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2022

National Nuclear Security Administration

NEVADA NATIONAL NNSS SECURITY SITES

Environmental Report

Summary


WARRIOR XII

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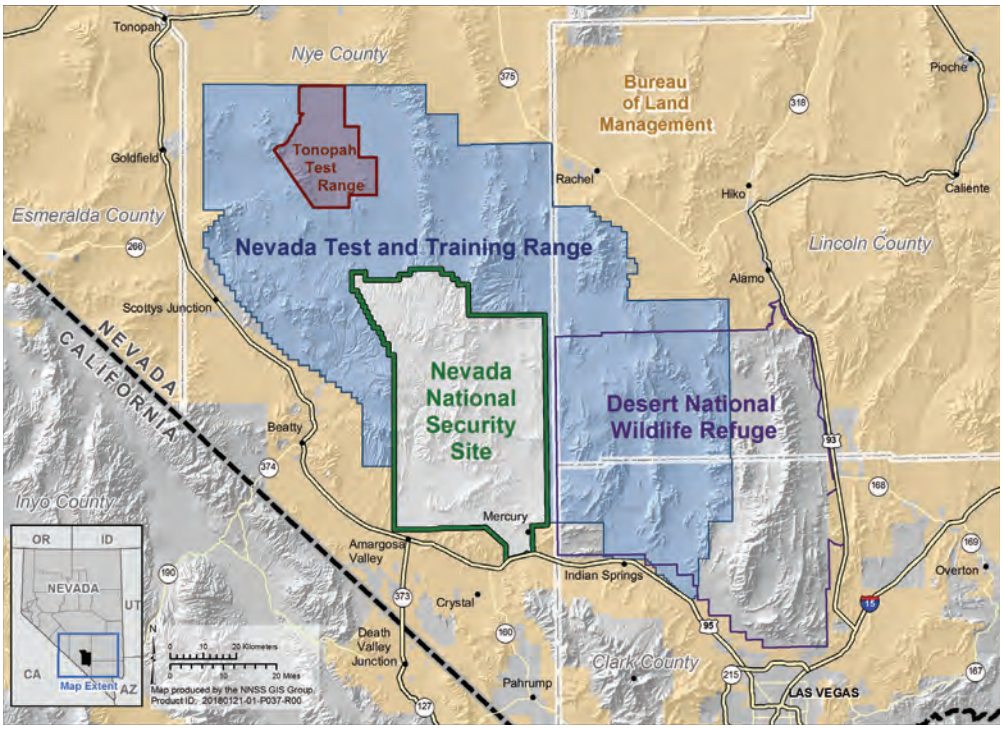
NEVADA NATIONAL SECURITY SITE

Environmental Report Summary 2022

This document is a summary of the full *2022 Nevada National Security Site Environmental Report* (NNSSER) prepared by the U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office (NNSA/NFO). This summary provides an abbreviated version of the full NNSSER. The reader may obtain hard copy and electronic copies of this report, the full report, and the 2022 Nevada National Security Site Environmental Report Attachment A: Site Description as directed on the inside back cover of this report.

NNSA/NFO prepares the NNSSER to provide the public an understanding of the environmental monitoring and compliance activities that are conducted on the Nevada National Security Site (NNSS) to protect the public and the environment from radiation hazards and from potential nonradiological impacts. It is a comprehensive report of environmental activities performed at the NNSS and offsite facilities over the previous calendar year.

The NNSS is currently the nation's unique site for ongoing national security–related missions and operations. The NNSS is located about 65 miles northwest of Las Vegas. The approximately



1,360-square-mile site is one of the largest restricted access areas in the United States. It is surrounded by federal installations with strictly controlled access as well as by lands that are open to public entry.

History of the NNSS

Between 1940 and 1950, the area now known as the NNSS was part of the Las Vegas Bombing and Gunnery Range. In 1950, the NNSS was established as the primary location for testing the nation's nuclear explosive devices. Such testing took place from 1951 to 1992. Tests conducted through the 1950s were predominantly atmospheric tests. These involved a nuclear explosive device detonated while either on the ground surface, on a steel tower, suspended from tethered balloons, dropped from an aircraft, or placed on a rocket. Several tests were categorized as "safety experiments" and "storage-transportation tests," involving the destruction of a nuclear device with non-nuclear explosives, some of which resulted in dispersion of plutonium in the test vicinity. Some of these test areas are off of the NNSS on the Nevada Test and Training Range (NTTR) and on the Tonopah Test Range (TTR).

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

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

Other nuclear-related experiments at the NNSS included the Bare Reactor Experiment–Nevada series in the 1960s. These tests were performed using a neutron generator mounted on a 1,527-foot steel tower to study neutron and gamma-ray interactions on various materials and to assess radiation doses experienced by the nuclear bomb survivors of Hiroshima and Nagasaki. From

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NNSS – Continental Test Site

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

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

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

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

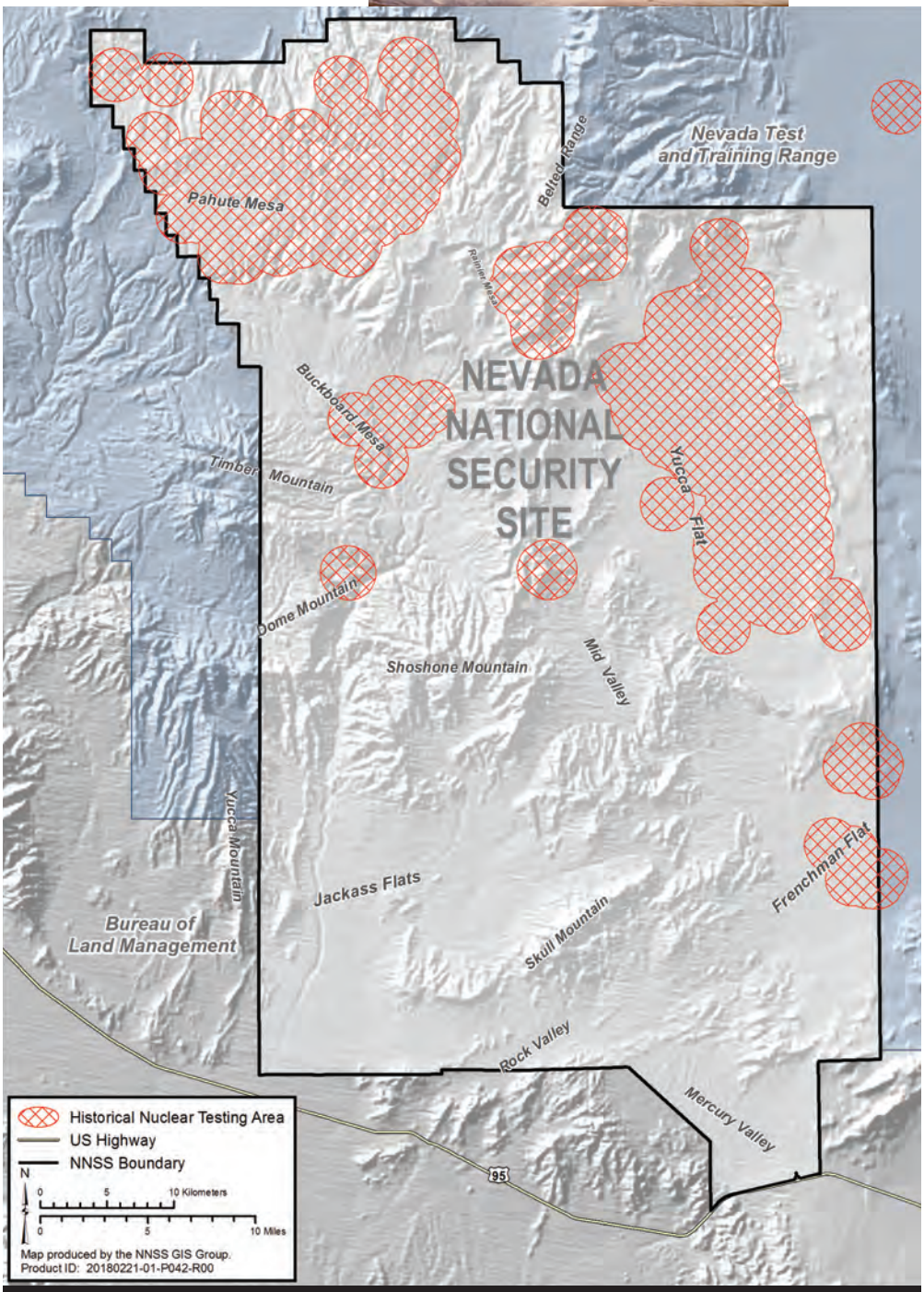
On September 23, 1992, the last underground nuclear test was conducted on the NTS, after which Congress imposed a moratorium on nuclear weapons testing. Since 1951, a total of 100 atmospheric and 828 underground nuclear tests have been conducted at the NTS.

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.

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

1959 through 1973, a series of open-air nuclear reactor, engine, and furnace tests were conducted in Area 25, and a series of tests with a nuclear ramjet engine were conducted in Area 26. The tests released mostly gaseous radioactivity (radioiodines, radioxenons, radiokryptons) and some fuel particles that resulted in negligible deposition on the ground.

All nuclear device tests are listed in *United States Nuclear Tests, July 1945 through September 1992* (U.S. Department of Energy, Nevada Field Office, 2015, DOE/NV--209, Rev. 16).

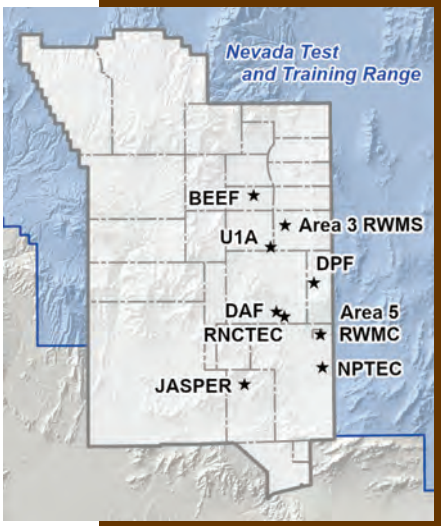


Historical Nuclear Testing Areas on and adjacent to the NNSS

The NNSS Now

NNSA/NFO conducts three major missions and their programs on the NNSS. Experimental programs are sponsored mainly by Los Alamos, Lawrence Livermore, and Sandia National Laboratories. During the conduct of all missions and their programs, NNSA/NFO complies with applicable environmental and public health protection regulations and strives to manage the land and facilities at the NNSS as a unique and valuable national resource. Mission Support and Test Services LLC (MSTS) is the Management and Operating (M&O) Contractor accountable for ensuring work is performed in compliance with environmental regulations.

NNSS activities in 2022 continued to be diverse, with the primary goal to ensure that the existing U.S. stockpile of nuclear weapons remains safe and reliable. Other activities included weapons of mass destruction first responder training; remediation of legacy contamination sites; characterization of waste destined for offsite disposal facilities; disposal of classified, low-level and mixed low-level waste; and environmental research. Facilities and centers that support the National Security/Defense mission include the U1a Facility, Big Explosives Experimental Facility (BEEF), Device Assembly Facility (DAF), National Criticality Experiments Research Center (NCERC) located in the DAF, Joint Actinide Shock Physics Experimental Research (JASPER) Facility, Dense Plasma Focus (DPF) Facility, the Radiological/Nuclear Countermeasures Test and Evaluation Complex (RNCTEC), and the Radiological/Nuclear Weapons of Mass Destruction Incident Exercise Site (known as the T-1 Site). Facilities that support the Environmental Management mission include the Area 5 Radioactive Waste Management Complex (RWMC) and the Area 3 Radioactive Waste Management Site (RWMS).



NNSS Missions and Their Programs

National Security/Defense

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

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

Strategic Partnership Program — Provides support facilities and capabilities for other agencies/organizations involved in defense-related activities.

Environmental Management

Environmental Restoration Program — Characterizes and implements corrective actions to address the environmental legacy of nuclear weapons and other testing at the NNSS and certain offsite locations, and develops and deploys technologies that enhance environmental corrective actions.

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

Nondefense

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

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

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

Environmental Compliance

Activities on the NNSS are subject to federal and state laws intended to protect the environment and public health. These laws define emission limits or prohibit the emission of toxic substances into the air, water, and ground; require plans to prevent spills, unplanned releases, and accidents; and call for programs to monitor, measure, document, and report on compliance to regulatory agencies and the public. The U.S. Environmental Protection Agency (EPA) and the Nevada Division of Environmental Protection (NDEP) are the principal regulators of NNSS activities. The following table defines and summarizes results for a few of the many federal regulations with which NNSA/NFO must comply.

Summary of NNSA/NFO's Compliance with Major Federal Statutes

Environmental Statute or Order and What It Covers	2022 Status
Atomic Energy Act (through compliance with DOE O 435.1, "Radioactive Waste Management"): Management of low-level waste (LLW) and mixed low-level waste (MLLW) generated or disposed on site	599,002 cubic feet of waste was disposed on site in LLW and MLLW disposal cells at the Area 5 RWMS. Some of this volume also included classified low-level and nonradioactive items. Waste volumes were within permit limits; vadose zone and groundwater monitoring continued to verify that disposed LLW and MLLW are not migrating to groundwater or threatening biota or the environment. No waste was disposed at the Area 3 RWMS in 2022.
Clean Air Act: Air quality and emissions into the air from facility operations	Onsite air sampling stations detected man-made radionuclides at levels comparable to previous years and well below the regulatory dose limit for air emissions to the public of 10 millirem per year (mrem/yr). The estimated dose from all 2022 NNSS air emissions to the maximally exposed individual (MEI) is 0.061 mrem/yr.
Clean Water Act: Water quality and effluent discharges from facility operations	All domestic and industrial wastewater systems and groundwater monitoring well samples were within permit limits for regulated water contaminants and water chemistry parameters.
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/Superfund Amendments and Reauthorization Act (SARA): Cleanup of waste sites containing hazardous substances	No NNSS cleanup operations are regulated under CERCLA or SARA; they are regulated under the Resource Conservation and Recovery Act (RCRA) and Federal Facility Agreement and Consent Order (FFACO) *(see below)*.
DOE O 458.1, "Radiation Protection of the Public and the Environment": Measuring radioactivity in the environment and estimating radiological dose to the public due to NNSA/NFO activities	Radiological monitoring of air, water, wildlife and direct radiation was conducted. The total annual dose to the MEI from all exposure pathways due to NNSA/NFO activities was estimated to be 0.60 mrem/yr, well below the DOE limit of 100 mrem/yr.
Emergency Planning and Community Right to Know Act (EPCRA): The public's right to know about toxic chemicals being stored, released to the environment, and/or managed through recycling or treatment	Approximately 99,763 lbs of lead, 100 lbs of mercury, and 17 lbs of PCBs were released as a result of NNSS activities. These amounts exceeded the reporting thresholds of 100 lbs, 10 lbs, and 10 lbs, respectively. About 58% of the lead released was for offsite recycling, 40% was disposed onsite, with the remaining amount emitted to air and disposed offsite. Almost 99% of the mercury and PCBs were disposed onsite.
Endangered Species Act (ESA): Threatened or endangered species of plants and animals	Forty-eight projects were reviewed, with 2 requiring formal consultation with the US Fish and Wildlife Service, 15 required biological surveys, and 31 were determined to have no effects to the tortoise. No tortoises were reported injured or killed due to project activities. A total of 28.2 acres of tortoise habitat was disturbed in 2022. There were an unprecedented 115 reported roadside observations, with 5 roadkill (3 small, 2 large), and the rest observed and/or moved off roadways.

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Summary of NNSA/NFO's Compliance with Major Federal Statutes

Environmental Statute or Order and What It Covers	2022 Status
Federal Facility Agreement and Consent Order (FFACO): Identifying, prioritizing, investigating, and implementing corrective actions at sites in Nevada contaminated by historic nuclear testing activities, and completing post-closure monitoring, as required	All 2022 corrective action milestones under the FFACO were met and 1 Corrective Action Site (CAS) was closed. As of December 31, 2022, 2,953 of 3,044 Corrective Action Sites have been closed in accordance with state-approved corrective action plans.
Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA): Storage and use of pesticides and herbicides	Only nonrestricted-use pesticides were applied by state-certified personnel. Storage and use of pesticides were in compliance with federal and state regulations.
Migratory Bird Treaty Act (MBTA): Protecting migratory birds, nests, and eggs from harm	A total of 39 dead birds were documented in 2022, the second highest number recorded in a single year. Sixteen carcasses were found inside a water tank fill pipe, which had been brought to the NNSS several years ago from an unknown location. It is suspected the birds were killed before it arrived. The tank's pipe was modified so no more birds could be trapped, and similar tanks on the NNSS were checked to make sure they were avian safe. Eleven birds were found dead due to unknown causes, 5 were electrocuted, 4 were hit by vehicles, 1 was rescued from a glue trap but later died, 1 was found with a broken wing and euthanized, and 1 red-tailed hawk chick died following a nest relocation.
National Environmental Policy Act (NEPA): Evaluating projects for environmental impacts	Fifty-two proposed projects/activities were reviewed, with 13 being exempted from further NEPA analysis because they were of Categorical Exclusion status, and 39 were exempted due to their being included under the Site-Wide Environmental Impact Statement analysis.
National Historic Preservation Act (NHPA): Identifying and preserving historic properties	Field surveys and historical evaluations for 9 projects were conducted, 819.3 acres were surveyed, and 87 cultural resources were identified, 33 of which were determined eligible for the National Registry of Historic Places.
Resource Conservation and Recovery Act (RCRA): Generation, management, disposal of hazardous waste (HW) and MLLW and cleanup of inactive, historical waste sites	1,616 tons of MLLW were disposed on site, 5.87 tons of HW were received for temporary onsite storage and/or treatment, 2.49 tons of HW, and 2.51 tons of polychlorinated biphenyl waste were shipped off site for disposal, all in accordance with state permits. No explosive ordnance was disposed at the Explosive Ordnance Disposal Unit during 2022. In compliance with the June 2021 Settlement Agreement* that resolved regulatory actions resulting from the July 2019 waste issue, DOE fulfilled all the CY 2022 commitments which contribute to enhancing the rigor of waste management activities for the protection of the DOE workforce, the public, and the environment. * https://ndep.nv.gov/uploads/land-doe-aip-docs/NDEPDOEJune22SASignedF.pdf
Safe Drinking Water Act: Quality of drinking water	All three permitted public water systems on the NNSS met applicable national and state water quality standards.
Toxic Substances Control Act (TSCA): Management and disposal of PCBs	NNSS demolition activities generated 24 drums (3,656 kg, 8,060 lb) of PCB waste. Fifteen drums (2,274 kg, 5,013 lb) were shipped off site for treatment and/or disposal.

The Legacy of NNSS Nuclear Testing

Approximately one-third of the 828 underground nuclear tests on the NNSS were detonated near or below the water table, resulting in radioactive contamination of groundwater in some areas. In addition, the 100 atmospheric nuclear tests conducted on the NNSS and numerous nuclear-related experiments resulted in radioactive contamination of surface soils, materials, equipment, and structures, mainly on the NNSS.

The mission of the DOE Environmental Management Nevada Program is to address this legacy contamination. EM Nevada Program responsibilities include overseeing characterization and implementation of corrective actions at contaminated sites, post-closure monitoring, and the compliant and safe acceptance and disposal of classified, low-level, and mixed low-level radioactive waste.

Aerial view of Yucca Flat showing subsidence craters from historical underground nuclear tests.

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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.

Legacy Contamination

Groundwater — The total amount of radiation below the groundwater table is estimated to be 20 to 25 million Ci, which incorporates corrections for radioactive decay since the last underground test in 1992. The areas of known and potential groundwater contamination on the NNSS due to underground nuclear testing are called Underground Test Area (UGTA) corrective action units (CAUs). Three of the five UGTA CAUs have, with State approval, transitioned to long-term monitoring. Characterization activities for the two remaining Pahute Mesa CAUs were nearly complete at the end of 2022. It is anticipated that these CAUs will complete the FFACO closure process in 2030 and transition to long-term monitoring.

Soil — Corrective actions have been completed at 148 sites on and around the NNSS where radioactively contaminated surface and near surface soils resulted from atmospheric nuclear testing. The soils were contaminated by radioactive materials, oils, solvents, and heavy metals, as well as contaminated instruments and test structures used during testing activities.

Air — Airborne radioactive contamination from the resuspension of contaminated soils at legacy sites and from current activities is monitored continuously. Airborne concentrations of monitored contaminants have been decreasing at most sample locations on the NNSS. Total Ci estimated to be released across the entire NNSS fluctuate annually; the highest annual estimates since 1992 have been 2,240 Ci for tritium, 0.40 Ci for plutonium, and 0.070 Ci for americium. NNSS air emissions cannot be distinguished from background radiation in communities surrounding the NNSS.

Structures/Materials — Facilities, equipment, structures, and/or debris contaminated by historical nuclear activities are referred to as Industrial Sites and include disposal wells, inactive tanks, contaminated buildings, contaminated waste sites, inactive ponds, muck piles, spill sites, drains and sumps, and ordnance sites. As of December 31, 2022, corrective actions have been completed at more than 1,950 of these sites located on the NNSS and NTTR. The 9 remaining sites involve the demolition and disposal of historic structures at the Test Cell C and EMAD facilities by 2032 and completing closure of the last remaining chromium-containing waste disposal cell at the Area 5 RWMS in 2023.

Waste Disposal — Classified, low-level and mixed low-level radioactive wastes have been generated by historical nuclear research, development, and testing activities and environmental cleanup activities. From the 1960s, when waste disposal began, through December 31, 2022, more than 2 million cubic yards of waste have been safely disposed at the Area 3 and Area 5 RWMSs.

The Federal Facility Agreement and Consent Order (FFACO) between the State of Nevada, DOE, and DoD identifies sites of potential contamination related to legacy (historical) nuclear testing in Nevada and outlines a strategy to address sites identified. Corrective actions have been completed for 97% of the 3,044 sites identified. The public is kept informed of EM Nevada Program activities through outreach events, fact sheets, and EM Nevada Program briefings for the Nevada Site Specific Advisory Board (NSSAB).

The NSSAB, a volunteer group of 15-20 citizens representing Nevada communities, provides independent advice, information, and recommendations on EM Nevada Program activities. The public may also provide comments at the beginning of NSSAB public meetings that are typically held every other month. More information can be found at https://www.nnss.gov/NSSAB/.

Numerous man-made and naturally occurring radionu-clides occur on the NNSS. The radionuclides produce ionizing radiation in the form of alpha particles, beta particles, and gamma rays,

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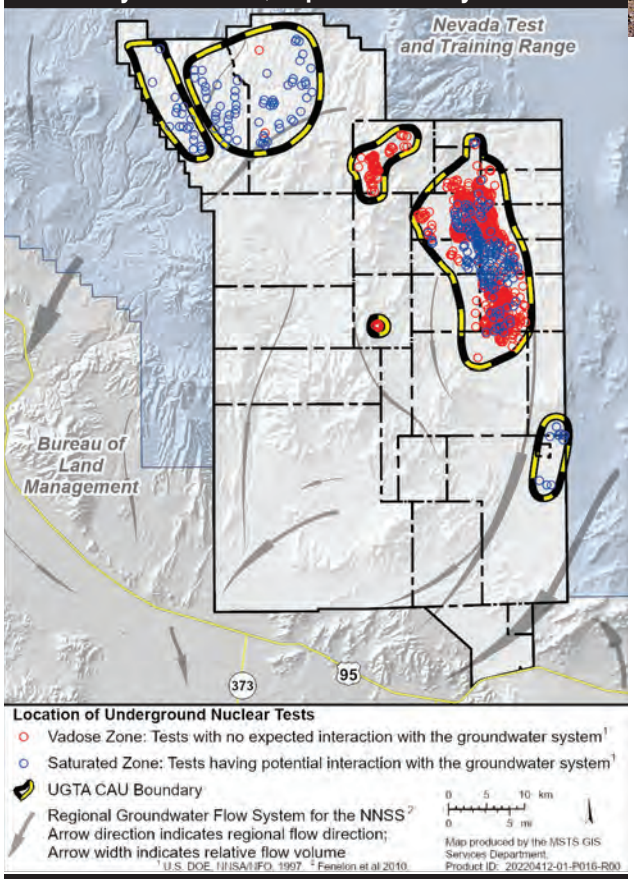
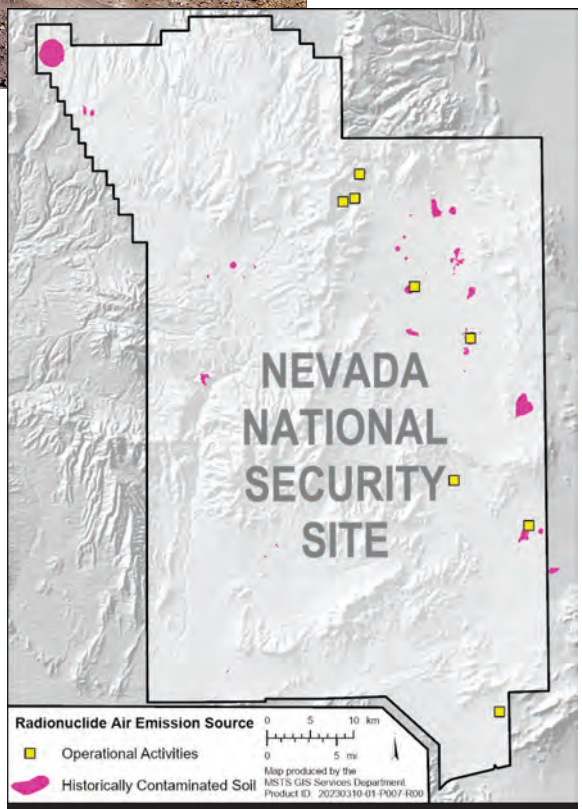
Schooner Crater in Area 20 formed during a 1968 crater test exploring peaceful uses of nuclear explosives.

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



Areas of Potential Groundwater Contamination on the NNSS



Sources of Radiological Air Emissions on the NNSS

which are emitted from the unstable radionuclides as they decay to form more stable atoms. Almost all human exposure to ionizing radiation comes from natural sources that include cosmic radiation from outer space, terrestrial radiation from materials like uranium and radium in the earth, and naturally occurring radionuclides in food, water, and the aerosols and gases in the air we breathe. Man-made sources and applications of ionizing radiation in our everyday life include smoke detectors, X-rays, CT scans, and nuclear medicine procedures. For people living in areas around the NNSS, less than 0.2% of their total radiation exposure is potentially attributable to past nuclear testing or to current NNSS activities.

Forms of Radiation

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

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

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

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

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

Radionuclides Monitored on the NNSS[a]

	Name[b]	Abbreviation	Primary Type(s) of Radiation	Major NNSS Sources
Man-Made	Tritium	^{3}H	Beta	Some or all of these radionuclides exist in various locations, such as 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 radioactive waste management sites, and may be monitored in water, soil and/or air (due to particulate resuspension or evaporation [Tritium]).
	Carbon-14	^{14}C	Beta	
	Chlorine-36	^{36}Cl	Beta	
	Cobalt-60	^{60}Co	Gamma	
	Strontium-90	^{90}Sr	Beta	
	Technetium-99	^{99}Tc	Beta	
	Iodine-129	^{129}I	Beta	
	Cesium-137	^{137}Cs	Beta, gamma	
	Europium-152	^{152}Eu	Gamma	
	Europium-155	^{155}Eu	Gamma	
	Americium-241	^{241}Am	Alpha, gamma	
	Plutonium-238	^{238}Pu	Alpha	
	Plutonium-239/240	$^{239+240}Pu$	Alpha	
Naturally Occurring	Beryllium-7	^{7}Be	Gamma	Produced by interactions between cosmic radiation from the sun and the earth's upper atmosphere. Detected in air.
	Potassium-40	^{40}K	Beta, gamma	Naturally occurring in the earth's crust. Detected in water, soil, and air.
	Radium-226	^{226}Ra	Alpha, gamma	
	Thorium-232	^{232}Th	Alpha	
	Uranium-234[c]	^{234}U	Alpha	
	Uranium-235[c]	^{235}U	Alpha, gamma	
	Uranium-238[c]	^{238}U	Alpha	

[a] For samples analyzed for gamma-emitting radionuclides, any man-made radionuclide identified by the laboratory will be reported. The most common are listed.

[b] The number given with the name of the radionuclide is the atomic mass number, which is the total number of protons and neutrons in the nucleus of the atom. Atoms with the same number of protons are the same element; atoms of the same element with different mass numbers are called isotopes of one another.

[c] These uranium isotopes, though of natural origin, can also be detected at specific NNSS locations where man-made depleted uranium has been released during experiments, resulting in an alteration of the relative amounts of each isotope.

Completing FFACO Corrective Actions

Corrective Actions Progress

The DOE EM Nevada Program is responsible for evaluating and implementing corrective actions at sites within Nevada as identified in the FFACO that were impacted by historical nuclear testing, research, and development activities. These CASs are located on the NNSS, NTTR, and TTR and are grouped into larger, geographic CAUs according to location, physical and geological characteristics, and/or contaminants. Environmental corrective action strategies are developed and completed based on the nature and extent of contamination, the risks posed by contamination, and future land use. Since 1989, EM Nevada Program has overseen the compliant completion of corrective actions at 99% of the more than 2,100 surface and near-surface CASs and transitioned 91% of the 878 deep subsurface CASs into long-term monitoring.

Restoration Progress under FFACO

In 2022, 1 CAS was closed and all FFACO milestones were met. As of December 31, 2022, 2,953 of 3,044 CASs have been closed in accordance with state-approved corrective action plans and closure reports.

UGTA Sites

The EM Nevada Program gathers data to characterize impacts to groundwater that resulted from historical nuclear testing at the NNSS. The data are used to develop groundwater flow and transport models that forecast groundwater movement and transport of radiological contaminants in five characterization areas, referred to as Corrective Action Units (CAUs). The agreed-upon corrective action for UGTA CAUs is closure in place with institutional con-

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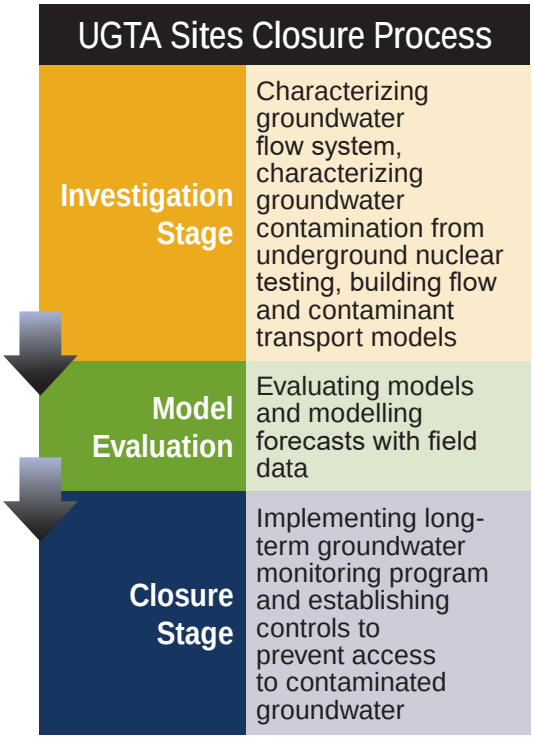

trols and monitoring (FFACO, 1996, as amended). This corrective action is based on three assumptions: (1) groundwater technologies for removal or stabilization of subsurface radiological contamination are not cost effective; (2) because of high remediation costs, closure in place with monitoring and institutional controls is the only likely corrective action; and (3) in order for workers, the public, and the environment to be exposed to the potential risks from radiological contamination in groundwater, the contaminated groundwater must first be accessed. Three UGTA CAUs, Frenchman Flat (CAU 98), Rainier Mesa/Shoshone Mountain (CAU 99), and Yucca Flat/ Climax Mine (CAU 97), are in the closure stage. During the closure stage, contaminant, regulatory, and use-restriction boundaries are identified in agreement between DOE and NDEP. If radionuclides exceeding the agreed upon level reach the regulatory boundary, the EM Nevada Program is

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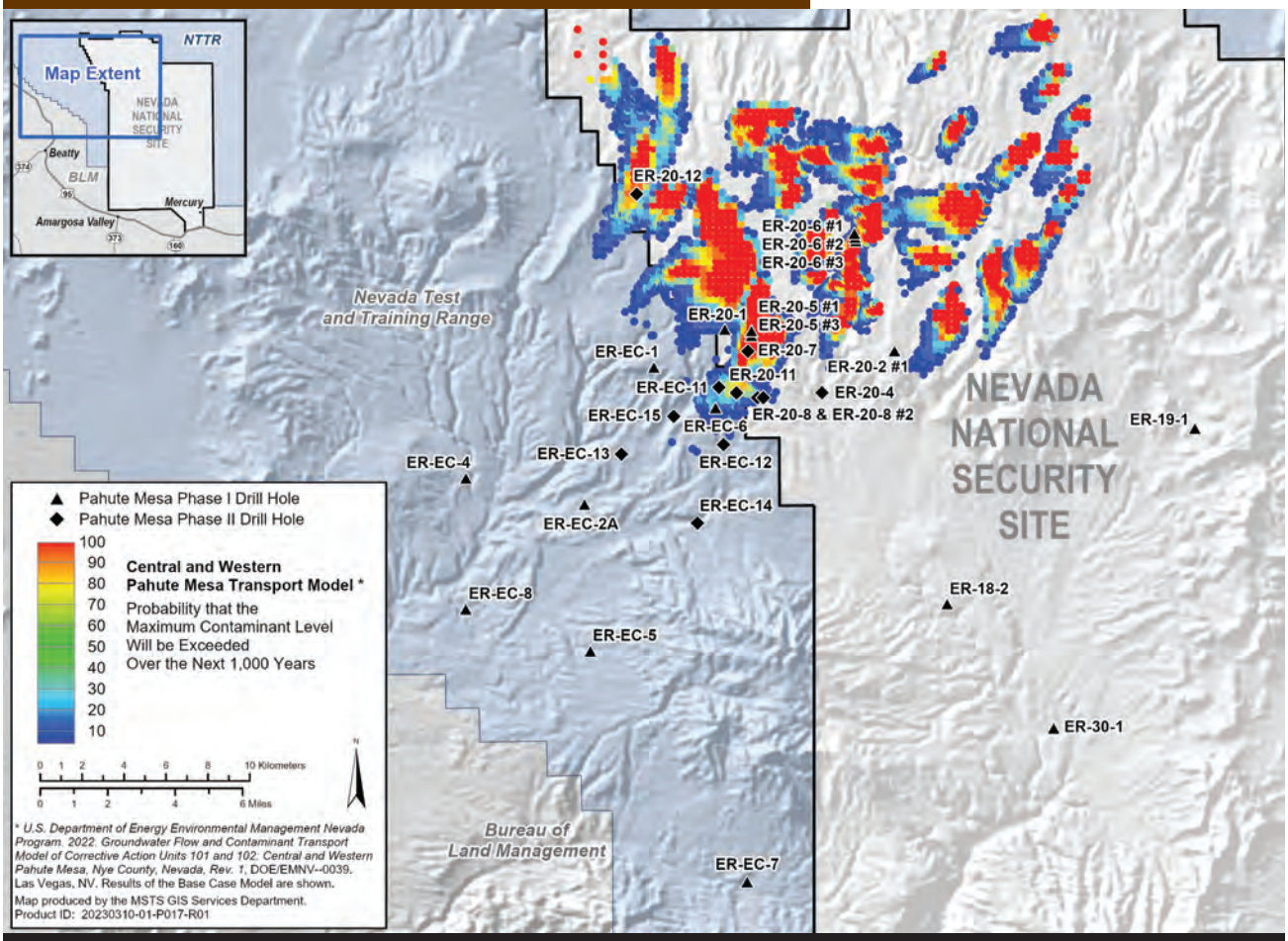
Pahute Mesa Groundwater Monitoring Results in Perspective

- Based on conservative scientific calculations and sampling results, it will take at least 100 years for tritium to reach the closest public land boundary.
- In approximately 100 years, the concentration of tritium is estimated to be in compliance with safety standards at the closest public land boundary.
- In approximately 200 years, the concentration of tritium will be nearly zero at the closest public land boundary.



Results of 2009 Phase I Central and Western Pahute Mesa Transport Modeling

required to submit to NDEP a plan that meets the CAUs regulatory boundary objectives. Groundwater sampling and water-level measurements both on and off the NNSS will continue throughout the entire closure process. Two UGTA CAUs, Central and Western Pahute Mesa (CAUs 101/102), remained in the investigation stage during 2022.

Setting a transducer in well PM-3 on August 8, 2022 (Central and Western Pahute Mesa Corrective Action Units 101/102)

The Central and Western Pahute Mesa groundwater flow and transport model was completed and peer reviewed in 2022 marking the final steps in the investigation stage for these CAUs. The model forecasted 1,000 year contaminant boundary extends a few kilometers beyond the NNSS boundary but remains more than 12 km upgradient of the closest public receptor in Oasis Valley.

Central and Western Pahute Mesa CAUs

– The Central and Western Pahute Mesa groundwater flow and transport model was completed and peer reviewed in 2022 marking the final steps in the investigation stage for these CAUs (comprising 82 total CASs). The results of decades of scientific investigations were used as the basis for developing the model. The groundwater flow and transport model represents the complex geologic structure underlying Pahute Mesa, as well as the complex contaminant transport processes associated with radionuclide movement through the fractured rock.

The page 14 figure depicts the model forecasted probability for groundwater to exceed Safe Drinking Water Act maximum contaminant levels over the next 1,000 years (i.e., contaminant boundary). The contaminant boundary extent is primarily defined by tritium which is the only radionuclide currently present in groundwater at concentrations exceeding the maximum contaminant level (20,000 pCi/L) at locations downgradient of the underground tests. The contaminant boundary extends a few kilometers beyond the NNSS boundary but remains more than 12 km upgradient of the closest public receptor in Oasis Valley.

As part of the modeling process, simulated tritium (along with 15 other test-related radionuclides) concentrations were compared to those measured in groundwater samples collected within the model boundaries. The result of this comparison provides confidence that the flow and transport model adequately simulates tritium migration from underground nuclear tests on Pahute Mesa. This comparison will continue throughout all stages of the closure process. In 2022, four wells on the NNSS or NTTR were sampled. These locations have not historically contained test-related contaminants which was also the case in 2022.

In 2022, an external peer review panel assessed the scientific appropriateness of the model; whether its assumptions, methods, and conclusions are based on sound scientific principles; and whether sufficient confidence in the model exists to accept its results. The panel was comprised of four highly qualified subject matter experts external to the UGTA Activity. The peer review panel responded favorably in their review and provided recommendations that are being addressed by the modeling team. The path forward, including planning model evaluation activities for the next stage of

Continued on Page 16 ...

the closure process (Corrective Action Decision Document / Corrective Action Plan [CADD/CAP]), is being discussed with NDEP. These plans will be documented in 2023 in the CADD/CAP.

Frenchman Flat CAU – The Closure Report for this CAU (comprising 10 CASs) was approved by NDEP in 2016 and describes the monitoring program for the first 5 years post-closure (2016 through 2020). An evaluation of the 5-year monitoring data was published in 2022 to support recommendations for future monitoring and to ensure that the closure decisions remain protective. This evaluation showed that 1) radionuclide results are consistent with the forecasted slow rates of radionuclide migration and with the contaminant boundaries; 2) water-level monitoring locations provide useful long-term data to assess changes to the Frenchman Flat groundwater flow system; and 3) use restrictions continue to prevent exposure to the public, workers, and the environment from contaminants of concern by preventing the use of potentially contaminated groundwater. Future monitoring requirements will be documented in an addendum to the Closure Report that will require NDEP approval before implementation.

August 2022 sampling activities at well ER-EC-12 (Central and Western Pahute Mesa Corrective Action Units 101/102)

The Frenchman Flat CAU regulatory boundary objective is to protect receptors downgradient of the Rock Valley fault system from radionuclide contamination. Although contaminants resulting from underground nuclear tests are not forecasted to migrate out of the basin within the next 1,000 years, the Rock Valley fault system is the expected groundwater migration pathway. All monitoring results indicate that the regulatory boundary objective has been met.

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Post-closure monitoring results for the Frenchman Flat, Rainier Mesa/Shoshone Mountain, and Yucca Flat/Climax Mine CAUs are consistent with the groundwater flow and contaminant transport models. All monitoring results indicate that the regulatory boundary objective has been met. Use restrictions continue to prevent exposure of the public, workers, and the environment.

Rainier Mesa/Shoshone Mountain CAU – The Closure Report for this CAU (comprising 66 CASs) was approved by NDEP in 2020 and includes a description of the monitoring program, use-restriction and regulatory boundaries, and land-use restrictions. This CAU is unique when compared to other UGTA CAUs because most of its CASs are associated with nuclear tests conducted in tunnels rather than in vertical shafts. The monitoring network includes 16 locations for sampling and/or water-level measurements. Sampling for tritium is required every 6 years; additional radionuclides are analyzed at three locations that sample water from the tunnels. Water levels are measured annually. Separate regulatory boundaries were established for Rainier Mesa and Shoshone Mountain. The regulatory boundary objective for Rainier Mesa is to protect groundwater receptors from radionuclide contamination within the three groundwater basins downgradient of Rainier Mesa and the regulatory boundary objective for Shoshone Mountain is to verify that radionuclide contamination does not reach the lower carbonate aquifer (i.e., the regional aquifer) below Shoshone Mountain. All monitoring results indicate that the regulatory boundary objective has been met.

Yucca Flat/Climax Mine CAU – The Closure Report for this CAU (comprising 720 CASs) was approved by NDEP in 2020 and includes a description of the monitoring program; contaminant, use-restriction, and regulatory boundaries; and land- use restrictions. The monitoring network includes 10 sampling locations and 20 water-level monitoring wells (25 total intervals). Samples will be collected and analyzed for tritium every 6 years and water levels will be measured annually. In addition, one well in southern Yucca Flat will be sampled annually for the first 6 years closure.

The regulatory boundary objective for the Yucca Flat-Climax Mine CAU is to verify that radionuclide contamination from this CAU is contained within the Yucca Flat basin, thus not impacting the Frenchman Flat lower carbonate aquifer or downgradient receptors. The lower carbonate aquifer is a regional aquifer and is the only pathway out of Yucca Flat. The regulatory boundary aligns with the southern extent of the Yucca Flat hydrographic basin (Basin 159) and supports the regulatory boundary objective. All monitoring results indicate that the regulatory boundary objective has been met.

Industrial Sites and Soils

Corrective actions have been completed, with characterization and closure of 2,156 Industrial Sites and Soils CASs on and off the

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NNSS. Closure strategies include removal of debris, excavation of soil, decontamination and decommissioning of facilities, and closure-in-place with subsequent monitoring. The contaminants of concern include hazardous chemicals/materials, unexploded ordnance, and low-level radiological materials. Clean closures are those where pollutants, hazardous materials, radiological materials, and solid wastes have been removed and properly disposed, and where removal of all contaminants to concentrations agreed upon between DOE and NDEP is verified in accordance with corrective action plans approved under the FFACO. Closure-in-place entails the stabilization or isolation of pollutants, hazardous materials, radiological materials, and solid wastes, with or without partial treatment, removal activities, and/or post closure monitoring in accordance with corrective actions plans approved under the FFACO.

Post-closure monitoring requirements are established as needed to provide long-term protection of the public and the environment. Post-closure inspections are required for 131 closed FFACO CASs (non-RCRA sites) and 12 CASs (RCRA sites) identified in the RCRA Part B Permit. In 2022, the EM Nevada Program conducted 142 inspections at 62 CAUs managed under the FFACO, including seven RCRA Part B Permit CAUs. The results were published in annual inspection reports.

In 2022, NDEP approved an Addendum to the CAU 577 Closure Report for closure of waste disposal cell 20. Corrective actions for this CAU includes construction of RCRA compliant closure covers over the waste disposal cells and revegetation of the closure covers. Corrective actions for the remaining CAS in CAU 577 is expected in 2023. Eight additional Industrial Sites CASs from two other CAUs remain to be closed. Both CAUs are located on the NNSS: Area 25 Engine Maintenance, Assembly, and Disassembly Facility (CAU 114) and Test Cell C Ancillary Buildings and Structures (CAU 572). Their closures will occur prior to the end of the EM Nevada Program mission, which is currently planned for 2032.

Closure of One CAS in CAU 577 in 2022

An Addendum for the CAU 577 Closure Report to close waste disposal cell 20 in October 2022 was approved by NDEP. The corrective actions for CAU 577 CASs includes construction of RCRA compliant closure covers over the waste disposal cells and revegetation of the closure covers.

Radiological Monitoring of Groundwater

For decades NNSA/NFO and EM Nevada Program have sampled groundwater from wells on and off the NNSS to detect radionuclides that may be present due to historical underground nuclear testing. More than 100 wells are available for sampling by NNSA/NFO and the EM Nevada Program to meet various objectives. NNSA/NFO and EM Nevada Program developed the NNSS Integrated Groundwater Sampling Plan, a comprehensive, integrated approach for collecting and analyzing groundwater samples to meet the requirements for UGTA CAU closures and for all other compliance and environmental protection objectives.

Types of Groundwater Sampling Locations	
Characterization	Used for groundwater characterization or UGTA CAU model evaluation
Source/Plume	Located within the plume from an underground nuclear test; test-related contamination is currently present
Early Detection	Located downgradient of an underground test; no radioisotopes are detected above standard detection levels
Distal	Located outside the Early Detection area
Community	Located on BLM or private land; used as a water supply source or is near one
NNSS PWS	Potable water supply well that is part of a state-designated non-community PWS
Compliance	Monitored to comply with specific regulations or permits

In November 2020, the Plan was updated to focus on the Central and Western Pahute Mesa CAUs (CAUs 101/102) which are the only UGTA CAUs that have yet to enter the closure stage. Sampling for CAUs in the closure stage is described within the closure reports. Groundwater sampling on the NNSS for compliance is performed according to the

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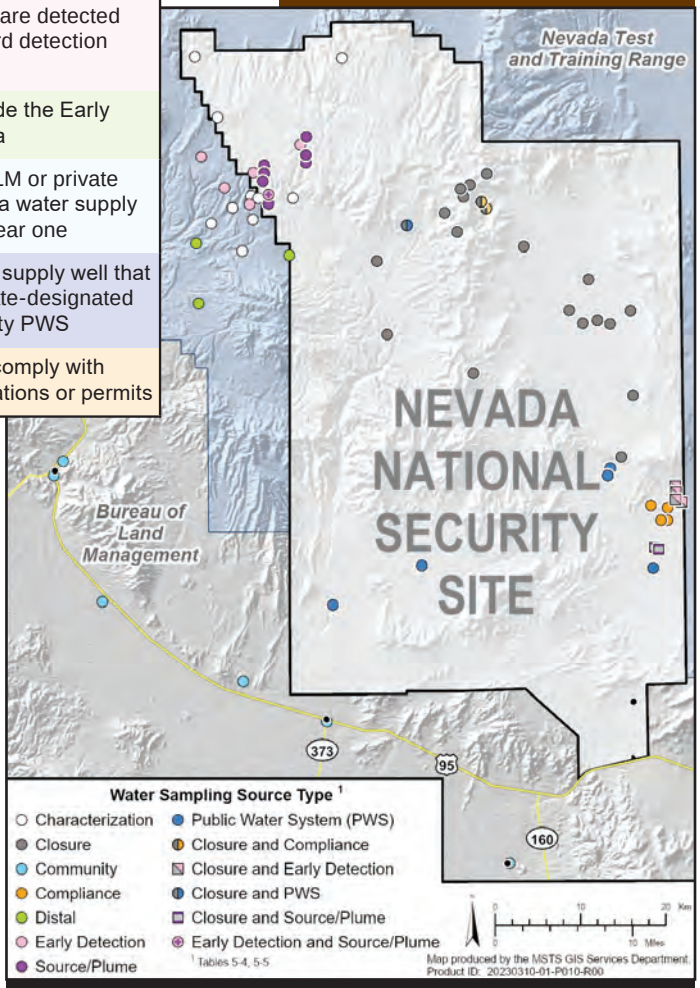
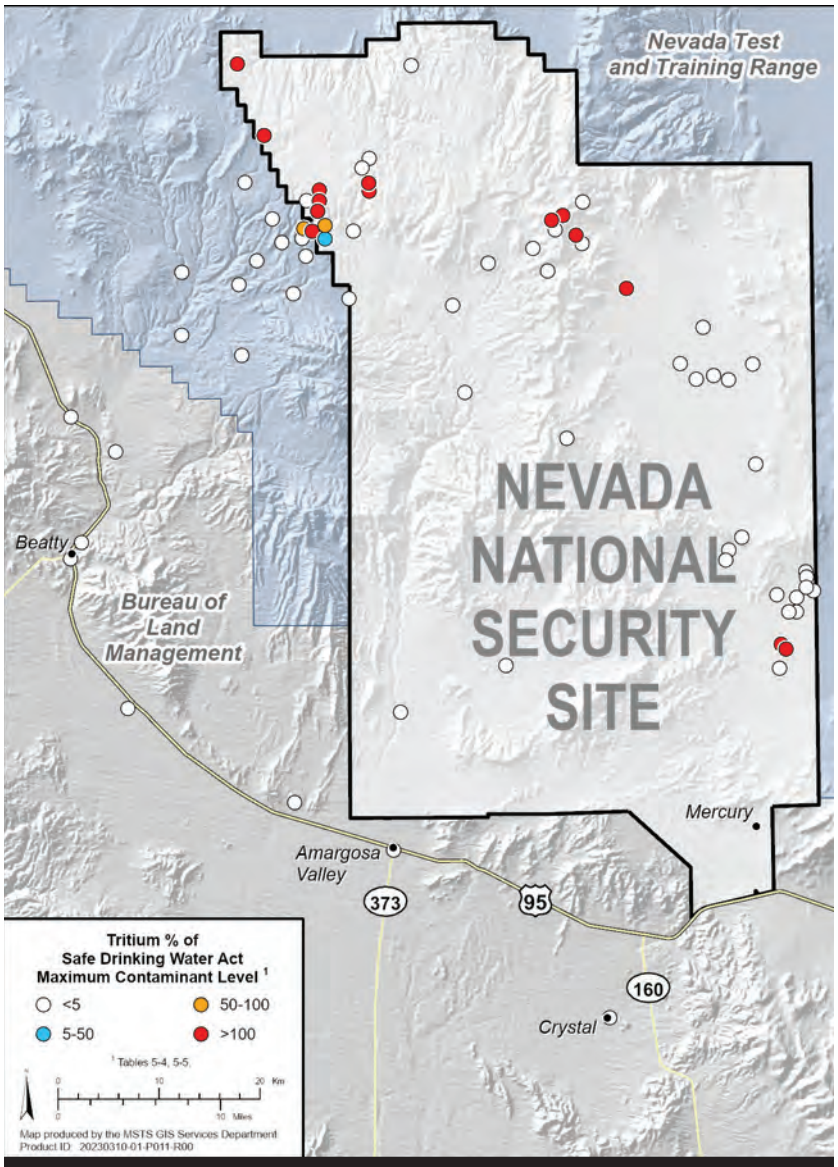
Tritium is the single contaminant of concern and is analyzed in water samples from all locations. Samples may be analyzed for other radionuclides as needed, but tritium is the most mobile in groundwater and is known to exceed its allowable drinking water limit in wells down gradient of underground nuclear testing.



NNSA/NFO and EM NV Program Water Sampling Network



Tritium in NNSA/NFO Groundwater Monitoring Wells

various permits, and sampling for other environmental objectives is documented in various procedures.

The water sampling network under the Plan consists of sampling locations categorized into four types: Characterization, Source/Plume, Early Detection, and Distal locations.

The tritium analysis results for all sampling locations in the network are shown on the map to the left. The well sites are color coded based on the tritium concentration of their most recent water sample. The maximum contaminant level (MCL) allowed for tritium in drinking water, set by the EPA under the Safe Drinking Water Act (SDWA), is 20,000 pCi/L. The color codes represent tritium levels expressed as a percentage of this MCL. For example, the 5%–50% category means that tritium was found to be between 5% to 50% of the MCL, or between 1,000 and 10,000 pCi/L.

The 14 wells that currently exceed the SDWA MCL (coded red on the map) are all located on the NNSS and are either Source/Plume or Characterization wells. All Community sampling locations, which are on Bureau of Land Management (BLM) or private land, have undetectable levels of tritium (coded white on the map). Characterization well ER-EC-11 on the NTTR just west of the NNSS is the only offsite well in the network that has tritium concentrations greater than 10,000 pCi/L (coded orange on the map). Tritium has not been detected in any NNSS PWS wells, and all wells and surface waters that are monitored to ensure compliance with NNSS permits had either undetectable levels of tritium or tritium levels that were below permit limits.

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Community Environmental Monitoring Program

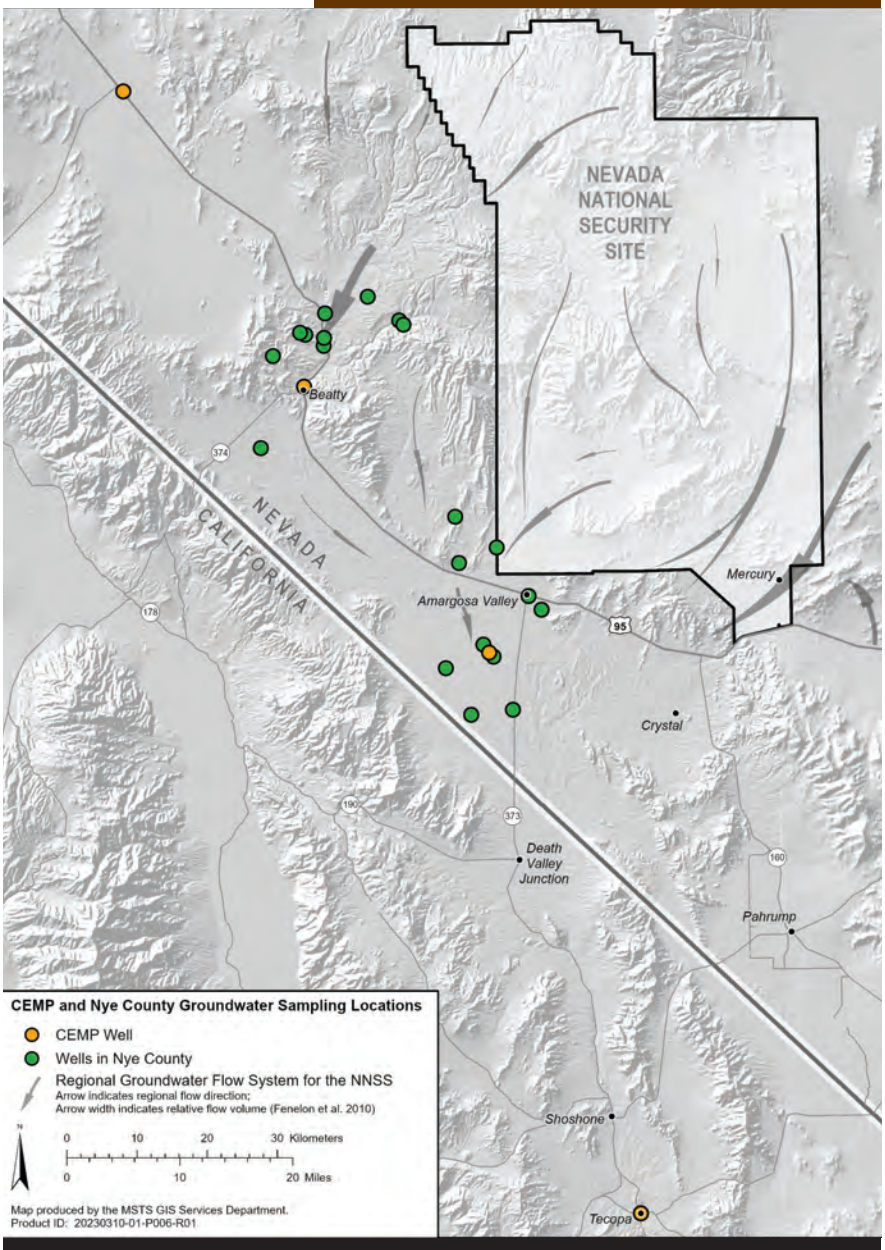
Offsite water supply wells are also monitored for the presence of tritium by the independent Community Environmental Monitoring Program (CEMP), which is coordinated by the Desert Research Institute (DRI) of the Nevada System of Higher Education under contract with NNSA/NFO. The CEMP provides the public with these data as part of a non-regulatory public informational and outreach program.

In 2022, the CEMP monitored groundwater wells in communities located within the regional groundwater flow system that are downgradient or perceived to be downgradient of the NNSS. As in previous years, none of these wells had detectable levels of tritium.

Nye County Tritium Sampling and Monitoring Program

The Nye County Tritium Sampling and Monitoring Program (TSaMP) was initiated in 2015 in response to the county's request to expand its support of offsite community-based monitoring of wells for ^{3}H. EM Nevada Program issued a 5-year grant to Nye County to monitor ^{3}H in wells downgradient of the NNSS. The grant was extended through 2026 and supports the annual sampling of 10 core wells (i.e., the same wells year to year) and 10 additional wells (selected locations change from year to year). The grant also supports Nye County's involvement in technical reviews of the UGTA sites closure process. The Nye County TSaMP sampled 20 locations (18 wells, 2 springs) in 2021. None of the 20 locations had detectable levels of tritium.

Tritium from underground nuclear testing has not been detected in any onsite or offsite drinking water wells.



2022 CEMP and Nye County Water Monitoring Locations

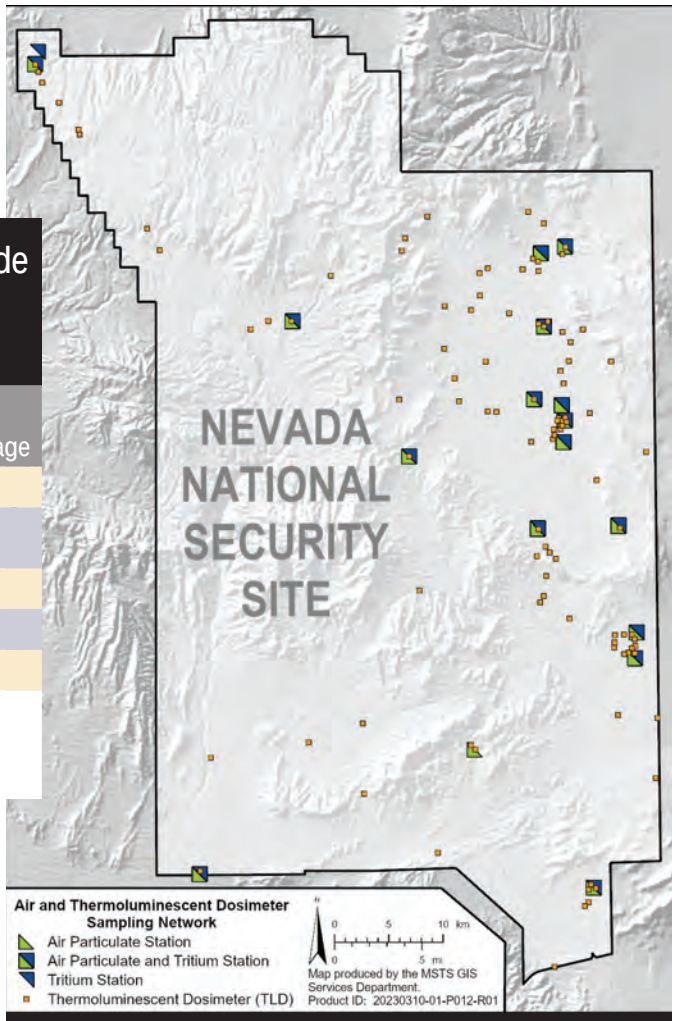
Radiological Monitoring of Air

Range in Average Concentrations of Man-Made Radionuclides in Air Samples on the NNSS in 2022 Attributable to NNSS Operations

Radionuclide	Concentration (10^{-15} µCi/mL)[a]		
	Limit[b]	Lowest Average	Highest Average
^{241}Am	1.9	-0.00199	0.17358
^{137}Cs	19	-0.02801	0.07257
^{3}H	1,500,000	-1520	84,770
^{238}Pu	2.1	-0.00165	0.02385
$^{239+240}$Pu	2.0	-0.00088	0.94231

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

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



2022 NNSS Air Sampling Network

NNSS radioactive emissions are monitored to determine the public dose from inhalation and to ensure compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) under the Clean Air Act. A network of 18 air sampling stations and a network of 105 thermoluminescent dosimeters (TLDs) are located throughout the NNSS (see map to the right). NNSS air sampling stations monitor tritium in water vapor, man-made radionuclides, and gross alpha and beta radioactivity in airborne particles. The TLD stations monitor direct gamma radiation exposure.

Radioactive emissions are also monitored at stations in selected towns and communities in Nevada, Utah, and California by the CEMP. A network of 24 CEMP stations was operational in 2022 (see map on Page 23). The CEMP stations monitor gross alpha and beta radioactivity in airborne particles using low-volume particulate air samplers, penetrating gamma radiation using environmental dosimeters, gamma radiation exposure rates using pressurized ion chamber (PIC) detectors, and meteorological (MET) parameters using automated weather instrumentation.

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Estimated Quantity of Man-Made Radionuclides Released into the Air from the NNSS in 2022 (in Curies)

	Tritium (^{3}H)	Americium (^{241}Am)	Plutonium (^{238}Pu)	Plutonium ($^{239+240}$Pu)	Noble Gases	Other Radionuclides	
	26	0.070	0.039	0.29	407	0	96.2
Half-life*	12 years	432 years	88 years	>6,500 years	<6 days	<3 hours	>3 hours

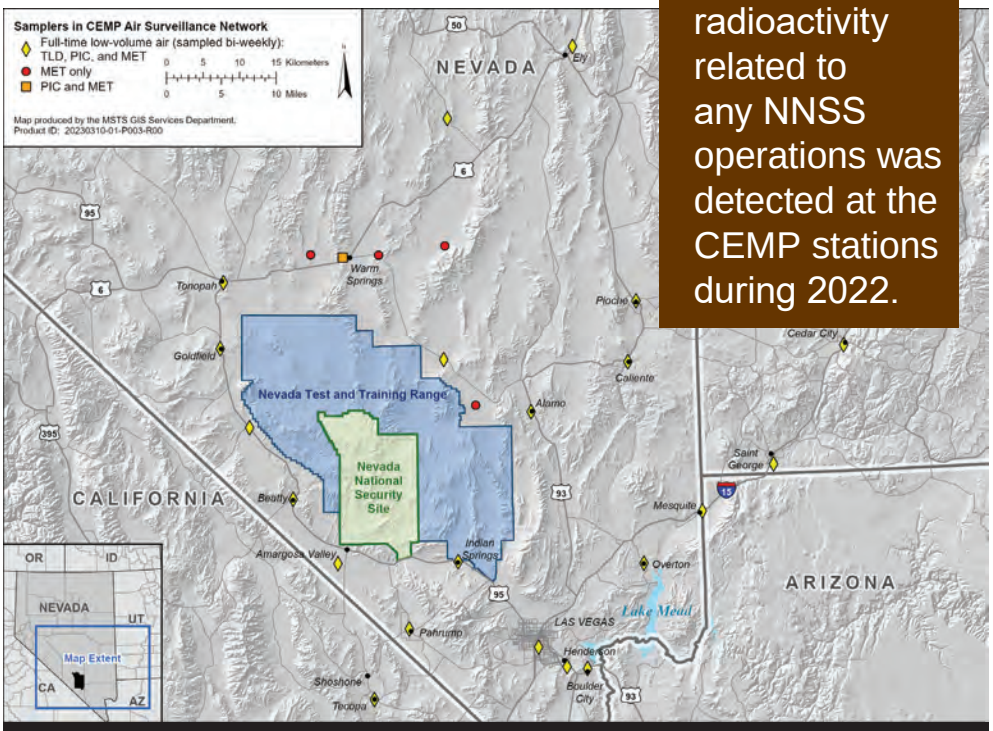
* Half-life is the time required for one-half of the radioactive atoms in a given amount of material to decay.

Several man-made radionuclides were detected at NNSS air sampling stations in 2022: none exceeded concentration levels established by the Clean Air Act. The highest average levels of ^{241}Am, ^{238}Pu, and $^{239+240}$Pu were detected at the Plutonium Valley station in Area 11, located within areas of known soil contamination from past nuclear tests. The highest average level of tritium was detected at Schooner, site of the second-highest yield Plowshare cratering experiment on the NNSS, where tritium-infused ejecta surrounds the crater. ^{137}Cs was detected in one sample during the second quarter at 190% above the MDC.

CEMP air monitoring station located in Tonopah, Nevada.

The total amount of man-made radionuclides emitted to the air was estimated to be 530 Ci. All radionuclides detected by environmental air samplers in 2022 are from known sources which include: (1) legacy deposits of radioactivity on and in the soil from past nuclear tests, (2) the upward flux of tritium from the soil at sites of past nuclear tests and low-level radioactive waste burial, and (3) NNSS operations.

No airborne radioactivity related to any NNSS operations was detected at the CEMP stations during 2022.



2022 CEMP Air Surveillance Network

Direct Radiation Monitoring

Ten NNSS TLD stations are located where radiation effects from past or present NNSS operations are negligible, and therefore measure only natural background levels of gamma radiation from cosmic and terrestrial sources. In 2022, the mean measured background level from the 10 stations was 124 milliroentgens per year (mR/yr). This is well within the range of variation in background levels observed in other parts of the U.S. of similar elevation above sea level. Background radiation varies not only by elevation but by the amounts of natural radioactive materials in soil and rock in different geographic regions.

The highest estimated mean annual gamma exposure measured at a TLD station on the NNSS was 431 mR/yr at Schooner, one of the legacy Plowshare sites on Pahute Mesa.

In the fall of 2021, the CEMP began deploying a new type of dosimeter at CEMP stations and implemented calculation methods that more accurately reflect exposure rates at each site. The CEMP offsite dosimeter and PIC results remained consistent with previous years' background radiation levels and are also well within the range of variation in background levels observed in other parts of the U.S. and with the 124 mR/yr level measured on the NNSS. The highest annual gamma exposure measured off site, based on the PIC detectors, was 169 mR at Warm Springs Summit, Nevada. The lowest offsite exposure rate, based on the PIC detectors, was 78 mR at Pahrump, Nevada.

Average Background Radiation of Selected U.S. Cities (Excluding Radon)
Ranked from Highest to Lowest

City	Elevation Above Sea Level (feet)	Radiation (mR/yr)
Denver, CO	5,280	164.6
Wheeling, WV	656	111.9
Rochester, NY	505	88.1
St. Louis, MO	465	87.9
Portland, OR	39	86.7
Los Angeles, CA	292	73.6
Las Vegas, NV	2,030	69.5
Fort Worth, TX	650	68.7
Richmond, VA	210	64.1
New Orleans, LA	39	63.7
Tampa, FL	0	63.7

Source: https://cemp.dri.edu/cemp/Radiation.html

2022 NNSS Background Gamma Radiation

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

TLD station (post with TLD attached) located at Schooner Crater.

Average Direct Radiation Measured in 2022 on and off the NNSS

Location	Elevation Above Sea Level (feet)	Radiation Exposure (mR/yr)
NNSS – Schooner TLD station (highest measurement)	5,660	431
NNSS – 35 Legacy Site TLD stations (includes Schooner)	3,077–5,938	199
Las Vegas, Nevada CEMP PIC station	2,030	92
NNSS – 17 Waste Operation TLD stations	3,176–4,021	143
NNSS – 10 Background TLD stations	2,755–5,938	124
Bloomington Hills, St. George, Utah CEMP PIC station	2,706	124
Pahrump, Nevada CEMP PIC station	2,639	78
NNSS – Gate 100 Truck Parking 2	3,602	56

Understanding Radiation Dose

Dose is a generic term to describe the amount of radiation a person receives. The energy deposited generally correlates with the number of molecules potentially affected. The energy the radiation deposits in tissue is called the absorbed dose. The units of measure of absorbed dose are the rad or the gray. The biological effect of radiation depends on the type of radiation (alpha, beta, gamma, or X-ray) and the tissues exposed. A measure of the biological risk of the energy deposited is the dose equivalent. The units of dose equivalent are called rems or sieverts. In the NNSSER, the term dose is used to mean dose equivalent measured in rems. A thousandth of a rem is called a millirem (mrem).

An average person in the United States receives about 310 mrem each year from natural sources and an additional 310 mrem from medical procedures and consumer products (Source: https://www.epa.gov/radiation/radiation-sources-and-doses). Whether there is a "safe" radiation dose equivalent is a controversial subject. Because the topic has yet to be settled scientifically, regulators take

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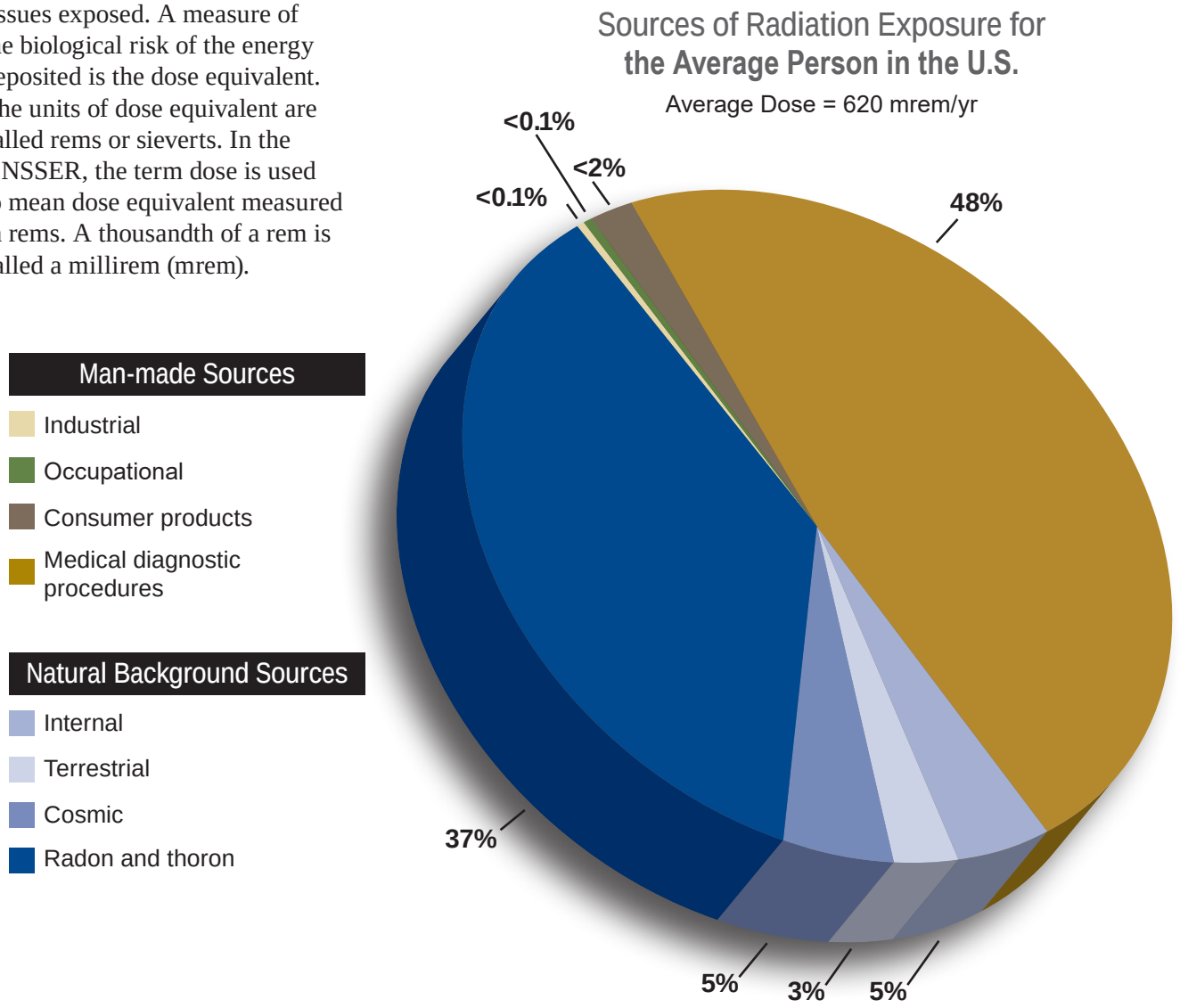


a conservative approach and assume that there is no such thing as a 100% safe dose equivalent. It is believed that the risk of developing an adverse health effect (such as cancer) is proportionate to the amount of radiation dose received.

Many human activities increase our exposure to radiation over and above the average background radiation dose of 310 mrem per year. These activities include, for example, uranium mining, airline travel, and operating nuclear power plants. Regulators balance the benefit of these activities with the risk of increasing radiation exposures above background and, as a result, set dose limits for the public and workers specific to these activities. DOE has set the dose limit to the public from exposure to DOE-related nuclear activities to 100 mrem/yr. This is the same public dose limit set by the U.S. Nuclear Regulatory Commission (NRC) and recommended by the International Commission on Radiological Protection and the National Commission on Radiological Protection and Measurements. The NRC has set the dose limit for radiation workers to 5,000 mrem/yr. There are no common or agreed-upon dose limits for workers or the public across industries, states, or countries.

Average Doses from Radiation Sources

Source	Dose (mrem)
Living near a nuclear power station *(annual)*	<1
Chest X-ray *(single procedure)*	10
Terrestrial radioactivity *(annual)*	21
Radiation in the body *(annual)*	29
Cosmic *(at sea level) (annual)*	30
Mammogram *(single procedure)*	42
Cosmic *(in Denver) (annual)*	80
Head CT scan *(single procedure)*	200
Radon in average U.S. home *(annual)*	228
Upper gastrointestinal X-ray with fluoroscopy *(single procedure)*	600
Whole body CT scan *(single procedure)*	1,000

Source: https://www.epa.gov/radiation/radiation-sources-and-doses#tab-2

Dose — The amount of radiation a person receives.

Absorbed dose — The energy the radiation deposits in tissue, where the energy deposited indicates the number of molecules disrupted. The units of measure of absorbed dose are the rad or the gray.

Dose equivalent — A measure of the biological risk of the energy deposited in tissue, which depends on the type of radiation (alpha, beta, gamma, or X-ray) and the tissues exposed. The units of measure of dose equivalent are called rems or sieverts.

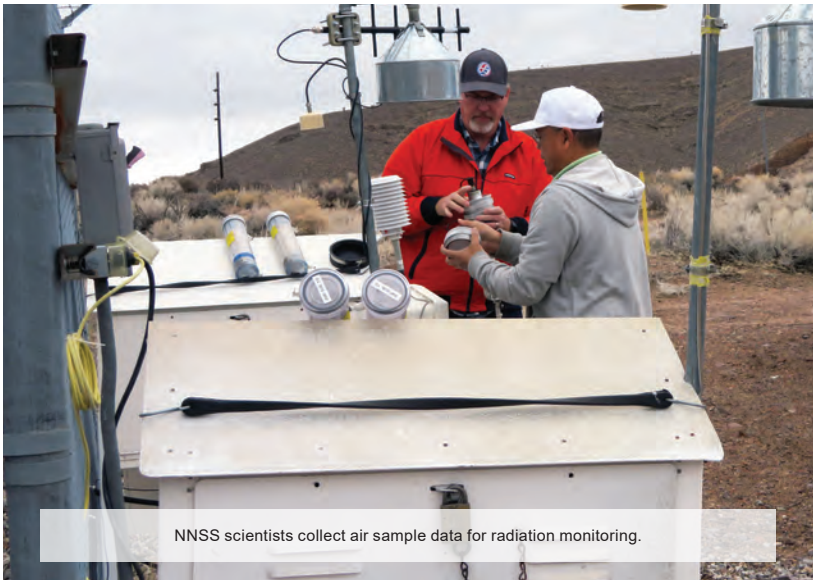
Estimating Dose to the Public from NNSS Operations

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

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

Air Transport Pathway –

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



NNSS scientists collect air sample data for radiation monitoring.

Estimated Inhalation Dose to the Public

Compliance with radiation dose limits to the general public from the air transport pathway is demonstrated using air sampling results from six onsite "critical receptor" sampling stations, which were proposed and formally submitted to the EPA in 2001. The radionuclides detected at one or more of the NNSS critical receptor samplers were ^{137}Cs, ^{241}Am, ^{238}Pu, $^{239+240}$Pu, and ^{3}H.

As in previous years, the 2022 data from the six critical receptor samplers show that the NESHAP dose limit to the public of 10 mrem/yr was not exceeded. The radioactive air emissions from each 2022 NNSS source were modeled using the Clean Air Package, 1988 model from EPA. The highest value is predicted to be a person residing on the Nevada Test and Training Range and received a predicted dose of 0.061 mrem/yr.

Estimated Ingestion Dose to the Public

There are three potential sources for ingestion dose to the public: eating contaminated plants and animals and drinking contaminated groundwater that comes from the NNSS.

Current NNSS land-use practices discourage the harvest of plants or plant parts for direct consumption by humans. However, it is possible that individuals with access will collect and consume edible plant material. One species in particular, the pinyon pine tree, produces pine nuts that are harvested and

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consumed across the western United States. Pinyon pine trees grow throughout regions of higher elevation on the NNSS. In 2013, pine nuts were sampled from three locations on the NNSS (Area 15, Area 17, and in Area 12 near the E Tunnel Ponds). The estimated dose from consuming them was shown to be extremely low (0.00056 mrem or 0.0000056 millisieverts) and a negligible contribution to the total potential dose to a member of the public. No other edible plant materials have been collected for analysis on the NNSS in recent history, and no edible plants were sampled in 2022.

NNSS game animals include pronghorn antelope, mule deer, chukar, Gambel's quail, mourning doves, cottontail rabbits, and jackrabbits. Small game animals from different contaminated NNSS sites are trapped each year and analyzed for their radionuclide content. These results are used to construct worst-case scenarios for the dose to hunters who might consume these animals if the animals moved off the NNSS.

In 2022, tissue, bone and/or blood samples were collected from three cottontail rabbits from the E Tunnel Ponds vicinity (Area 12), five mourning doves (Areas 5, 12), one duck (Area 23), three mule deer (one predated in Area 19, two roadkill Areas 2 and 4), and six pronghorn antelope (one roadkill in Area 4 and five that died from unknown causes in Areas 2, 3, 4 and 5). Four of the six pronghorn and the deer from Area 19 were study animals fitted with a GPS [global positioning system] collars in 2019. Based on data from these samples, an individual who consumes one animal of each of the sampled species from each location may receive an estimated dose of 0.25 mrem based on the averages. To put

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Groundwater Pathway –

Based on monitoring data, drinking contaminated groundwater is currently not a possible pathway for public exposure, given the restricted public access to the NNSS and the location of known contaminated groundwater on and off the NNSS. No man-made radionuclides have been detected in drinking water sources monitored off and on the NNSS.

NNSS Scientists conduct routine safety sampling of the public water system on the NNSS.

Ingestion Pathway –

Members of the public may ingest game animals that have been exposed on the NNSS, have moved off the NNSS, and have then been hunted.

NNSS scientists collect plant samples at Cane Springs.

this dose in perspective, it is about 40% of the dose received from naturally occurring cosmic radiation during a 2-hour airplane flight at 39,000 feet. Consuming just one animal sampled in 2022, the maximum would come from eating 20.0 kg of meat with concentrations observed in a pronghorn sampled in Area 5, and would result in a dose of 0.54 mrem. Radionuclide concentrations are also below levels considered harmful to the health of plants and animals; the dose resulting from observed concentrations is less than 4% of limits set to protect populations of plants and animals.

The 2022 groundwater monitoring data indicate that groundwater from offsite private and community wells and springs has not been impacted by past NNSS nuclear testing operations. No man-made radionuclides have been detected in any sampled wells accessible to the offsite public or in sampled private wells or springs. These field monitoring data also agree with the forecasts of current groundwater flow and contaminant transport models. Therefore, drinking water from underground aquifers containing radionuclides is not a possible pathway of exposure to the public residing off site.

Direct Exposure

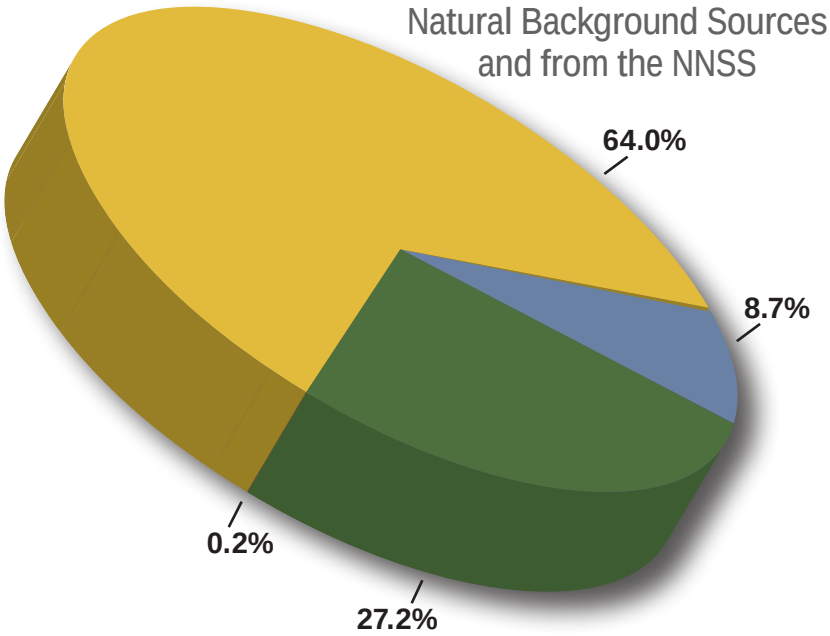
No members of the public are expected to receive direct gamma radiation that is above background levels as a result of NNSS operations. Areas accessible to the public, such as the main entrance gate, had direct gamma radiation exposure rates comparable to natural background rates from cosmic and terrestrial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

Public Dose Limits for NNSS Radiation

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

100 mrem/yr — This is the dose limit to the public (above natural background) from all possible pathways combined, as specified by DOE O 458.1, "Radiation Protection of the Public and the Environment."

Dose to the Public from Natural Background Sources and from the NNSS



2022 Dose to the Public from All Pathways

0.60 mrem/yr — This is the maximum dose to the public from inhalation, ingestion, and direct exposure pathways that is attributable to NNSS operations. It is well below the dose limit of 100 mrem/yr established by DOE O 458.1 for radiation exposure to the public from all pathways combined. This total dose estimate is indistinguishable from natural background radiation experienced by the public residing in communities near the NNSS.

Nonradiological Monitoring of Air and Water

Nonradioactive Air Emissions

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

An estimated 14 tons of criteria air pollutants and 0.025 tons of HAPs were released on the NNSS in 2022. The majority of the emissions were volatile organic compounds. No emission limits for any air pollutants were exceeded.

Nonradiological Monitoring of Drinking Water and Wastewater

NNSA/NFO operates a network of six permitted wells that comprise three permitted PWSs on the NNSS that supply the drinking water needs of NNSS workers and visitors. NNSA/NFO also hauls potable water to work locations at the NNSS that are not part of a PWS. Monitoring results for 2022 indicated that water samples from the three PWSs and from the potable water hauling trucks met all applicable National Primary and Secondary Drinking Water Standards.

Estimated Quantity of Pollutants Released into the Air from NNSS Operations in 2022

Criteria Air Pollutants:	Tons
Particulate Matter[a]	2.81
Carbon Monoxide	1.79
Nitrogen Oxides	3.57
Sulfur Dioxide	0.47
Volatile Organic Compounds	5.37
Hazardous Air Pollutants (HAPs)	0.025

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

NNSS Drinking Water

The public water systems that supply drinking water to NNSS workers and visitors meet all applicable Safe Drinking Water Act standards.

Domestic wastewater on the NNSS is discharged to 17 active permitted septic systems, which are permitted to process / store up to 5,000 gallons of wastewater per day. A septic tank pumping contractor is permitted to pump out and dispose of the wastewater. Inspections of the trucks and maintenance and assessments of the septic systems is performed to demonstrate compliance with permit conditions.

Industrial discharges on the NNSS are limited to three operating sewage lagoon systems: Area 6 Yucca, Area 23 Mercury, and Area 6 DAF. Under the requirements of the state operating permit, liquid discharges to these sewage lagoons were tested quarterly in 2022 for biochemical oxygen demand, pH, and total suspended solids. All sewage lagoon water measurements were within permit limits.

The discharge water from the E-Tunnel complex is sampled annually under a state water pollution control permit for 14 nonradiological contaminants, which are mainly metals. All parameters were within the threshold limits.

Managing Cultural Resources

The historical landscape of the NNSS contains archaeological sites, buildings, structures, and places of importance to American Indians and others. These are referred to as "cultural resources." NNSA/NFO requires that NNSS activities and programs comply with all applicable cultural resources regulations. The Cultural Resources Management Program (CRMP) is implemented by DRI to meet this requirement.

Cultural Resources Inventories and NRHP Eligibility Evaluations

In 2022, DRI completed cultural resources inventories and architectural surveys for nine projects in seven areas of the NNSS that had the potential to impact cultural resources. DRI surveyed over 819 acres and identified/recorded 87 cultural resources, 33 of which were determined to be eligible for the National Register of Historic Places (NRHP). Documented cultural resources consist of prehistoric and historic sites and Cold-War era buildings, structures and districts. In accordance with the National Historic Preservation Act, NNSA/NFO consults with the Nevada State Historic Preservation Office (SHPO) regarding the adequacy of the identification efforts, eligibility determinations, and findings of effect prior to initiating an undertaking that has the potential to affect historic properties.

In 2022, DRI completed two identification, evaluation, and finding of effect reports for the Rock Valley Direct Comparison Experiment in Area 27. The purpose of the experiment is to identify the location of a fault for shallow earthquake monitoring. Over the course of two inventories, DRI identified 41 resources: 12 archaeological sites and 29 isolated finds. None of the resources were recommended eligible for the NRHP. The SHPO concurred with the NNSA/NFO's finding that no historic properties would be affected by the undertaking.

DRI completed two other identification, evaluation, and finding of effect reports for the UGTA Program. Both projects support groundwater quality sampling on Pahute Mesa in Area 20. The purpose of the first project is to deepen the existing ER-20-1 monitoring well, and the second project's purpose is to drill a new groundwater monitoring well at ER-20-13. DRI identified no cultural resources in the Area of Potential Effect (APE) for the ER-20-1 well, and the SHPO concurred with the NNSA/NFO's finding of no historic properties affected for the undertaking. Within the ER-20-13 APE, DRI identified 14 cultural resources: six prehistoric sites and eight isolated finds. Two sites are eligible for the NRHP for their potential to yield important data in prehistory and would have been adversely affected by the undertaking. To avoid adverse effects, the UGTA Program modified the location of the proposed ER-20-13 well. As a result of the project modification, the SHPO agreed with the NNSA/NFO's finding that no historic properties would be affected by the undertaking.

Skyraider drone crash including radial engine (DRI 2020)

Continued on Page 32 ...

DRI completed an identification, evaluation, and finding of effect report for the proposed removal of rolling stock in Area 25. This rolling stock is from the Engine Maintenance Assembly and Disassembly (E-MAD) facility at the Nuclear Rocket Development Station (NRDS). In total, DRI identified 11 resources, and all were determined to be eligible for the NRHP. The SHPO agreed that their removal would result in an adverse effect. At the end of 2022, consultation between the NNSA/NFO and the SHPO to mitigate the adverse effects of the undertaking was on hold to explore feasible mitigation options.

DRI completed an identification, evaluation, and finding of effect report for the Signal Exploration Testbed (SET) project in Area 26. This project will detect foundry-type operations with remote sensing and will require the reactivation of Building 26-2205, the former Pluto Compressor Building. DRI conducted an architectural survey during which Building 26-2205 and the potential Pluto Test Bunker district were identified. Building 26-2205 has previously been determined eligible for the NHRP. The district is unevaluated for the NRHP but was treated as if it were eligible for the purposes of Section 106 compliance and SHPO consultation. The SHPO agreed with the NNSA/NFO's findings that historic properties would be affected by the undertaking. Consultation between the NNSA/NFO and the SHPO to mitigate the adverse effects is ongoing.
DRI completed a finding of effect report for the removal of two buildings in the Area 12 Camp Historic District. Both buildings were found to be historic properties that contribute to the historic district. Therefore, their demolition would result in an adverse effect to both the buildings and the historic district. As a result, the NNSA/NFO, in consultation with the SHPO, executed a Memorandum of Agreement (MOA) to mitigate the adverse effects of the undertaking (see Agreement Documents).

Pursuant to Section 110 of the NHPA, DRI completed two identification and evaluation reports. The first report focused on Cold War-era structures and buildings that contribute to the Apple-2 Historic District in Area 1. These resources were constructed in 1955 to assess the effects of the Apple-2 atmospheric nuclear blast to various structures and buildings along a blast line at a distance of 10,500 ft from ground zero. DRI identified 15 resources. Fourteen of these resources were recommended as contributing elements to the district and recommended eligible for the NRHP.

The second report was for an aboveground test chamber associated with the Huron King nuclear test conducted on June 24, 1980. The Huron King Test Chamber was designed to hold a defense communications satellite connected to a nuclear device. Upon detonation, the satellite was exposed to an electromagnetic pulse and nuclear

Huron King Test Chamber (DRI 2022)

Continued on Page 33 ...

radiation and evaluated for effects. The Huron King Test Chamber was recommended eligible for the NRHP. Consultation with the SHPO on both Section 110 reports is expected to be completed in 2023.

Building 23-109, Mercury, when it was used as a maintenance building and service station, facing northeast, 1962 (REECo 1397-6)

Mercury Modernization

In 2018, the NNSA/NFO executed a programmatic agreement (PA) with the SHPO that specifies the approach NNSA/NFO will take to streamline the Section 106 compliance process for modernization activities in Mercury. Pursuant to the PA, DRI completed NRHP evaluation and finding of effect reports and other mitigation documents for six buildings in Mercury.

Curation

DRI continues to maintain and manage the NNSS archaeological collections and associated records consistent with all professional standards. These collections contain more than 467,000 artifacts.

American Indian Consultation Program

NNSA/NFO's American Indian Consultation Program (AICP) serves to facilitate government-to-government consultation with 16 Tribes with cultural and historic ties to the NNSS. The AICP Coordinator joins ten other Tribes currently serving from New Mexico, Idaho, Washington, Oregon, and New York on the State Tribal Government Working Group (STGWG). The STGWG works closely with various DOE sites throughout the U.S. The AICP Coordinator is also appointed to the Nevada Site Specific Advisory Board to serve as a liaison giving advisory insight into activities conducted on the NNSS.

In 2022 NNSA/NFO supported the goals of the AICP by:

- interacting with the DRI AICP Coordinator to identify topics of interest and enhance communications with Tribal representatives
- participating in the annual Tribal Update Meeting, which brings together Tribal representatives from the 16 culturally affiliated Tribal governments
- participating in Tribal Planning Committee (TPC) meetings
- supporting TPC field visits to two locations on the NNSS: Big George Cave and Petroglyph Site in Area 18, and the Basket and Cane and Prehistoric Ladder Sites in Area 29
- continuing to support a tribal revegetation project at the Area 5 RWMC.

In 2022, NNSA/NFO did not receive any requests from culturally affiliated tribes to access the NNSS for ceremonial or traditional use.

Endangered Species Protection and Ecological Monitoring

The Ecological Monitoring and Compliance (EMAC) Program monitors the ecosystem of the NNSS and ensures compliance with laws and regulations pertaining to NNSS natural resources. Sensitive and protected/regulated species of the NNSS include 43 plants, 1 mollusk, 2 reptiles, 242 birds, and 30 mammals. These species are protected, regulated, or considered sensitive according to state or federal regulations and natural resource agencies and organizations.

The desert tortoise is the only resident species on the NNSS listed under the Endangered Species Act as threatened. Habitat of the desert tortoise is in the southern portion of the NNSS. Activities conducted in desert tortoise habitat must comply with the terms and conditions of a Biological Opinion issued to NNSA/NFO by the U.S. Fish and Wildlife Service. Forty-eight projects occurring within the range of the tortoise were reviewed by biologists in 2022 and 6 projects in progress were carried over from previous years. Of the forty-eight projects reviewed, 2 required formal consultation with FWS, 15 required biological surveys, and 31 were determined to have no effects to the tortoise. These determinations were based on the amount of anticipated habitat disturbance, habitat quality, and location of projects (e.g., within developed versus undisturbed areas). In 2022, no desert tortoises were accidentally injured or killed at a project site, nor were any found, captured, or displaced from project sites. There were an unprecedented 115 reported tortoise roadside observations on the NNSS during 2022. Due to two years of below average rainfall followed by the monsoon rains in August and September, forage availability along road edges drew tortoises nearer to roads.

Of the 115 roadside sightings, 5 were roadkill (2 large, 3 small), 3 were observations of small tortoises that were not handled, 12 were observations of large tortoises that were not handled, 23 were of small tortoises that were moved off roads, 71 were of large tortoises that were moved off roads, and 1 was documented on a project site. The 2 large tortoises killed by vehicles were determined to be incidental take.

In 2012, 60 juvenile tortoises were moved from captivity at the Desert Tortoise Conservation Center near Las Vegas to undisturbed tortoise habitat at the NNSS to investigate the fate of translocated individuals. The San Diego Zoo Institute for Conservation Research started the study and transferred it to NNSS biologists in 2013. At the end of 2022 12 of the 60 juveniles were still alive.

Biological surveys for the presence of sensitive and protected/regulated species and important biological resources on which they depend were conducted for 26 projects. A total of 659.3 acres were surveyed for these projects. Some of the sensitive and protected/regulated species found during the surveys included western burrowing owl sites, two live tortoises, tortoise burrows, bat sign, active bird nests, desert cottontail, coyote and kit fox burrows, antelope, burro and mule deer sign, Joshua tree and Mojave yucca plants, singleleaf pinyon, multiple cactus species, and one sensitive plant (Darin buckwheat).

Ongoing monitoring and surveys of sensitive and protected/regulated animal and plant species continued to demonstrate the long-standing stewardship of the NNSS ecological resources. Additional information may be found in the annual ecological monitoring and compliance program report found at https://nnss.gov/publication-library/environmental-publications/.

Gold Meadows Spring and Camp 17 Pond continue to be valuable resources for these animals, especially during the hot, dry summer. A total of 133 and 907 photos of horses were recorded using a motion-activated camera at Gold Meadows Spring and Camp 17 Pond, respectively.

NNSA/NFO is committed to working collaboratively with other agencies to provide research opportunities on the NNSS that benefit ecological and conservation science.

An NNSS Tortoise with transmitter eating beavertail cactus

Eighteen pronghorn and 23 mule deer were captured and collared in 2019. Radio-collars were programmed to drop off in November 2022, which they did successfully. At the end tracking period, four pronghorn (two does, two bucks) and seven mule deer (all does) were still alive.

Environmental Stewardship

NNSA/NFO's Environmental Management System (EMS) is a business management practice that incorporates concern for environmental performance throughout the NNSS and its support facilities. The goal of the EMS is continual reduction of NNSA/NFO's impact on the environment. An EMS ensures that environmental issues are systematically identified, controlled, and monitored, and it provides mechanisms for responding to changing environmental conditions and requirements, reporting on environmental performance, and reinforcing continual improvement. Environmental commitments are incorporated into an Environmental Policy with goals to protect environmental quality; mitigate environmental impacts; collaborate with employees, customers, subcontractors, and suppliers on sustainable development; comply with environmental laws and regulations; and, commit to environmental excellence in company activities.

The **Energy Management Program** was formed specifically to reduce the use of energy and water in NNSA/NFO facilities, to advance the use of solar and other renewable energy sources, and to help NNSA meet DOE's 2020 Site Sustainability Goals.

In December 2022, the Sustainability Division completed the FY 2023 NNSA/NFO Site Sustainability Plan, which reported the progress toward meeting DOE's Site Sustainability Goals. Thus far, the Energy Management Program is on track to meet the majority of the DOE long-term goals.

The **Pollution Prevention and Waste Minimization Program** helps to reduce the volume and toxicity of waste that must be disposed.

Clean and Renewable Energy

- The goal was to increase consumption of clean and renewable electric energy.

  Status: 35%, with the consumption breakdown as; 1% on-site carbon pollution-free energy (CFE), 34% grid-supplied CFE, 65% grid-supplied fossil based electricity. Fire Station #1 solar produced 506 megawatt-hours (MWh), off-grid solar estimated at 253 MWh. Developed an accelerated solar plan.

Energy **Efficiency and** Management

- The goal was to reduce energy use intensity in goal-subject buildings.

  Status: Energy use intensity increased 2.7% from the FY2015 baseline.

- The goal was to meter all individual buildings for electricity, natural gas, steam and water, where cost-effective and appropriate.

  Status: no new appropriate buildings were metered. Current metered buildings: Electric 85/106 = 80%; Gas 14/15 = 93%; Water 33/109 = 30%.

- The goal was to ensure that eligible facilities under Section 432 of the Energy Independence and Security Act are assessed once every 4 years.

  Status: year 2 of the 4 year cycle was completed and 72 assessments were conducted.

Water **Efficiency** and Management

- The goal was to reduce potable water use intensity (gallons per gross square foot).

  Status: potable water use intensity was reduced 28.9 %.

- The goal was to reduce non-potable freshwater consumption (gal) for industrial, landscaping, and agricultural.

  Status: there was a 49% increase from the 2010 baseline.

Wildlife watering trough that replaced the closed Well 5b sump.

Fleet Management

- The goal was to increase alternative fuel consumption.

  Status: exceeded the 10% increase.

- The goal was to reduce petroleum consumption.

  Status: reduced to 64% below the baseline.

- The goal was to acquire alternative fuel and electric vehicles.

  Status: 75% of the fleet are alternative fuel and electric vehicles.

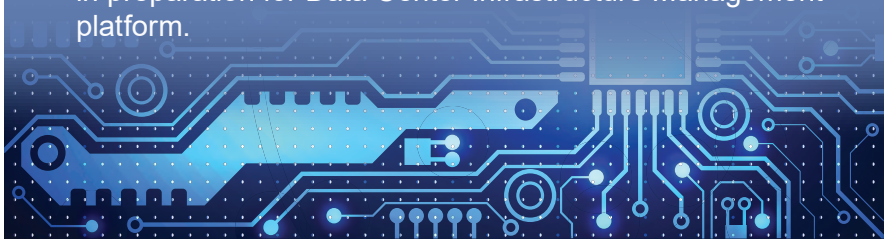
Electronic Stewardship and Data Centers

- The goal was electronics stewardship from acquisition, operations, to end of life.

  Status: Disposition goal met. All electronic equipment that passed excess screening was e-recycled. Partnered with Blind Center of Nevada for e-recycling of electronics. 81% of purchased electronics were Electronic Product Environmental Assessment Tools (EPEAT). 0% of computers and monitors have power management enabled, while 100% of managed printers have duplex printing enabled. Received EPEAT Award.

- The goal was to increase energy and water efficiency in high performance computing and data centers.

  Status: Balanced power and heat loads in a NLV data center; raised ambient temperature and optimized computer room air conditioning units. Completed room power distribution units and computer room air conditioning units in preparation for Data Center Infrastructure Management platform.



Climate Change Resilience

- The goal was to further implement climate adaptation and resilience measures.

  Status: Conducted severe weather event workshops. Submitted Energy Resilient Infrastructure and Climate Adaptation projects. Continued work on Technical Resilience Navigator (TRN) Cohort; utilized TRN tool to complete Vulnerability Assessments inputs. Submitted Vulnerability Assessment and Resilience Plan. Purchased equipment and PPE.

Investments: Improvement Measures, Workforce and Community

- The goal was to implement life-cycle cost effective efficiency and conservation measures with appropriated funds and/or performance contracts.

  Status: Reviewed options for Shooting Range lighting replacement for Energy Savings Performance Contract (ESPC) Delivery Order 2 (DO2) scope. Supported Year 12 ESPC DO2 measurement and verification activities. Conducted virtual Energy Action Month (EAM) and Earth Day activities. Continued the Acts of Sustainability employee outreach program.

High Performance Sustainable Buildings (HPSBs)

- The goal was to increase the number of owned buildings that are compliant with the Guiding Principles for Sustainable Buildings.

  Status: There are 17 HPSB certified facilities in the NNSS building inventory totaling 517,074 gross square feet (gsf). Five facilities over 25k totaling 348,776 gsf.

Pollution Prevention and Waste Minimization

- The goal was to reduce non-hazardous solid waste sent to treatment and disposal facilities (TSDFs).

  Status: 33.4% of non-hazardous solid waste was diverted.

- The goal was to reduce construction and demolition materials and debris sent to TSDFs.

  Status: 8.8% of construction waste was diverted, and new directives were implemented to advance on this goal.

Acquisition and Procurement

- The goal was to promote sustainable acquisition and procurement to the maximum extent practicable, ensuring all sustainability clauses are included as appropriate.

  Status: Relevant sustainable acquisition clauses are included in applicable subcontracts

Greenhouse Gas (GHG) Emissions

- The goal was to reduce Scope 1 & 2 greenhouse gas (GHG) emissions.

  Status: 53.5% below the baseline. Two Cooling and Heating Asset Management Program projects were completed.

- The goal was to reduce Scope 3 GHG emissions.

  Status: 69.8% below the baseline. Utilized new survey program to collect commuter data.

GHG emissions targeted for reduction are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride (SF6) and are classified depending on their source:

Scope 1 — from sources owned or controlled by a federal agency.

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

Scope 3 — from sources not owned or directly controlled by a federal agency but related to agency activities.

Natural Resources Conservation Programs and Projects

The White House issued Executive Order (E.O.) 14008 entitled ***Tackling the Climate Crisis at Home and Abroad***, in January 2021, which set a goal of conserving 30 percent of land and water by 2030, among other goals. The White House Council on Environmental Quality (CEQ) named this initiative the America the Beautiful Initiative and asked DOE (and other Federal agencies), to support it by preparing a **Conservation Action Plan** (CAP) detailing programs and projects across several discrete areas of early focus, and a **Climate Adaptation and Resilience Plan** (CARP) detailing programs and projects across five priority adaptation actions.

DOE CAP[1] and CARP[2] Elements	NNSA/NFO and DOE EM Nevada Program Contributions
The CAP areas of early focus included: ▶ Create More Parks and Safe Outdoor Opportunities in Nature-Deprived Communities ▶ Support Tribally Led Conservation and Restoration Priorities ▶ Expand Collaborative Conservation of Fish and Wildlife Habitats and Corridors ▶ Increase Access for Outdoor Recreation ▶ Incentivize and Reward the Voluntary Conservation Efforts of Fishers, Ranchers, Farmers and Forest Owners ▶ Create Jobs by Investing in Restoration and Resilience; and ▶ Other Activities Supportive of the America the Beautiful Initiative. **The CARP includes five priority adaptation** actions: 1. Assess Vulnerabilities and Implement Resilience Solutions at DOE 2. Enhance Climate Mitigation Efforts at DOE Sites 3. Institutionalize Climate Adaptation and Resilience Across DOE Policies, Directives and Processes 4. Provide Climate Adaptation Tools, Technical Support, and Climate Science Information on Adaptation and Mitigation 5. Advance Deployment of Emerging Climate Technologies	The NNSA/NFO and DOE EM Nevada Program participated in working groups and **contributed to developing the DOE CAP. In particular, NNSA/NFO and DOE EM Nevada Program identified:** ▶ The DOE EM Nevada Program Tribal Revegetation Project implemented at the Area 5 RWMC combined Tribal Ecological Knowledge (TEK) with Western scientific ecological methods to create a vegetative cover within test plots located at the RWMC. ▶ NNSA/NFO maintains a comprehensive ecological monitoring and compliance (EMAC) program consisting broadly of biological surveys of sites and sensitive and protected species and potential habitat disturbance. ▶ NNSA/NFO and DOE EM Nevada Program participate in numerous collaborative activities with other federal and state agencies including, but not limited to the U.S. Fish and Wildlife Service, Bureau of Land Management, U.S. Forest Service, U.S. Geological Survey, U.S. Air Force, Nevada Department of Wildlife, Nevada Department of Transportation, and others. ▶ The NNSS is one of the seven DOE National Environmental Research Parks (NERP), and has identified over 864,000 acres available for various ecological research objectives related to the development of energy sources, the study of environmental impacts of energy development, and for informing the public of environmental and land-use options. **The NNSA/NFO began implementing and executing some of the five priority adaptation actions provided in the CARP. In particular, NNSA/NFO and the site's Sustainability** Division actions included: ▶ Actions 1 and 4: NNSA/NFO continues participation in the DOE Technical Resilience Navigator (TRN) Cohort trainings which will help feed various information required for the Vulnerability Assessment and Resilience Plan (VARP). ▶ Action 2: NNSA/NFO continued solar project planning across the site and continued activities associated with the ordering of new solar electric vehicle charging stations for the NNSS. ▶ DOE Sustainable Environmental Stewardship goals are outlined in DOE's most current Site Sustainability Plan Guidance Document and incorporated into NNSA/NFO's Site Sustainability Plan.

1. https://www.directives.doe.gov/ipt_members_area/doe-o-436-1-departmental-sustainability-ipt/background-documents/doe-conservation-action-plan

2. https://www.energy.gov/sites/default/files/2021-10/DOEClimateAdaptationandResiliencePlan.pdf

2022 Sustainability and Outreach

Energy Action Month

In October 2021, the NNSS Energy Action Month (EAM) activities were offered virtually. NNSS employees and their family members were offered the opportunity to enjoy virtual EAM activities while at home. Those activities began October 1st, and lasted the entire month. EAM activities included the following:

- The Regional Transportation Commission (RTC) Club Ride program provided NNSS employees with an online video that highlighted their achievements and the positive impacts they made by considering commute alternatives, which improved our air quality.
- Employees also visited local online utility companies to learn about services and resources to help them become more sustainable, and were educated about the significance of effective and sustainable waste management practices, and proper recycling techniques. They learned interesting recycling facts and how to replace single-use plastics with reusable items. After visiting the website, employees mentioned what actions they would implement to live a more sustainable life.
- Employees utilized a home energy tool that showed how to save and provided tips to allow for the breakdown of energy consumption by appliance. Employees who completed the home assessment survey also learned how to increase the accuracy of their home appliances energy consumption.

Earth Day

Earth Day continued to remind NNSS employees to make conscious decisions to invest in our planet. To change, to act, to preserve and, most of all, to protect the Earth. During the entire month of April, employees were given the opportunity to engage in several activities. These activities included:

- NNSS partnered with Keep America Beautiful for the "Give a Hoot Don't Pollute" activity. This cleanup and plogging event allowed employees and families a chance to exercise while picking up litter to beautify a local community park.
- Employees calculated their personal plastic consumption and received tips to help manage their plastic pollution.
- Employees participated in the Earth Day Mile Challenge. The goal of this challenge was for Team MSTS, along with other participants from across the world, to collectively walk or run 24,901 miles, which is equivalent to the circumference of the equator.
- Employees also enjoyed a YouTube video of a discussion between DOE Secretary Jennifer Granholm and Jonathan Scott of the "Property Brothers" television show about building a clean energy future and making it accessible to all.
- Two Operations Security Shred Day events were held at the NLVF and the NNSS. Once employees dropped off their shred materials, they received giveaways and sustainability educational handouts.
- RTC's Club Ride offered free sign-ups for the Club Ride program. Existing members received a carpool match service, free rides on RTC Bike Share, or 14 days of free public transit.
- NNSA/NFO employees continued to donate items to Safe Nest, a local non-profit organization that donates clothing and other items to women who have been victims of domestic violence. Currently, two Safe Nest bins are located at the NLVF, and in FY 2022, MSTS employees diverted a total of 4,370 pounds of items from the landfill by donating to Safe Nest.

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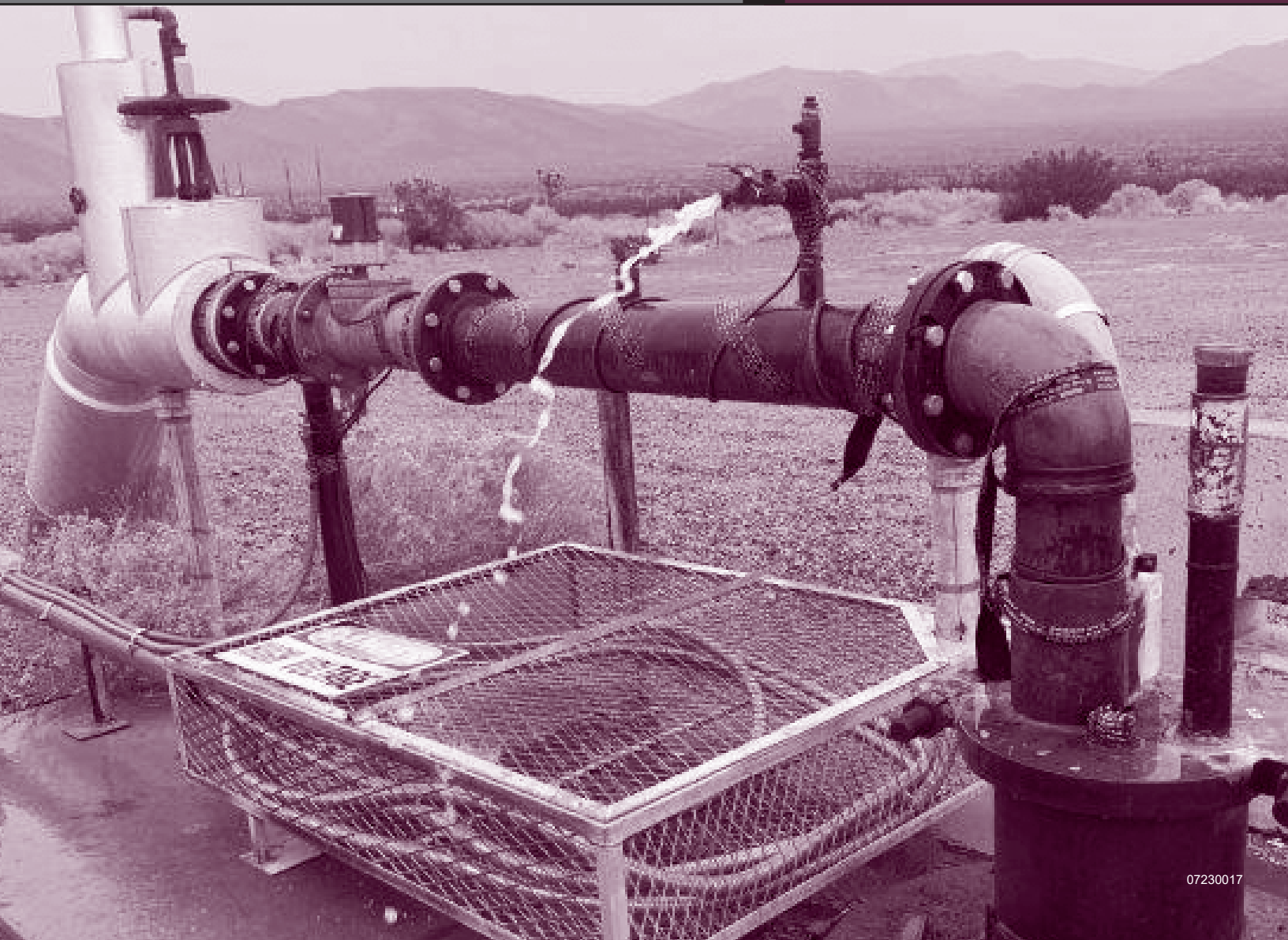

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