas	68.7
Los Angeles, California	73.6
New Orleans, Louisiana	63.7
Portland, Oregon	86.7
Richmond, Virginia	64.1
Rochester, New York	88.1
St. Louis, Missouri	87.9
Tampa, Florida	63.7
Wheeling, West Virginia	111.9

Source: < http://www.wrcc.dri.edu/cemp/Radiation.html> "Radiation in Perspective," August 1990, as accessed on 3/22/2005



2004 CEMP Air Surveillance Network

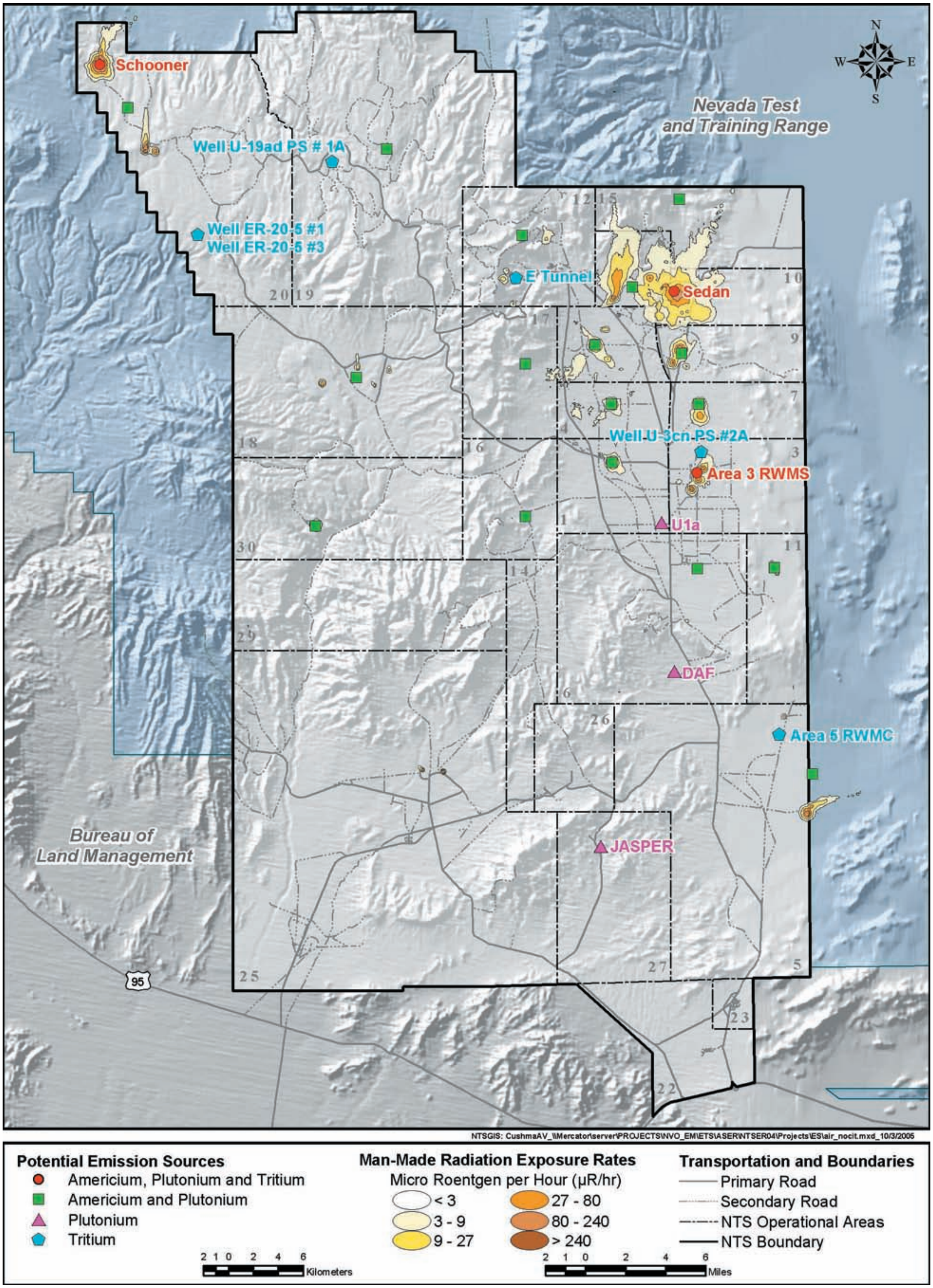
gamma exposure rate measured was 67 mR per year at Pahrump, Nevada.

Onsite Radiological Air Emissions

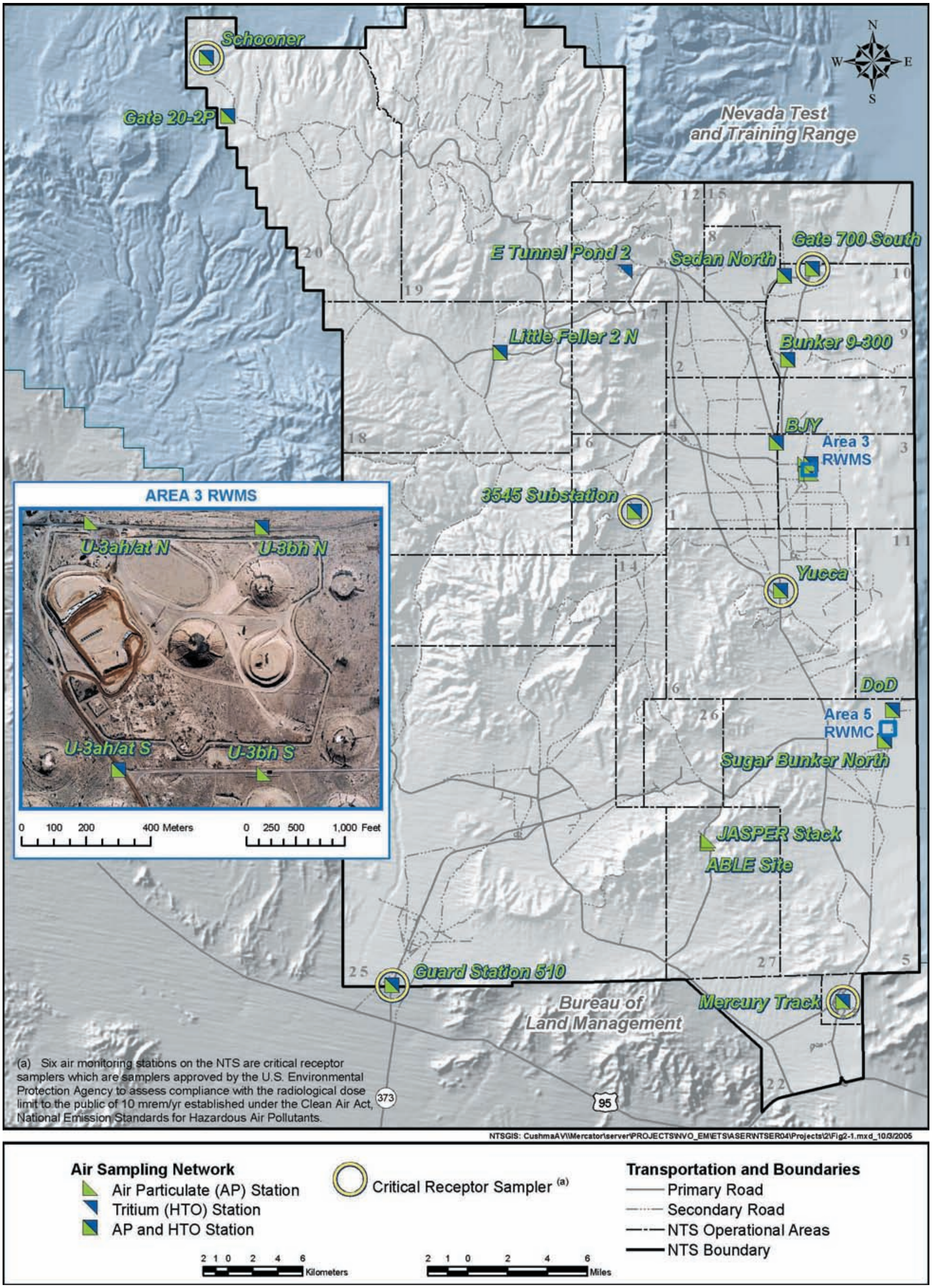
The potential for radioactive air emissions on the NTS is due to operations involving radioactive materials and to legacy soil contamination from past nuclear tests. Therefore, continuous onsite radiological sampling of air is conducted and reported annually by BN to assure the public and regulatory agencies that the emissions are safe and in compliance with state and federal regulations. A network of 19 air sampling stations (3 having low-volume particulate air samplers, 1 having a tritium water vapor sampler, and 15 having both) and a network of 107 TLDs were used to monitor NTS radioactive emissions in 2004 (see map on page 8). Air sampling stations and TLDs are placed throughout the NTS, mainly within those numbered Operational Areas where historic nuclear testing has occurred or where current radiological operations occur. The 2004 monitoring results were also used, in conjunction with U.S. Environmental Protection Agency (EPA)-approved mathematical models, to calculate the radiological dose to the public residing within 50 miles of the NTS (see page 17).

The modeling results indicate that there were minimal radioactive air emissions from current NTS activities in 2004, which came from only one NTS facility. A total of 0.000042 Curies (Ci) of tritium gas was released at Building 650 (in Mercury, Area 23) during the calibration of laboratory equipment. No radioactivity was detected above minimum detectable concentrations (MDCs) in any of the samples collected from the JASPER Facility stack. No radiological releases occurred at U-1a, BEEF, or DAF, and no increasing trends in the concentrations of man-made radionuclides were detected from air samples collected nearest these facilities.

Background gamma radiation exposure rates on the NTS, measured at TLD stations located away from radiologically contaminated sites, ranged from 60 to 156 mR/yr during 2004. Direct gamma radiation exposure to the public from NTS operations was negligible. Areas accessible to the public (such as the NTS entrance gate) had exposure rates which were equal to natural background rates, with one exception. During the fourth quarter of 2004, the daily average gamma radiation exposure rate measured on the west side of the parking area outside the NTS entrance



Potential Sources of Radiological Air Emissions on the NTS



2004 NTS Air Sampling Network

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

	Average Gross Alpha (x 10^{-15} µCi/mL)		Average Gross Beta (x 10^{-14} µCi/mL)		Total Gamma Exposure Rate (mR/yr)	
	Offsite	Onsite	Offsite	Onsite	Offsite	Onsite
Highest Average Value	*2.96 (Boulder City)*	*3.80 (Sugar Bunker)*	*2.46 (Boulder City, Pahrump, Sarcobatus Flats)*	*2.12 (Sugar Bunker)*	*157[(a)] (Twin Springs) 178[(b)] (Milford)*	*863[(a)] (Schooner)*
Lowest Average Value	*1.11 (Nyala Ranch)*	*1.57 (Little Feller 2)*	*1.85 (Ely)*	*1.75 (3545 Substation)*	*81[(a)] (Pahrump) 67[(b)] (Pahrump)*	*59[(a)] (Mercury Fitness Track)*

(a) Based on TLDs
(b) Based on PIC detectors

gate rose to 358 mR/yr, up from 73, 77, and 113 mR/yr during the first, second, and third quarters, respectively. It is likely that low-level radioactive waste shipments entering the NTS were responsible for this increase during the fourth quarter.

Radionuclide contamination at legacy sites has resulted in localized elevated gamma exposure rates, but the public has no access to these sites nor are there NTS personnel working in these areas. As in previous years, the highest exposure rate at monitored locations was 863 mR/yr at Schooner, one of the legacy Plowshare sites on Pahute Mesa. The 16 TLD stations that monitor the Area 3 RWMS and the Area 5 RWMC showed a mean gamma exposure rate of 148 mR/yr and ranged from 106 to 401 mR/yr. The public are not allowed unsupervised access to these sites.

Gross alpha and gross beta radioactivity were detected at all stations on the NTS, but no increasing trend in levels of radioactivity was observed at any station. The highest average gross alpha and gross beta activities were seen at Sugar Bunker, an unoccupied structure used during past nuclear testing, located about 0.6 miles south-southwest of the Area 5 RWMC. The lowest average gross alpha and beta activities were measured at the Little Feller 2 and 3545 Substation samplers, respectively. The Little Feller 2 air sampler is in Area 18, 0.1 miles northwest of the Little Feller 2 site, where an above-ground nuclear test was conducted for the development of a nuclear warhead for the Davy Crockett rocket launcher. The 3545 Substation is in the lower half of Area 16 in the center of the NTS. The mean gross alpha concentrations were slightly higher at the locations near sites with known deposits of radioactivity from past nuclear tests in Areas 1, 3, 5, 6, 9, 10, and 20. The mean gross beta concentrations varied less by location throughout all NTS areas. Both the weekly gross alpha and gross beta concentrations continued to show a general temporal variation that was common for all locations.

Several man-made radionuclides were measured in air samples at levels above their MDCs in 2004: americium-241 (^{241}Am), tritium (^{3}H), plutonium-238 (^{238}Pu), and plutonium-238+239 ($^{239+240}Pu$). These "detects" were all attributed to the resuspension of contamination in surface soils from legacy sites and to the evaporation and transpiration of tritium from the soil, plants, and containment ponds at legacy sites.

Solar Powered BN Air Monitoring Station at Schooner, Area 20 (photo by Terrence Sonnenburg, August 2003)

All concentrations for each radionuclide were well below their "CL," which is the Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAP) Concentration Level for Environmental Compliance. The CL is the annual average concentration (different for each radionuclide) that would result in a dose of 10 mrem/yr, the federal dose limit to the public from all radioactive air emissions.

The highest levels of ^{241}Am were detected at Bunker 9-300, a vacant building located within an area of known soil contamination from past nuclear tests. The highest levels of tritium were detected at Schooner, site of the second-largest Plowshare cratering experiment on the NTS, where tritium-infused ejecta surround the crater. The highest levels of plutonium isotopes in air were at Bunker 9-300. Relatively high plutonium values occur most often at the Bunker 9-300 air sampling station, due to historical nuclear testing in Area 9 and surrounding Areas 3, 4, and 7. All concentrations of cesium-137 (^{137}Cs) in the network were below their sample-specific MDCs.

Uranium isotopes are 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.

Two of the most commonly detected man-made radionuclides, tritium and $^{239+240}$Pu, continued to show generally decreasing trends in concentrations at air sampler sites in 2004. The graphs on the next page show the trends in the annual mean concentrations for these radionuclides. Air sampler locations are color-coded into Area Groups consisting of adjacent NTS Operational Areas. The figures show a horizontal line labeled "CL" or "10% of CL."

The annual concentration averages of tritium in air were decreasing during the years 1982 to 1992 and continued to decrease more gradually from then to the present time. Sampling at Schooner (in Area 20) was not begun until 1998 when solar photo-voltaic electricity was available for remote areas of the NTS.

The decrease in tritium air concentrations is a result of: 1) the cessation of testing in 1992 (there have been no additional releases), 2) radioactive decay (the half-life of tritium is 12 years), and 3) its depletion from the soil over the years due to evaporation and transpiration (uptake and release of water through plants). Note that the scale of the tritium graph is not linear but logarithmic and that annual mean tritium concentrations by NTS area have dropped a factor of one thousand since the early 1980s for all areas except Area 20 (Schooner).

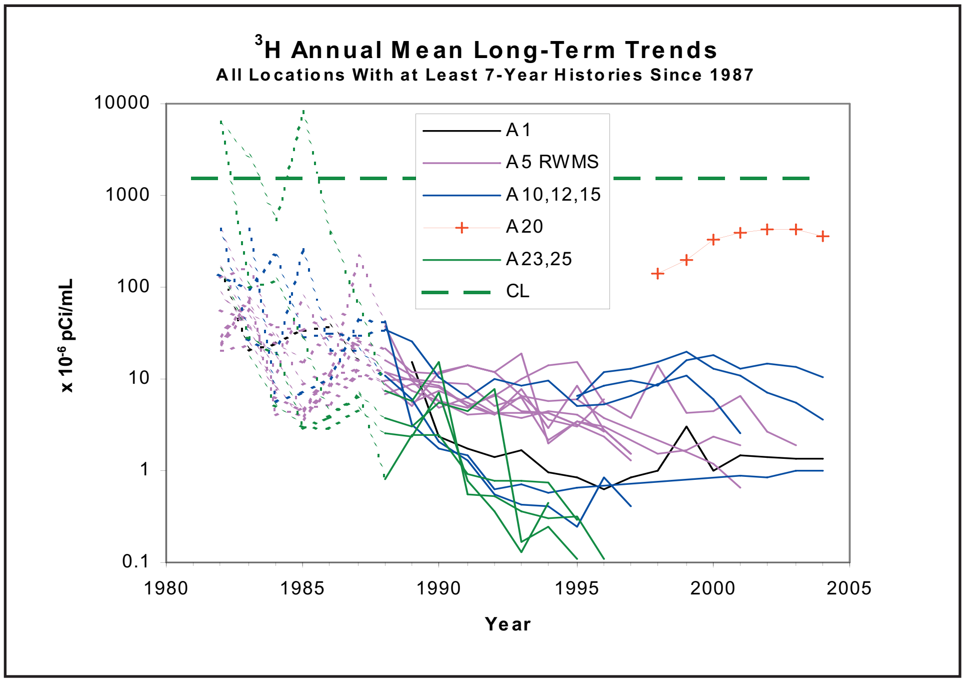
Highest Average Concentrations of Man-Made Radionuclides in Air Samples on the NTS

Man-Made Radionuclide	CL [(a)] (10^{-15} µCi/mL)	Highest Average Concentration (10^{-15} µCi/mL)[(b)]	Sampler Location
^{241}Am	1.9	0.048	Bunker 9-300
^{3}H	1,500,000	365,000	Schooner
^{238}Pu	2.1	0.0056	Bunker 9-300
$^{239+240}$Pu	2.0	0.29	Bunker 9-300

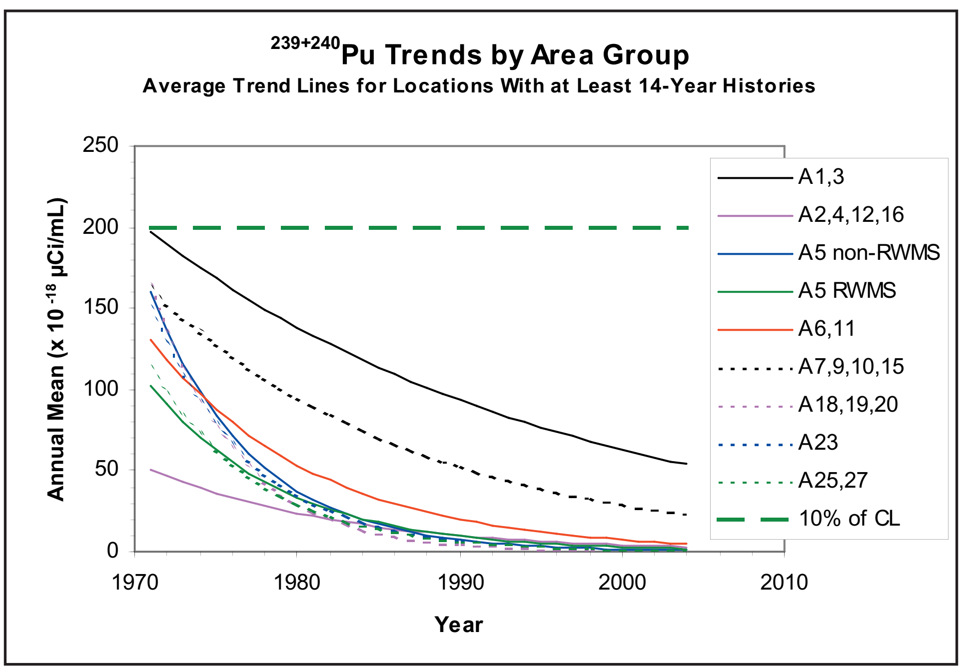
(a) Limits established by the Clean Air Act National Emission Standards for Hazardous Air Pollutants (NESHAP).

(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.

A steady decrease in air-borne $^{239+240}Pu$ over the past three decades has occurred at most locations. The gradual decrease in plutonium concentrations in air over time is attributed to its dispersal by wind and its weathering into the ground where it is bound to less mobile particles. Annual mean $^{239+240}Pu$ concentrations show decreasing mean trends by areas and area groups over the past three decades.



Average Long-term Trends in Tritium at Locations on the NTS Having at Least 7 Years of Data



Long-term Trends in Average Annual Mean $^{239+240}Pu$ for the NTS Area Groups

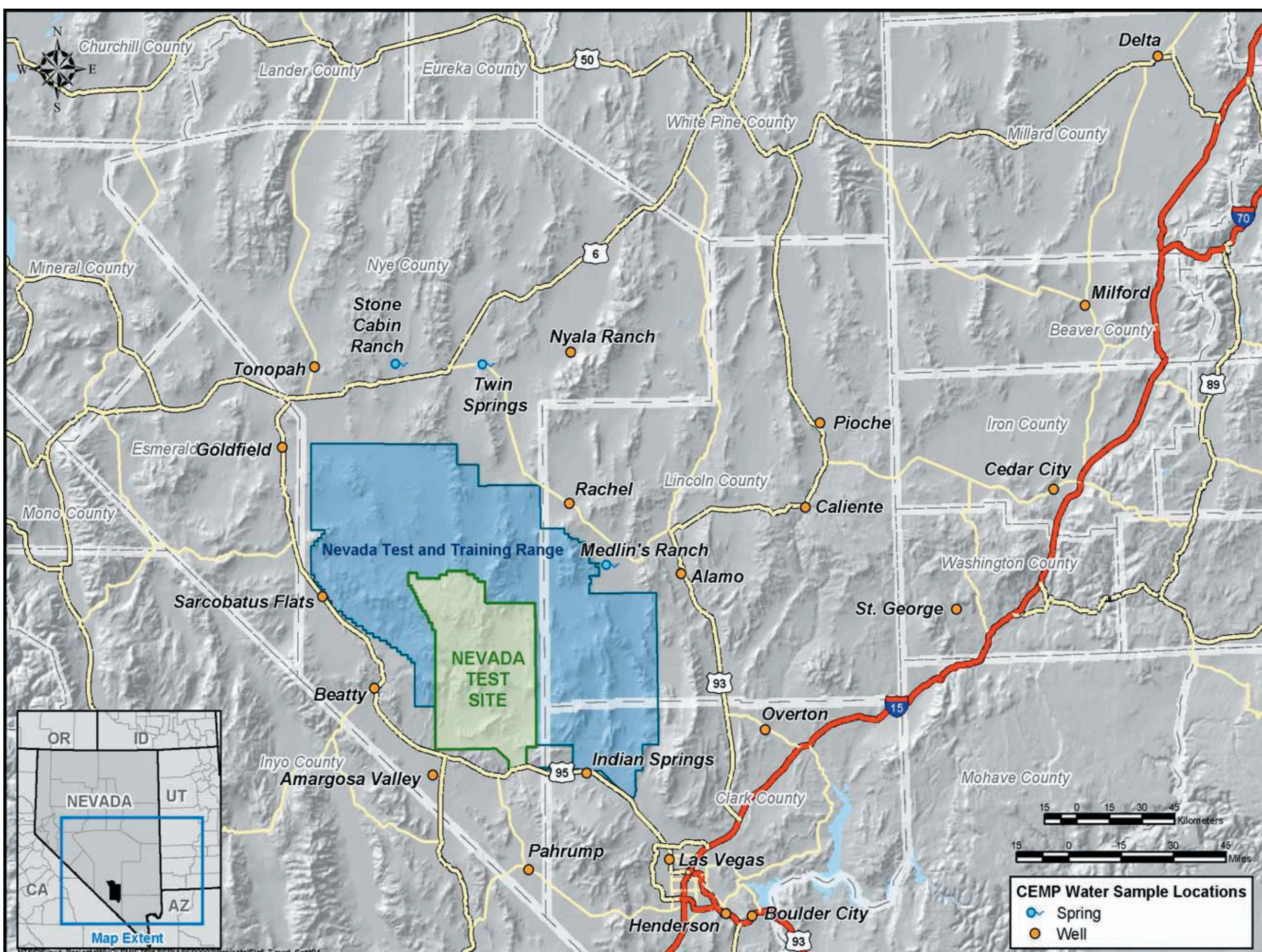
Offsite Radiological Monitoring of Groundwater

There have been 828 underground nuclear tests conducted at the NTS. Approximately one third of these tests were detonated near or below the water table, resulting in the contamination of groundwater in some areas of the NTS. The comprehensive radiological environmental monitoring program on 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.

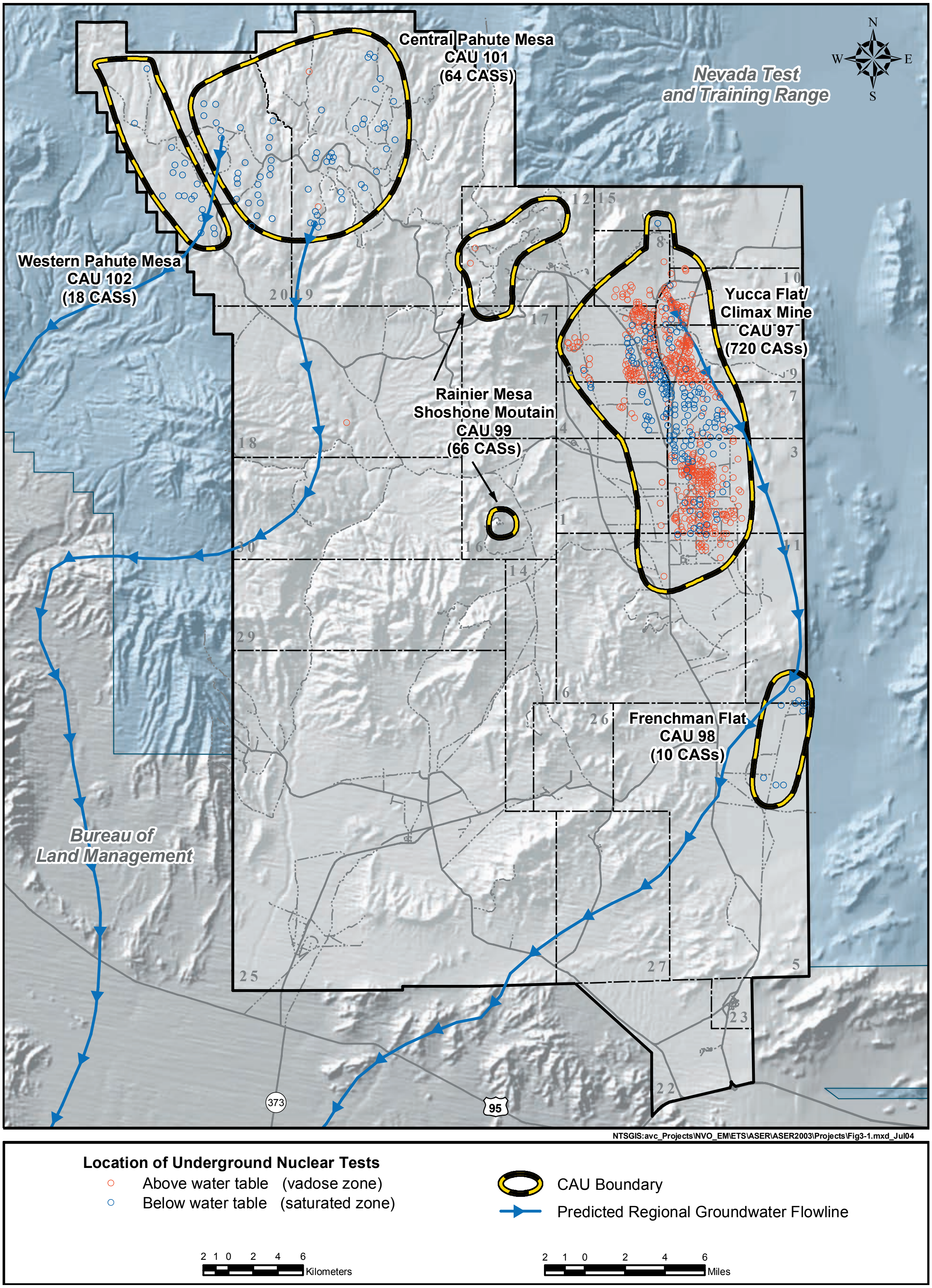
In 2004, BN conducted radiological monitoring of 14 offsite wells and 2 offsite springs. The 14 wells include 6 private domestic and local community wells and 8 NNSA/NSO wells drilled for hydrogeologic investigations including groundwater flow modeling. All of the BN-sampled wells and springs are in Nevada, within 18.6 miles from the western and southern borders of the NTS (see map on page 14).

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 BN. In 2004, the CEMP offsite water sampling locations included 17 wells, 3 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 BN and CEMP.

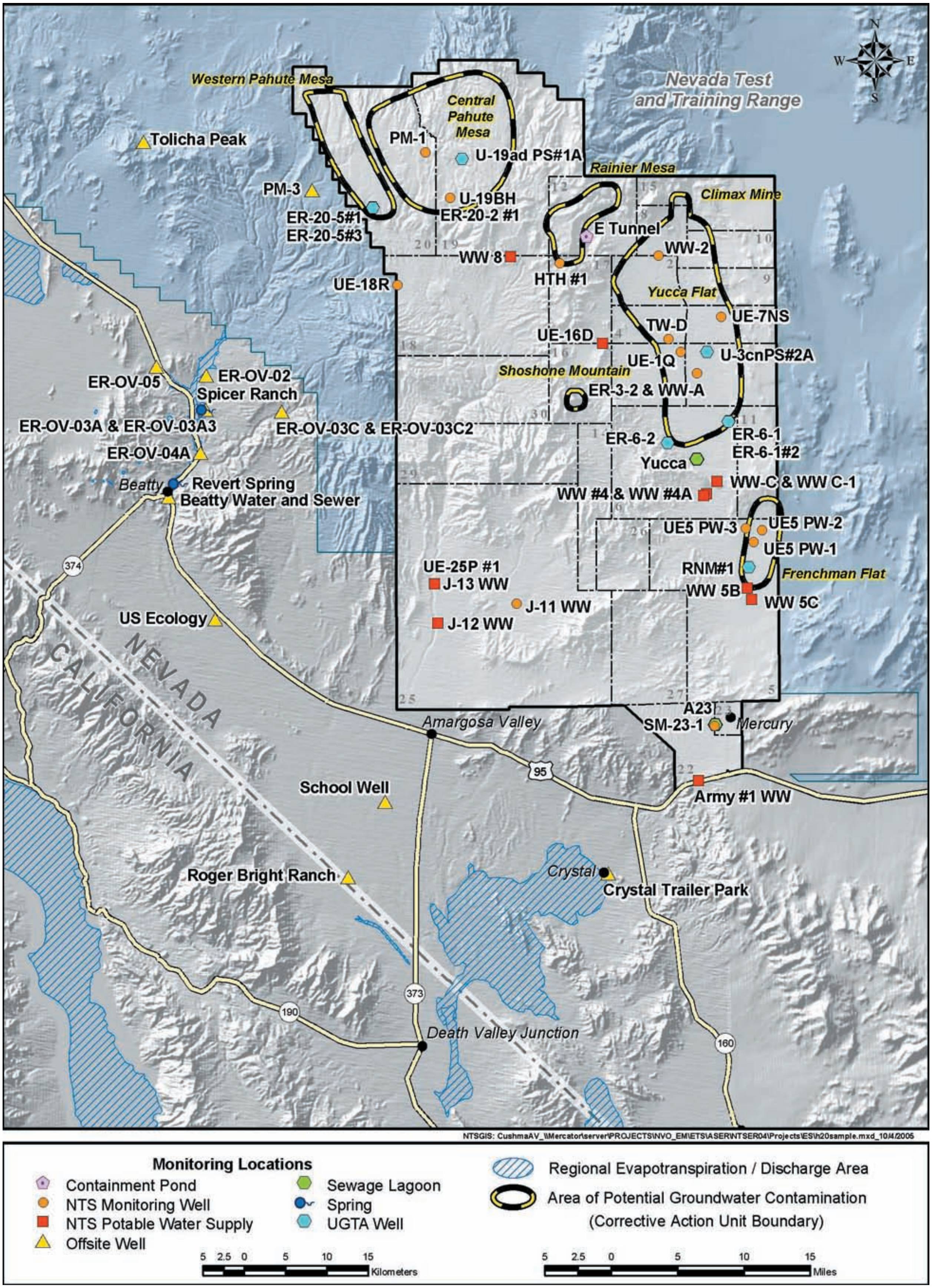
Tritium is the sole radionuclide for which CEMP water sample analyses are run. It is also the analyte of primary interest for the BN sampling program. Tritium is the radionuclide created in the greatest quantities in underground nuclear tests and is widely believed to be the most mobile. The EPA has established the Maximum Concentration Limit (MCL) of tritium in drinking water to be 20,000 picocuries per liter (pCi/L) (a picocurie is one-trillionth of a Ci). To be able to detect the smallest possible amounts of



2004 CEMP Offsite Water Monitoring Stations



Areas of Potential Groundwater Contamination on the NTS



2004 BN Water Monitoring Locations

Summary of Tritium Monitoring from Offsite Wells and Springs					
	CEMP		BN		
	Springs (N=4)	Potable Wells (N=20)	Springs (N=2)	Potable Wells (N=6)	Non-Potable Wells (N=8)
Number of Sites Where Detected (above MDC)	0	2	0	0	1
Highest Measured Value (pCi/L)	12 ± 22 *(Adaven Springs)*	29 ± 17 *(Boulder City)*	6.7 ± 15 *(Spicer Ranch)*	11 ± 15 *(Crystal Trailer Park)*	20 ± 12 *(PM-3)*

The EPA-established maximum concentration limit (MCL) for tritium in groundwater is 20,000 pCi/L

tritium in offsite water supplies, "enriched" tritium analyses were run on all CEMP and BN water samples. For the 2004 CEMP water samples, the MDC for tritium using this enrichment process was 26 pCi/L. Sample-specific MDCs for enriched tritium analyses of BN water samples ranged from 17 to 26 pCi/L. Without enrichment, the MDC for tritium typically ranges from 200-400 pCi/L.

BN offsite water samples are also analyzed for man-made gamma-emitting radionuclides which, if found, would signify contamination from nuclear testing, as well as for gross alpha and gross beta activity to determine if alpha or beta activity at any well or spring is increasing over time.

Samples from two municipal water supplies, Boulder City and Henderson, contained tritium at levels barely above detection. The Boulder City water treatment plant sample contained 29 ± 17 pCi/L and the sample collected at Henderson Community College of Southern Nevada contained 27 ± 16 pCi/L. The uncertainty, or error associated with these measures (the value shown after the ±), indicates that the true concentrations could be as low as 12 or 11 pCi/L, indistinguishable from background. Both of these municipal water systems obtain water from Lake Mead. Similarly, tritium was measured above its MDC in only one of the BN offsite wells and springs; the well PM-3 sampled on May 25, 2004, and the concentration was just barely detectable (20 pCi/L) in one sample and below its MDC in a duplicate sample collected the same day.

All offsite BN well and spring samples contained detectable gross alpha and gross beta radiation, believed to come from natural sources. Gross alpha was found at levels exceeding drinking water standards at only one offsite monitoring well, ER-OV-02. This well, an NNSA/NSO well drilled specifically for hydrologic investigations, is not used for drinking water and is closed to the public. It produces water from a volcanic aquifer that may have relatively high quantities of natural alpha-emitting elements in the host rock. All gross beta concentrations in samples from offsite wells sampled by BN were less than the EPA "Level of Concern" for drinking water.
No offsite wells contained any man-made gamma-

Summary of Gross Alpha and Gross Beta Monitoring from Offsite Wells and Springs

Analyte	Springs (N=2)	Potable Water Supply Wells (N=6)	Non-Potable Water Wells (N=8)
Gross Alpha[(a)]			
Number of sites where detected	2	6	8
Highest measured value (pCi/L)	6.2 ± 1.4 *(Spicer Ranch)*	14.7 ± 2.7 *(Beatty Water and Sewer)*	51.1 ± 8.7 *(ER-OV-02)*
Gross Beta[(b)]			
Number of sites where detected	2	6	8
Highest measured value (pCi/L)	8.3 ± 1.9 *(Spicer Ranch)*	14.3 ± 2.9 *(Roger Bright Ranch)*	48.1 ± 8.1 *(ER-OV-02)*

(a) The EPA-established drinking water MCL for gross alpha is 15 pCi/L
(b) The EPA-established "Level of Concern" for gross beta is 50 pCi/L

emitting radionuclides. The 2004 offsite water monitoring results, as in past years, continue to verify that no plume of contaminated groundwater has been detected beyond the NTS boundaries in public water supplies being monitored.

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 2004, the onsite monitoring network was comprised of 10 potable water supply wells (9 permitted by the state), 12 monitoring wells (which include 3 compliance wells for the Area 5 RWMS and 1 compliance well for the Area 23 sewage lagoon), 1 tritiated water containment pond system, and 2 sewage lagoons (see map on page 14).

Taking a water sample from an NTS non-potable groundwater monitoring well
(photo by Terrence Sonnenburg, May 2002)

Potable Water Supply Wells

The 2004 data continue to indicate that underground nuclear testing has not impacted the NTS potable water supply network. One water sample from each of three NTS supply wells had concentrations of tritium barely above their MDCs; none had detectable concentrations of man-made gamma-emitting radionuclides. Gross alpha and gross beta radioactivity were detected in most of the potable water supply wells at levels below drinking water limits; these are attributed to the presence of naturally-occurring radionuclides.

Monitoring Wells and Compliance 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 onsite monitoring wells (PM-1, U-19BH, UE-7NS, and WW A) had detectable concentrations of tritium in 2004 ranging from 23 ± 14 to 475 ± 27 pCi/L, all well below the MCL of 20,000 pCi/L. Each of the four monitoring wells is located within 0.6 miles of an historical underground nuclear test; all have consistently had detectable levels of tritium in past years. There were also tritium levels measured above their MDCs from three wells sampled to validate the performance of a radioactive waste disposal pit at the Area 5 RWMS (UE5PW-1, UE5PW-2, and UE5PW-3) ranging from 30 ± 12 to 37 ± 13 pCi/L. In each case, however, a duplicate sample collected at the same time from each well had measured tritium levels below its MDC.

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 non-radiological contaminants exceed the allowable contaminant levels regulated under a state water pollution control permit. Tritium concentrations in tunnel effluent waters in 2004 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 sampled by BN 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.

Monitoring Results for E Tunnel Effluent Waters Pertaining to Water Pollution Control Permit		
Analyte	Concentration Limit Set by Permit (pCi/L)	Average Measured Concentration (pCi/L)
Tritium	1,000,000	710,000
Gross Alpha	35.1	13.4
Gross Beta	101	72

Tritiated water is also pumped into lined sumps during studies conducted by the Underground Test Area Project (UGTA). To characterize the groundwater regime under the NTS, suitable additional wells are being drilled and existing wells re-completed 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. During 2004, water containing tritium was pumped from Wells U-3cn PS#2A, U-19ad PS#1A, ER-20-5 #1, and ER-20-5#3 (see map on page 14) into lined containment ponds. In 2004, levels of tritium in these ponds ranged from 113,000 pCi/L at ER-20-5 #3 to 38,000,000 pCi/L at ER-20-5 #1.

Permitted Sewage Lagoons

Two permitted sewage lagoons (Area 6 Yucca and Area 23 Mercury) are sampled annually and analyzed for tritium using standard (un-enriched) analyses and by gamma spectroscopy for other radionuclides. As during previous years, no tritium was detected at concentrations above their MDCs in the lagoon water samples and no man-made gamma-emitting radionuclides were detected during 2004.

Calculating Radiation Dose to the Public from All Possible Pathways

Man-made radionuclides from past nuclear testing have not been detected in offsite groundwater in the past or during 2004. The only pathways, therefore, by which the offsite public could receive a radiation dose from NTS operations are the inhalation and ingestion pathways.

Inhalation Pathway

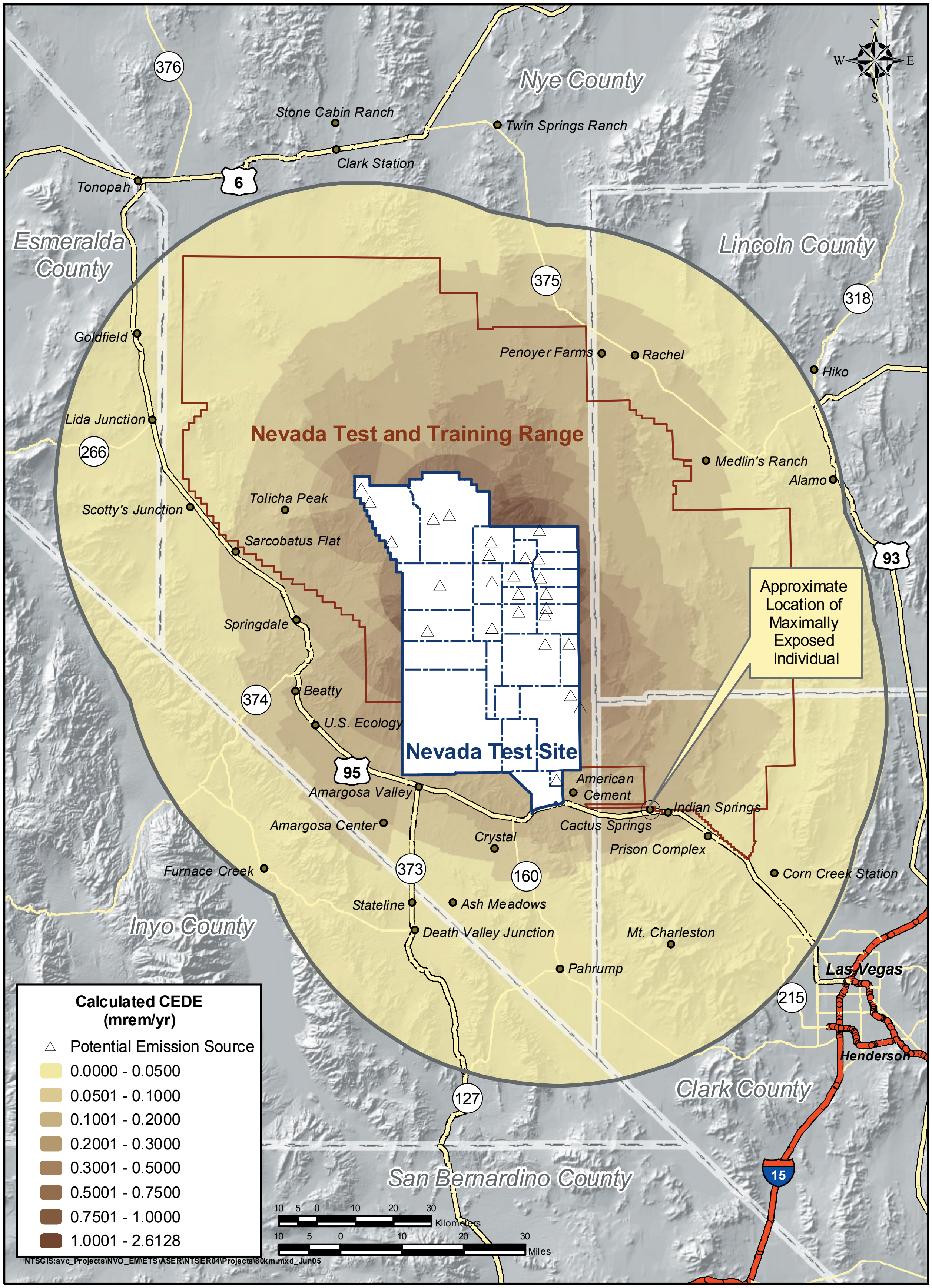
The radiation dose to the general public by just the air transport pathway was estimated using air sampling results from six onsite EPA-approved "critical receptor" sampling stations. Among these six stations, the Schooner air station in the far northwest corner of the NTS experienced the highest concentrations of radioactive air emissions. An individual residing at this station would experience a dose from air emissions of 2.5 mrem/yr. This dose is less than the dose limit of 10 mrem/yr specified by NESHAP under the Clean Air Act. Dose, via the air transport pathway, at offsite populated locations 12-50 miles from the Schooner station would be even lower due to wind dispersion.

Inhalation and Ingestion Pathway

The radiation dose to the general public from inhalation and ingestion of airborne radioactive contaminants was also estimated using the 2004 air sampling results and air transport models. Estimates of radionuclide emissions from the following sources were used to compute total air emissions from source locations on the NTS: (1) NTS facilities, (2) the resuspension of legacy deposits of radionuclides in NTS soil, (3) the transpiration and evaporation of tritium at sites of past nuclear tests, and (4) the evaporation of tritium from ponds used during 2004 to contain tritium-contaminated groundwater. The table below lists the location names of NTS air emission sources and their 2004 emission estimates.

Estimated 2004 Annual NTS Air Emissions		
Source	Radionuclide	Quantity (Ci)
Area 23 Building 650	^{3}H	0.000042
Area 12 E Tunnel Ponds	^{3}H	12
Well U-3cn PS#2	^{3}H	0.52
Well U-19ad PS#1A	^{3}H	18
Well ER-20-5 #1	^{3}H	4.5
Well ER-20-5 #3	^{3}H	0.020
Area 3 RWMS	^{3}H	83
Area 5 RWMS	^{3}H	4.9
Area 10 Sedan	^{3}H	200
Area 20 Schooner		240
Total for all ^{3}H Sources	^{3}H	562.94
Total for Grouped NTS Areas	^{241}Am	0.047
Total for Grouped NTS Areas	$^{239+240}Pu$	0.29

The radiation dose to the general public is expressed as the committed effective dose equivalent (CEDE) to the maximally-exposed individual (MEI) and was computed to be 0.12 mrem/yr for a resident of Cactus Springs, Nevada (see map on next page). This is well below the dose limit of 10 mrem/yr specified by NESHAP, and is consistent with those calculated for past years.



2004 Calculated Radiation Dose from Air Emissions to the Public Within 50 Miles of the NTS

Ingestion Pathway Through Game Animals

Each year, game animals from different contaminated NTS sites are trapped and analyzed for their radionuclide content. They are used to construct worst-case scenarios for dose to hunters who might consume these animals if the animals moved off the NTS and were then hunted. NTS game animals include pronghorn antelope, mule deer, chukar, Gambel's quail, mourning doves, cottontail rabbits, and jackrabbits. The MEI who is a hunter is assumed to eat 20 doves, 20 quail, 20 chukar, 20 jackrabbits, and 1 pronghorn antelope in a year. It is also assumed that the dose from each animal consumed is the average calculated dose for that species which was sampled from the NTS location where the highest levels of radionuclides in that species' muscle tissues were found. The resultant dose to a hypothetical hunter, given all of these worst-case assumptions, is 0.39 mrem/yr. This dose is less than the dose from cosmic radiation received by an individual while on a one hour plane ride at 39,000 feet.

Pronghorn antelope *(Antilocapra americana)* in Frenchman Flat (photo by Derek Hall, May 2004)

Gambel's quail *(Callipepla gambelli)* (photographer and date unknown)

All Possible Pathways

When the maximum doses from all pathways (inhalation and ingestion) are added together, the resultant total radiation dose to the MEI attributable to NTS operations during 2004 was 0.51 mrem/yr. This dose is so small it cannot be distinguished from the dose from background radiation (it is ~0.15 percent of the total dose from naturally-occurring sources, see pie chart on the following page). It is well below the dose limit of 100 mrem/yr established by DOE Order 5400.5 *Radiation Protection of the Public and the Environment* for radiation exposure to the public from all pathways combined.

DOE Order 5400.5 requires also that a collective population dose be estimated annually. The product of exposure multiplied by the size of the exposed population is known as the collective population dose. The collective population dose to all persons within 50 miles of the emission sources on the NTS was estimated to be 0.47 person-rem/yr.

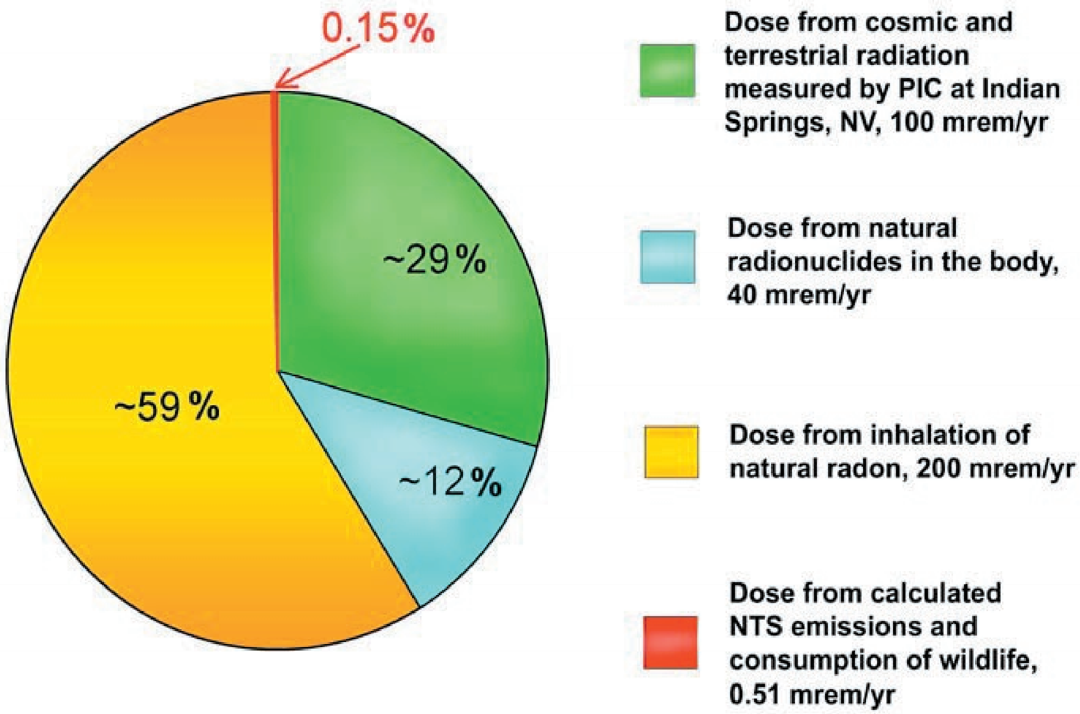
Estimated Radiation Dose to the General Public from the NTS in 2004

Pathway	Dose to the Maximally Exposed Individual (mrem/yr)	Estimated Collective Population Dose (person-rem/yr)
Air	0.12	0.47[(a)]
Water	0	0
Wildlife	0.39	U[(b)]
All Pathways	0.51	0.47[(c)]

(a) Sum of radiation doses from all emission sources at each populated location within 50 miles of emission sources multiplied by the population at each location, and then summed over all locations.

(b) Unable to make this estimate due to a lack of data on the number of game animals harvested near the NTS by hunters in 2004.

(c) The dose contribution from wildlife is not included. It is likely to be negligible when averaged over the entire population within a 50 mile radius.



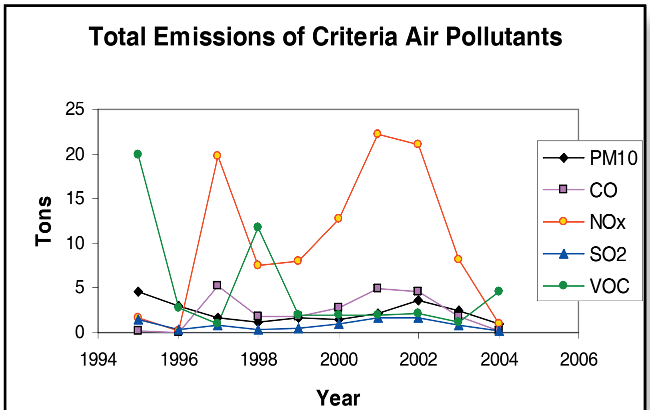
Comparison of Radiation Dose to the MEI and the Natural Radiation Background

Non-Radiological Onsite Air Emissions

There were no discharges of non-radiological hazardous materials to offsite areas in 2004. Therefore, only onsite non-radiological environmental monitoring of NTS operations was conducted. 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, 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).

An estimated 6.91 tons of criteria air pollutants were released on the NTS in 2004. They included particulate matter equal to or less than 10 microns in diameter (PM10), carbon monoxide (CO), nitrous oxides (NO_x), sulfur dioxide (SO_2), and volatile organic compounds (VOCs). The majority of the emissions (4.60 tons) were VOCs. The NPTEC facility, where controlled spills of hazardous materials are conducted, produced more VOCs than all other permitted NTS facilities. Total air emissions of lead, also a criteria pollutant, from the NTS in 2004 was 10.4 pounds. The quantity of HAPS released in 2004 was 0.41 tons. No emission limits for any criteria air pollutants of HAPS were exceeded. In May 2004, the state of Nevada conducted an inspection of the following facilities regulated by the NTS air quality permit: the Area 1 Aggregate Plant, Area 1 Batch Plant, and the NPTEC. The state found no permit violations.

Asbestos is the only non-radiological HAP of regulatory concern on the NTS. Building renovation or demolition projects may release asbestos. No large asbestos abatement projects were conducted on the



Non-Proliferation Test and Evaluation Complex in Area 5
(photo courtesy of NNSA/NSO)

NTS or at NTS support facilities in Las Vegas during 2004. All materials containing regulated asbestos (asbestos that is friable and therefore potentially breathable) that were removed from NTS facilities were disposed of in the Mercury landfill. The quantities removed did not exceed EPA's notification threshold of 260 linear feet or 160 square feet. The Mercury landfill documented receipt of 15 tons of such material in 2004.

Five tests, consisting of 25 releases of hazardous chemicals in all, were conducted at the Area 5 NPTEC and the new Area 25 Test Cell C NPTEC facility in 2004. 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.

Non-Radiological Onsite Discharges into Water

There are no liquid discharges to navigable waters, offsite surface water drainage systems, or publicly owned treatment works resulting from operations on the NTS. Therefore, no Clean Water Act National Pollution Discharge Elimination System (NPDES) permits are required for NTS operations.

In 2004, 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 during 2004. The majority of samples had concentrations of toxic chemicals below detectable levels; the few toxic chemicals which were detectable were found at levels less than 0.1 percent of their permit limits.

Area 23 Mercury Sewage Lagoon
(photo by Coby Moke, August 2005)

Non-Radiological Onsite Drinking Water Quality

NNSA/NSO operates a network of nine permitted wells that comprise three permitted public water systems on the NTS which supply the potable water needs of NTS workers and visitors. In addition, three private water systems are maintained but are not regulated under state permit. 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. Year 2004 monitoring results 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. Samples from two of the water systems slightly exceeded a Secondary Standard for pH. No monitoring of the private water systems was conducted.

Non-Radiological Emissions into Air and Discharges into Water at the North Las Vegas Facility

Like the NTS, the North Las Vegas Facility (NLVF) is regulated for the emission of criteria pollutants and HAPs. Air quality operating permits are maintained for a variety of equipment, including boilers, emergency generators, and a paint spray booth. There are no monitoring requirements associated with these permits. The Clark County Health District requires submittal of an annual emissions inventory. The estimated quantities of criteria air pollutants and HAPs emitted at the NLVF in 2004 are minimal, ranging from 0.0009 tons for HAPS to 0.679 tons for NO_x.

Water discharges at the NLVF are regulated by a permit issued by the City of North Las Vegas (CNLV) for sewer discharges and by three temporary state-issued NPDES discharge permits for groundwater discharges into the CNLV storm water drainage system during a groundwater characterization and dewatering project. Self-monitoring and reporting of the levels of non-radiological contaminants in sewage and industrial outfalls is conducted. All contaminant concentrations were below permit limits in water samples from NLVF outfalls and sludge and liquid samples from the NLVF sand/oil interceptor during 2004. Because the groundwater discharges are "clean" (i.e., not wastewater or discharges from an industrial process), no water parameters are required to be monitored. Sediment controls are required only if needed; no need for sediment controls was ascertained in 2004. Unauthorized discharges of tritiated water which occurred at the NLVF in 2004 are discussed below.

Accidental or Unplanned Environmental Releases or Occurrences

Only one reportable environmental occurrence took place on the NTS during 2004. This involved the release of used motor oil onto soil. About 75 gallons of oil leaked from a 650-gallon oil holding tank mounted on a lubrication truck. The direct, contributing, and root causes of the occurrence were determined. The oil release was controlled, contaminated soils were excavated to meet state clean up levels, and corrective actions were taken to prevent reoccurrence. No significant impact to the environment, biota, or the public occurred as a result of this release.

One other environmental occurrence in 2004 was at the NLVF. Parts of Building A-1 were contaminated with tritium by a previous contractor in 1995. In 2004, during a pre-inspection and safety walkthrough, it was observed that a 5-gallon bucket of water was located near a floor drain and under the drainpipe of the air-handling unit in Room 4520 of Building A-1. The bucket was being used to catch condensate from the air handler. Upon investigation, it was learned that, on at least three occasions, tritiated water from the bucket had been emptied into the floor drain, constituting an unauthorized discharge to the CNLV sewer system. Water samples from the bucket indicated a tritium concentration of 23,000 ± 4,000 pCi/L. NNSA/NSO reported the unauthorized discharge to CNLV. Several actions required by CNLV were taken to prevent future discharges and document that the tritium concentrations at the sewage outfall for the NLVF were not detectable following each of the discharge incidents.

Overall Compliance with Environmental Laws, Regulations, and Policies

The 2004 NTSER lists and discusses the many applicable environmental drivers 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 the NTSER in detail (available electronically at <http://www.osti.gov/bridge>).

For this summary document, the major categories of these drivers are listed below. Within each category, the number of *compliance measures* monitored and *compliance actions* taken is presented along with the percentage of those measures or actions which met compliance limits or requirements. For example, under Air Quality, the *tons of criteria air pollutants emitted on the NTS* is just one *compliance measure* which is monitored to determine if emission quantities are within permit limits. An example of a *compliance action* under Air Quality is *prepare annual report of calculated emissions to state of Nevada,* which must be submitted by a specified date. If both the tons of criteria air pollutants were all within permit limits, and the annual emissions report was prepared and submitted to the state on time, then the percent compliance would be 100 percent. Where compliance for a category is not 100 percent, the non-compliance incidents are noted. The reader is directed to Chapter 2, Compliance Summary, of the NTSER for the listing of all compliance measures and actions quantified in the table on the next page.

Percent of Environmental Measures/Actions Found in Compliance in 2004		
Category	**Number of Compliance Measures/Actions**	**Percent in Compliance**
Air Quality	18	94 One incidence of excessive fugitive dust
Water Quality and Protection	26	96 pH (a Secondary Standard for water quality) was exceeded in samples from two NTS public water systems
Radiation Dose Protection	12	100
Radioactive and Non-Radioactive Waste Management and Environmental Restoration	16	100
Hazardous Materials Control and Management	11	100
Pollution Prevention and Waste Minimization		100
Historic Preservation and Cultural Resource Protection	12	100
Conservation and Protection of Biota and Wild-life Habitat	13	92 16 accidental bird deaths attributable to NTS activities (e.g., roadkill), involving 8 species protected as migratory birds

Other Significant 2004 Environmental Accomplishments

Environmental Restoration

The cleanup of sites contaminated by past DOE operations on and off the NTS 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, DoD, 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 56 contaminated above-ground sites were closed safely in 2004. Extensive progress was made towards 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 well development, aquifer testing, groundwater characterization sampling, and the completion of several technical data documentation packages and modeling approach/strategy documents.

Pollution Prevention and Waste Minimization

Decommissioned NTS buildings destined for disassembly and disposal were donated or sold for reuse. This waste minimization effort diverted approximately 31 tons of waste from the NTS landfills. The Material Exchange Program reused 2.2 tons of non-hazardous chemicals, equipment, and supplies. The BN Payroll Department converted to a paperless, electronic time keeping system. This new process eliminated the need for paper timecards and reduced the amount of paper waste by about 2.2 tons.

Other significant waste reduction efforts continued in 2004, such as selling scrap ferrous metal to a vendor for recycling (826 tons) and offsite recycling of mixed pager and cardboard (571 tons). Overall, reductions of 126 tons of hazardous wastes and 1,581 tons of solid wastes were realized in 2004.

Wastes Reduced Through Pollution Prevention Activities

Calendar Year	Radioactive Waste Reduced (yd^3)	Hazardous Waste Reduced (tons)	Solid Waste Reduced (tons)
2004	0	126.3	1,581.2
2003	52.0	228.0	1,731.6
2002	82.2	194.9	994.6
2001	103.5	135.8	878.9

Note: Units presented in NTSER are cubic meters and metric tons

Historical Preservation/Cultural Resources Protection

Eight years ago, the Consolidated Group of Tribal Representatives (CGTO), in conjunction with on-going archaeological research, identified a place of significance to them on the NTS called Wunjiakuda. Before American Indian activities were disrupted by the Euro-American culture, Western Shoshone and Southern Paiute would gather at Wunjiakuda annually at pine-nut harvesting time. A small group of people lived at this location year round. The CGTO requested the opportunity to spend time there. In the late summer of 2004, an ethnographic study was conducted at Wunjiakuda with elders and cultural specialists from the Western Shoshone, Southern Paiute, and Owens Valley Paiute-Shoshone to record their knowledge about Wunjiakuda and the meaning of this place to them. This project, which was several years in the making, will result in the dissemination of information important to the Indian people.

Ecological Monitoring

A total of 22.3 acres of tortoise habitat were disturbed in 2004; no threatened desert tortoises were accidentally injured or killed, however, nor were any captured or displaced from project sites.

A West Nile Virus Sampling Program on the NTS was started in 2004 with guidance from the Clark County Health District. BN biologists conducted 10 trapping sessions at eight sites on the NTS. A total of 56

Anasazi San Juan Red potsherd from a bowl ~ 1,000 years old, Rainier Mesa
(photo by Robert Jones, September 2004)

mosquitoes of two different species were collected. None of the mosquitoes tested positive for the West Nile virus.

Three maternity roost sites of the Townsend's big-eared bat (*Corynorhinus townsendii pallescens*) and two of the fringed myotis (*Myotis thysanodes*) were found on the NTS in 2004. Both species are designated high risk for imperilment by the Nevada and Western Bat Working Groups. NTS bat roost data were presented at the North American Symposium on Bat Research in Salt Lake City in October 2004.

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

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