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September 2021

2020

Environmental Report

Summary

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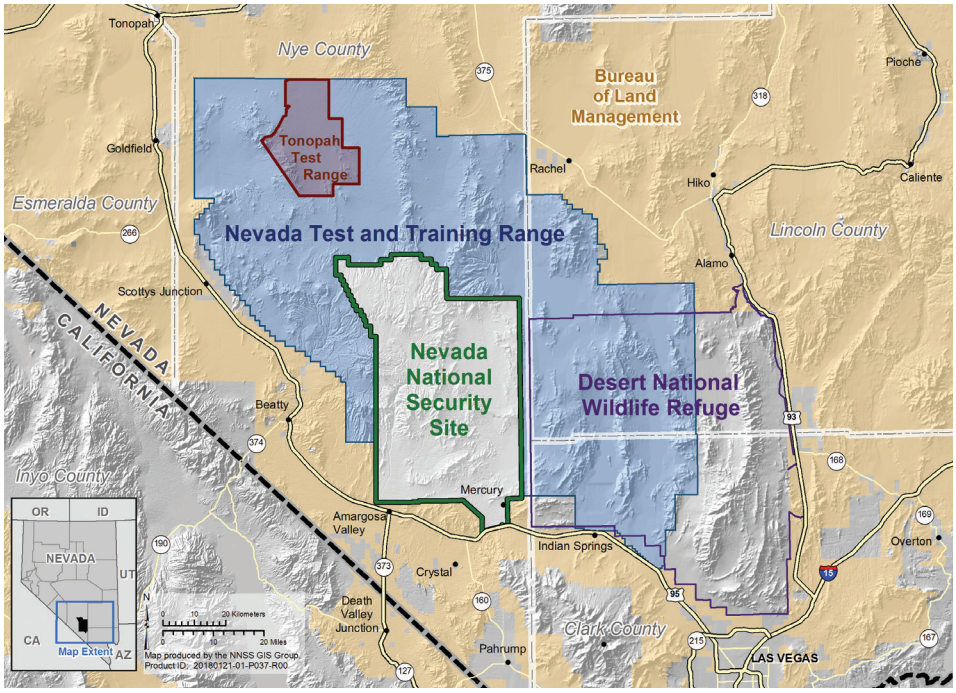
NEVADA NATIONAL SECURITY SITE

Environmental Report Summary 2020

This document is a summary of the full *2020 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 and more readable version of the full NNSSER. The reader is provided with an electronic file of the full NNSSER and of *Attachment A: Site Description* on a compact disc (see inside back cover). The reader may obtain a hard copy of the full NNSSER as directed on the inside back cover of this summary 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

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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).

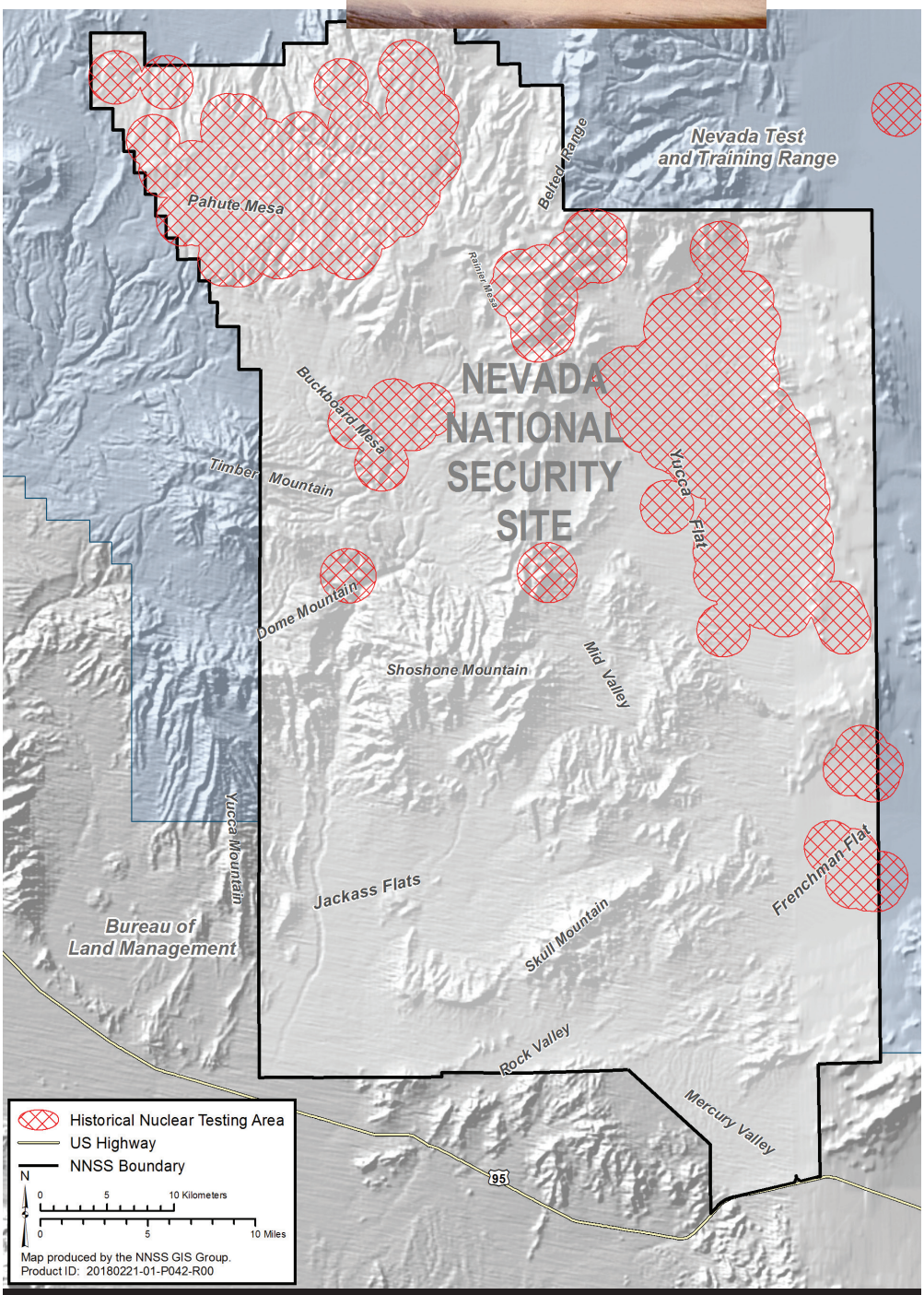
On September 23, 1992, the last underground nuclear test was conducted on the NTS, after which Congress imposed a moratorium on nuclear weapons testing. Since 1951, a total of 100 atmospheric and 828 underground nuclear weapons tests have been conducted at the NTS.

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.

gamma-ray interactions on various materials and to assess radiation doses experienced by the nuclear bomb survivors of Hiroshima and Nagasaki. From 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).

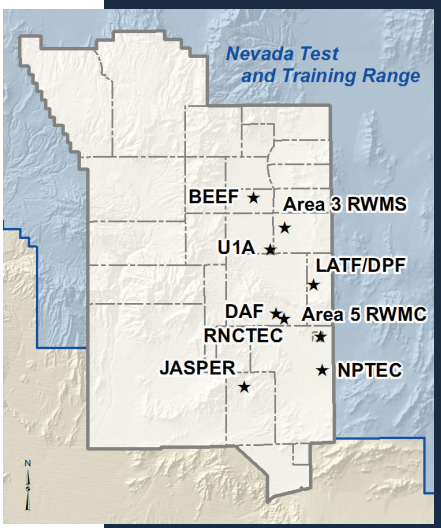


Historical Nuclear Testing Areas on and adjacent to the NNSS

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 2020 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 low-level and mixed low-level radioactive 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 remediates 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 low-level waste 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 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.

NNSS COVID-19 Response

In the midst of the coronavirus disease 2019 (COVID-19) pandemic, the NNSS community has responded with agility and resilience. The NNSS workforce, in mid-March 2020, maximized teleworking for approximately 3,200 personnel. The team has provided guidance and led support to surrounding communities in response to COVID-19 while maintaining the continued operational work stance. Discussion of impacts to Mission, Programs, and Operations are included throughout this report, as applicable.

Community – The NNSS donated more than $200,000 to educational and social causes, e.g., University of Nevada at Las Vegas, Clark County School District (Chromebooks to at-risk students); Spread the Word (promotes literacy); Three Square Food Bank; American Red Cross; and Las Vegas Global Alliance.

Security – NNSS and outlying personnel, material, and cyber security continued to provide the necessary controls to keep us productive and secure.

Fire and Rescue – These highly skilled personnel continued to respond to medical emergencies, wildland fires, vehicle fires and accidents, vehicle rescues, and hazardous materials incidents.

Operations Command Center – The Operations Command Center's highly skilled team continued to implement emergency notifications and protective actions, and oversaw NNSS access as well as mission scheduling and deconfliction for NNSS activities.

The COVID-19 Monitoring Team – The COVID-19 monitoring team, a subset of the Emergency Operations Center, was responsible for keeping track of employees, creating workplace COVID-19 mitigation plans, assisting with COVID-19 personal protective equipment and cleaning supply management and distribution, communicating information to the workforce, as well as providing DOE and NNSA information updates and ensuring compliance with regulations.

Occupational Medicine – The Occupational Medicine organization continued to provide Medical services consistent with safe work practices. The team established a drive-thru flu vaccination process to minimize people in the clinics and maximize social distancing. They coordinated with Federal and state agencies to develop and implement an aggressive complex-leading COVID-19 vaccination program, which through mid 2021 had administered over 4,000 total vaccinations. The Occupational Medicine team continues to provide a critical resource for ongoing support, questions, and concerns related to COVID-19, variants, and a multitude of other health-related concerns.

NNSS Workforce – Highly proficient and professional, they continued adhering to established protocols and guidance, including maximizing telework capabilities, practicing "social distancing," wearing face coverings, and other cleanliness and hygiene protocols while managing projects and coordinating subcontractors for the continued safe operations at the NNSS and outlying sites.

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.

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Summary of NNSA/NFO's Compliance with Major Federal Statutes in 2020

Environmental Statute or Order and What It Covers	2020 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	381,938 cubic feet of waste was disposed on site in LLW and MLLW disposal cells at the Area 5 RWMC and Area 3 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.
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 2020 NNSS air emissions to the maximally exposed individual (MEI) is 0.063 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) instead *(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, 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 0.55 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	69,699 lbs of lead, 380 lbs of mercury, and 160 lbs of polycyclic aromatic hydrocarbons (PACs) were released as a result of NNSS activities. About 42% of lead released was for offsite recycling, while nearly 100% of remaining chemicals were released onsite. No releases exceeded reportable thresholds.
Endangered Species Act (ESA): Threatened or endangered species of plants and animals	Field surveys for 34 projects in desert tortoise habitat on the NNSS were conducted. There were 24.4 acres of tortoise habitat disturbed. No desert tortoises were killed on roads, and no tortoises were injured or killed due to project activities. Thirty-two desert tortoises found on or near roads were moved out of harm's way. All actions were in compliance with the NNSS Programmatic Biological Opinion requirements.
Federal Facility Agreement and Consent Order (FFACO): Cleanup of waste sites containing hazardous substances	All 2020 corrective action milestones under the FFACO were met and 791 corrective action sites were closed. To date, 2,949 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	No projects harmed bird nests or eggs and only 8 accidental human-related bird deaths were documented, the lowest recorded since 2012 (e.g., electrocutions on powerlines and vehicle collisions).
National Environmental Policy Act (NEPA): Evaluating projects for environmental impacts	50 proposed projects/activities were reviewed under the NEPA compliance procedures and none required further NEPA analysis.
National Historic Preservation Act (NHPA): Identifying and preserving historic properties	Field surveys and historical evaluations for 9 projects were conducted, 266.5 acres were surveyed, and 27 cultural resources were identified, 25 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	384 tons of MLLW were disposed on site, 1.83 tons of HW were received for temporary onsite storage and/or treatment, 0.19 tons of MLLW, 2.55 tons of HW, and 0.161 tons of polychlorinated biphenyl waste were shipped off site for disposal, and 0.624 tons of explosive ordnance were detonated at the Explosive Ordnance Disposal Unit, all in accordance with state permits. On July 3, 2019, the U.S. Department of Energy (DOE) Environmental Management (EM) Nevada (NV) Program and NNSA/NFO notified the Nevada Division of Environmental Protection (NDEP) that a classified waste stream had been transported from the Y-12 National Security Complex (Y-12) in Oak Ridge, Tennessee and disposed at the Area 5 RWMC. Subsequent communications determined that between January 2013 to December 2018, there were 10 shipments of NNSS Waste Acceptance Criteria (WAC) non-compliant shipments involving 33 waste containers that had been shipped from Y-12 to the NNSS and had been disposed at the Area 5 RWMC. On June 15, 2020, NDEP issued to NNSA/NFO a Finding of Alleged Violation (FOAV) and Order citing the 33 waste containers received from Y-12. On April 13, 2020, the NNSA/NFO received a Notice of Violation (NOV) and report from EPA Region 9 that provided the results of a RCRA Compliance Evaluation Inspection (CEI) conducted in August 2019. The report detailed three items as areas of potential violations and one item as an area of concern. The potential violations addressed in the CEI were: 1) lack of confirmatory data regarding the status of the waste associated with a low-level waste profile, 2) adequacy of groundwater monitoring data in past submittals of groundwater reports, and 3) the hazardous waste compliance status of the Y-12 waste containers. The area of concern addressed in the CEI was the location of groundwater monitoring wells and the constituents tested in the groundwater monitoring program. Following a series of collaborative conversations, on June 22, 2021, the DOE and the State of Nevada reached a mutually beneficial resolution to all regulatory actions resulting from the July 2019 waste issue. The final agreement builds upon the Department's continued commitment to enhancing the rigor of its waste management activities for the protection of the DOE workforce, the public, and the environment.
Safe Drinking Water Act: Quality of drinking water	All three permitted public water systems (PWSs) on the NNSS met applicable national and state water quality standards.
Toxic Substances Control Act (TSCA): Management and disposal of PCBs	231 lbs of LLW containing PCBs were disposed on site and 321 lbs was shipped off site to an approved PCB disposal facility.

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 NNSA/NFO Environmental Management mission was established to address this legacy contamination. The Environmental Management (EM) Nevada Program is responsible for remediating contaminated sites, and Waste Management is responsible for safely managing and disposing of radioactive waste.

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

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Legacy Contamination

Groundwater — The total amount of radiation remaining below the groundwater table is approximately 20 to 25 million Ci, based on the most recent estimate, 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.

Soil — Radioactively contaminated surface soils, directly resulting from nuclear weapons testing, exist at over 100 locations on and around the NNSS. The soils may contain contaminants including radioactive materials, oils, solvents, and heavy metals, as well as contaminated instruments and test structures used during testing activities.

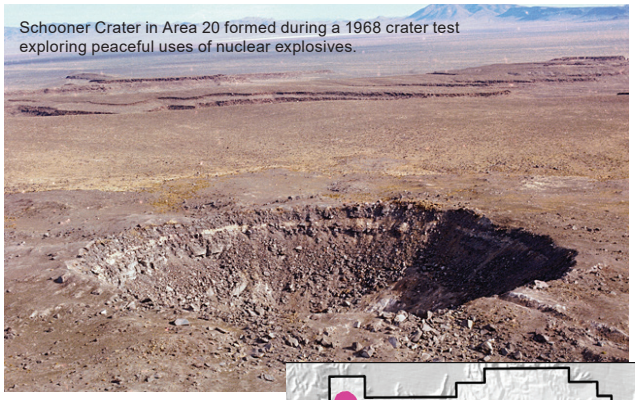
Air — Airborne radioactive contamination from the resuspension of contaminated soils at legacy sites and from current activities is monitored continuously on and off the NNSS. Airborne concentrations of monitored contaminants have been decreasing at most sample locations on the NNSS over the past decade. 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. In air measured in communities surrounding the NNSS, emissions from the NNSS cannot be distinguished from background airborne radiation.

Structures/Materials — There are 1,865 sites where facilities, equipment, structures, and/or debris were contaminated by historical nuclear research, development, and testing activities. These structures/materials 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.

Waste Disposal — Low-level and mixed low-level radioactive wastes have been generated by historical nuclear research, development, and testing activities and environmental cleanup activities. From the 1960s, when waste disposal began, through December 31, 2019, over 1.8 million cubic yards of waste have been safely disposed at the Area 3 and Area 5 RWMSs. The estimated cumulative radioactivity of all wastes at the time of disposal is 1.7 million Ci. The radioactive content of the waste decays over time, however, at a varied rate depending on the radionuclide.

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.

The Federal Facility Agreement and Consent Order (FFACO) between the State of Nevada, DOE, and DoD identifies corrective action units (CAUs), which are groupings of corrective action sites (CASs) that delineate areas of historical contamination. The FFACO establishes corrective actions and schedules for the remediation and closure of CASs. More than 3,000 CASs have been identified, the large majority of which have already been remediated and/or closed. The public is kept informed of EM Nevada Program activities through periodic newsletters, exhibits, and fact sheets, and EM Nevada Program provides the opportunity for public input via the Nevada Site Specific Advisory Board (NSSAB), consisting of 15–20 citizen volunteers from Nevada.



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

Numerous man-made and naturally occurring radionuclides occur on the NNSS. The radionuclides produce ionizing radiation in the form of alpha particles, beta particles, and gamma rays, which are emitted from the unstable radionuclides as they decay to form more

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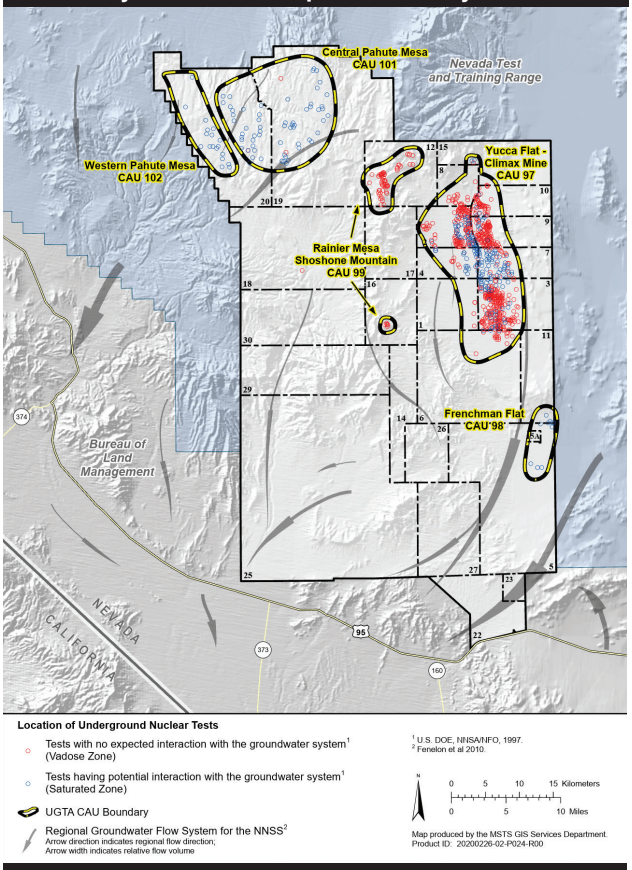
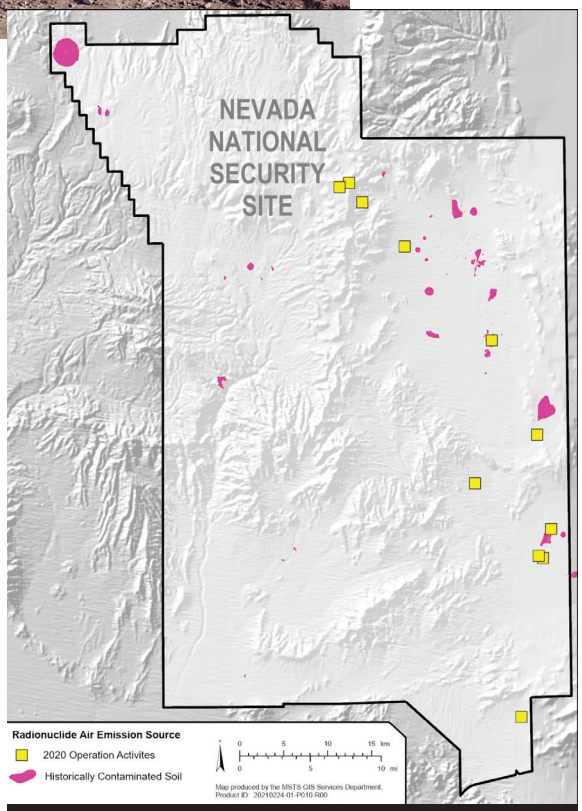
The direction of groundwater flow, shown by the arrows, is predominantly southwest.



Areas of Potential Groundwater Contamination on the NNSS



Sources of Radiological Air Emissions on the NNSS

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 2% of their total radiation exposure is 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.

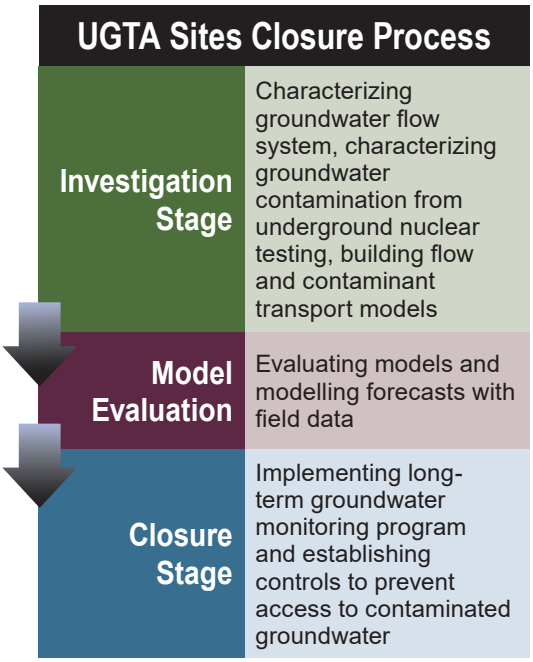
[b] The number given with the name of the radionuclide is the atomic mass number, which is the total number of protons and neutrons in the nucleus of the atom. Atoms with the same number of protons are the same element; atoms of the same element with different mass numbers are called isotopes of one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

Cleanup and Closure of Corrective Action Sites

UGTA Sites

The EM Nevada Program gathers data to characterize the groundwater aquifers beneath the NNSS and adjacent lands. The data are used to develop groundwater flow and transport models for each CAU that forecast groundwater movement and transport of radiological contaminants from the CASs. The agreed-upon corrective action for UGTA CASs is closure in place with institutional controls 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 required to submit to NDEP a plan that meets the CAUs regulatory boundary objectives. During 2020, groundwater sampling was focused on meeting closure objectives for Frenchman Flat, Rainier Mesa/Shoshone Mountain, and Yucca Flat/Climax Mine. In 2021, sampling activities are focused on Western and Central Pahute Mesa.



Central and Western Pahute Mesa CAUs – These CAUs are in the investigation stage of the closure process. The Phase I Central and Western Pahute Mesa groundwater flow and transport model, completed in 2009, forecasts that tritium in groundwater may migrate off the northwestern boundary of the NNSS within 50 years of the first nuclear detonation (1965) and that offsite tritium concentrations may exceed the Safe Drinking Water Act (SDWA) limit of 20,000 picocuries per liter (pCi/L) (see figure

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below). Contrary to the model forecast, validated laboratory results received to date reflect tritium concentrations within SDWA safety standards in wells beyond the NNSS boundary.

A Phase II Central and Western Pahute Mesa Corrective Action Investigation Plan (CAIP), completed in 2009, outlined the planned investigations to increase confidence in the Phase I model forecasts. Twelve new wells were proposed, eleven of which have been drilled. The new Phase II wells have yielded valuable new information regarding radionuclide migration within this CAU. Consistent with the model forecast, tritium was detected in 2009 at the Phase II offsite well ER-EC-11 located on the U.S. Air Force-controlled Nevada Test and Training Range (NTTR). It is located approximately 2,350 feet

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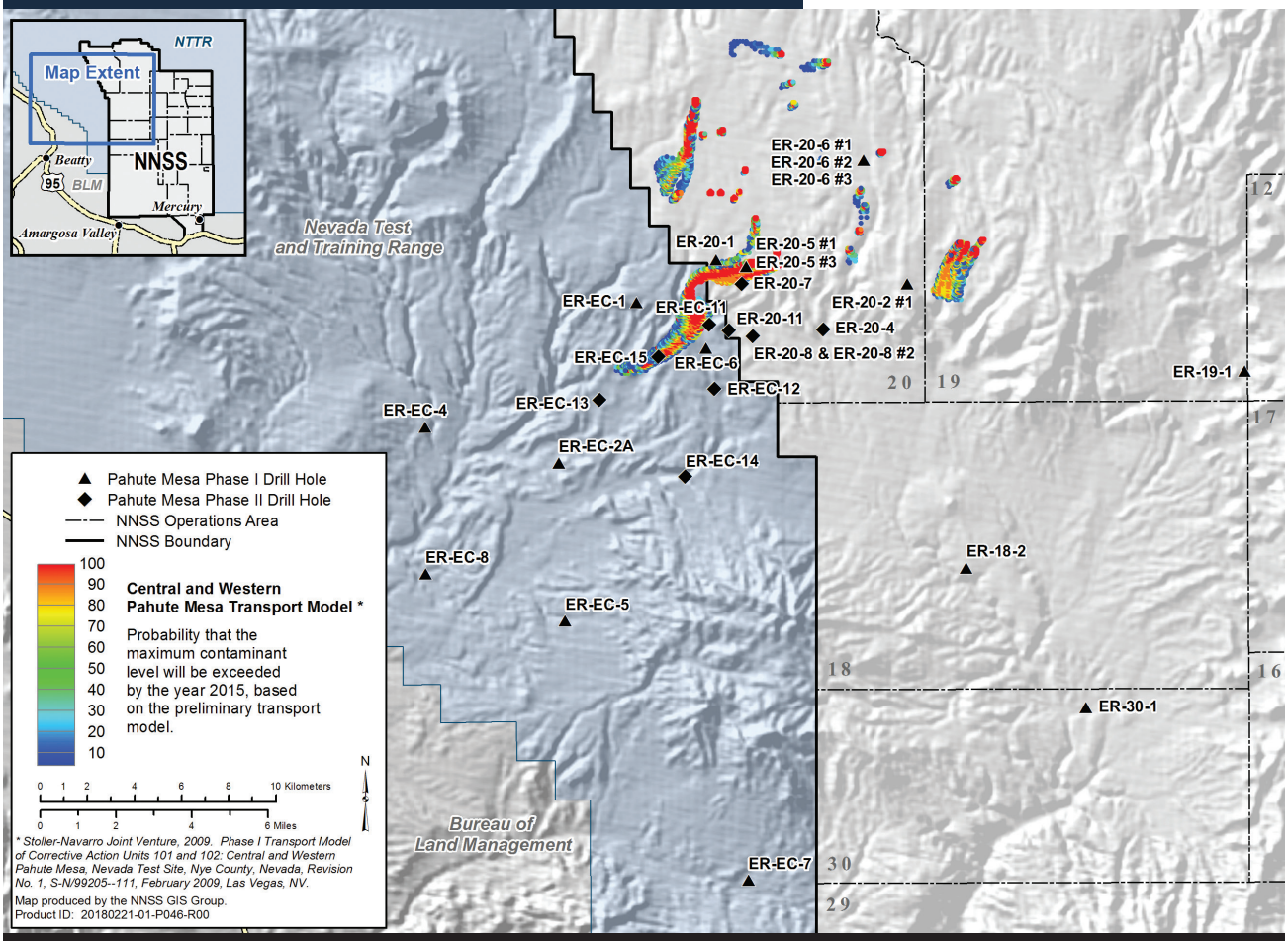
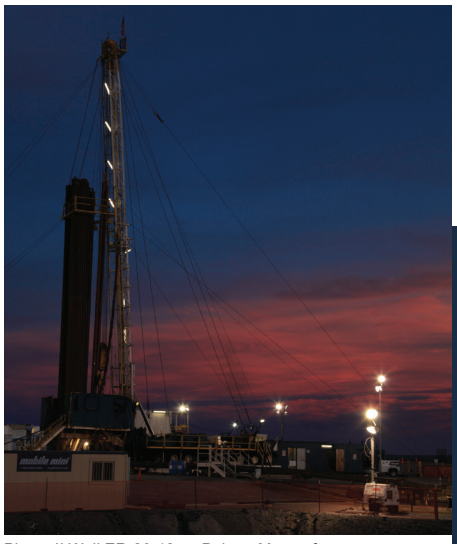
Pahute Mesa Groundwater Monitoring Results in Perspective

- 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

west of the NNSS boundary and approximately 2 miles from the nearest underground nuclear tests, Benham and Tybo, conducted in 1968 and 1975, respectively. Laboratory results for ER-EC-11 were within SDWA safety standards, including the highest measurement of tritium (18,400 pCi/L in 2017) among the offsite NTTR wells. Elevated tritium in ER-EC-11 and in a cluster of six Area 20 monitoring wells potentially represents the downgradient extension of the Benham-Tybo contaminant plume. Groundwater sampling results from these wells indicate that the contaminant plume may be more southerly, and the tritium concentrations lower, than previously forecasted.



Phase II Well ER-20-12 on Pahute Mesa after sunset.

Post-closure monitoring of the Frenchman Flat, Rainier Mesa/Shoshone Mountain, and Yucca Flat/Climax Mine CAUs involved sampling fifty-nine locations in 2020 for water quality and/or water levels. The 2020 monitoring results are consistent with the groundwater flow and contaminant transport models. No new radionuclide detections were observed during 2020 post-closure monitoring. Use restrictions continue to prevent exposure of the public, workers, and the environment to potentially contaminated groundwater within these CAUs.

In 2020, the Corrective Action Investigation Plan was updated based on the large amount of new data obtained through the Phase II investigations. The updated plan outlines the path forward for completing the investigation stage, including modeling activities, for the Pahute Mesa CAUs. Evaluation and documentation of the Phase II geologic, hydrologic, and chemistry (geochemical and radiochemical) data continued in 2020. A multi-agency groundwater geochemistry evaluation was completed to identify potential groundwater flow paths for these CAUs. In addition, models were developed to estimate radionuclide levels remaining in the underground test cavities with the objective to identify radionuclides potentially relevant for the groundwater flow and transport modeling. The new data and evaluation results were integrated into a hydrologic conceptual model of groundwater flow in the Pahute Mesa – Oasis

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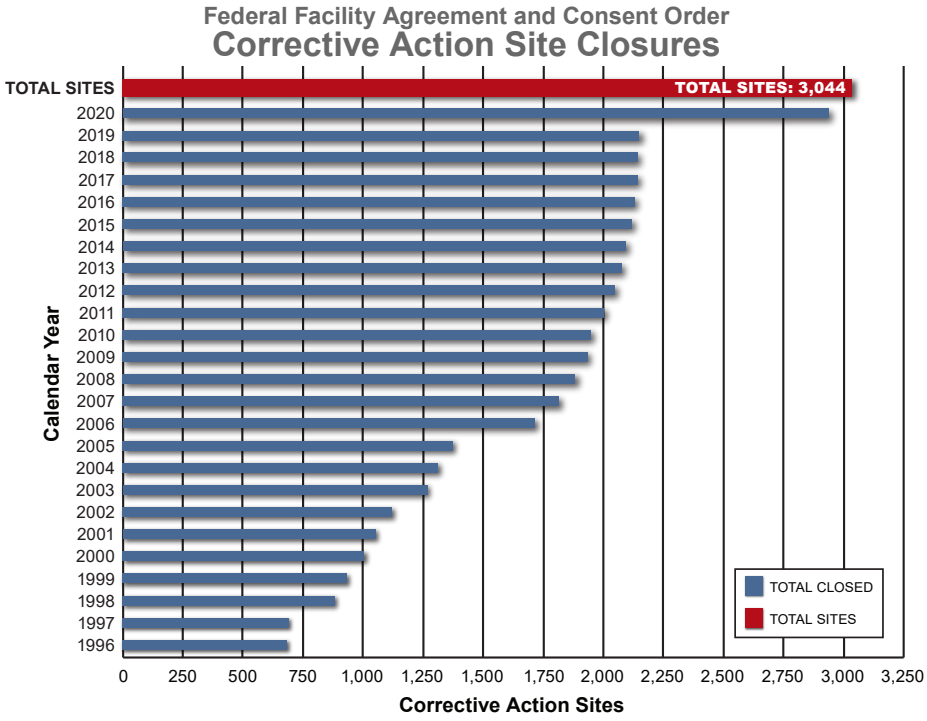
NNSS Scientists prepare to collect water samples in 2020 from the vent holes that access N Tunnel, a site of underground nuclear testing on Rainier Mesa.

Valley groundwater flow system to support Phase II modeling. The results are ultimately used to build confidence in the model forecasts of the potential extent of contamination over the next 1,000 years (i.e., contaminant boundaries). Groundwater sampling and water-level measurements both on and off the NNSS will continue throughout the entire closure process.

Frenchman Flat CAU – This CAU was the first to reach the closure stage and the start of long term, or post-closure monitoring. The Closure Report was approved in 2016 and is the culmination of 20 years of characterization, modeling, and model evaluation. The Report describes the final contaminant, use restriction, and regulatory boundaries. It also prescribes a monitoring program for the first 5 years which includes sampling for water quality, water level, and institutional control monitoring. 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.



Rainier Mesa–Shoshone Mountain CAU – The *investigation stage* of the closure process for the Rainier Mesa/Shoshone Mountain CAU was completed in 2019.

The Closure Report was approved by NDEP in 2020 and includes a description of the monitoring program, use-restriction and regulatory boundaries, and land-use restrictions for this CAU. 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 water-level and/or water-quality measurements.

Sampling for tritium is required every 6 years; additional radionuclides are analyzed at three locations that sample water from the tunnels. Separate regulatory boundaries were established for Rainier Mesa and Shoshone Mountain. The regulatory boundary

Continued on Page 17 ...

objective for Rainier Mesa is to protect receptors of groundwater from radionuclide contamination within the three downgradient groundwater basins that receive recharge from Rainier Mesa (Pahute Mesa-Oasis Valley, Ash Meadows, and Alkali Flat-Furnace Creek). 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.

Implementation of closure requirements was initiated in 2020. Use-restrictions were established, and the first round of water-level measurements and sampling was completed for this CAU in 2020. While tritium was observed in the samples from the tunnels where testing occurred, it was not present in monitoring locations downgradient of the tunnels. Monitoring results will be published in the post-closure monitoring report scheduled for 2021.

Yucca Flat–Climax Mine CAU – The Closure Report for this CAU (comprising 720 CASs) was approved by NDEP in 2020 and identifies: the monitoring network; the 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 of 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.

Use-restrictions were established, and the first round of water-level measurements and sampling was completed for this CAU in 2020. Except for two sampling locations, no tritium was detected in the 2020 samples. The tritium levels in the two wells are less than 0.1 percent of the SDWA safety standard. The tritium in one location, near an underground nuclear test, has been decreasing since 1978 when the well was used for a radionuclide migration experiment. An additional concentration step (i.e., enrichment process) is required to detect the low concentration of tritium at

Restoration Progress under FFACO

In 2020, 791 CASs were closed and all FFACO milestones were met. To date, 2,949 of 3,044 CASs have been closed in accordance with state-approved corrective action plans.

Continued on Page 18 ...

the second location. Tritium at this well has been reported since 1964 and is being measured annually to evaluate the continued trend. Monitoring results will be published in the post-closure monitoring report scheduled for 2021.

Industrial Sites and Soils

Corrective actions have been completed, with characterization and closure of 2,153 Industrial Sites and Soils CASs on and off the 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 wastes, and solid wastes have been removed and properly disposed, and where removal of all contaminants is verified in accordance with corrective action plans approved under the FFACO. Closure-in-place entails the stabilization or isolation of pollutants, hazardous wastes, 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 for the long-term protection of the public and the environment.

Following NDEP's approval of the Closure Report for the final Soils CAS located on the NTTR/TTR, the EM Nevada Program performed post-closure activities in 2020 and on September 30, 2020, transferred long-term stewardship responsibility of the 70 sites to the DOE Office of Legacy Management (LM). Post-closure activities consisted of revegetating Clean Slate II and III remediated areas, annual post-closure inspections of closed and use-restricted Industrial Sites, and radiological surveys at the Clean Slate I, II, III, and Double Tracks sites. Prior to the transfer of sites to LM, an extensive Site Transition Plan was prepared and completed by the EM Nevada Program in coordination with DOE LM to document the process that involved the review and transmission of more than 7,200 documents and records.

Only thirteen Industrial Sites CASs from three CAUs remain to be closed. The three CAUs are located on the NNSS: CAU 114, Area 25 Engine Maintenance, Assembly, and Disassembly Facility; CAU 572, Test Cell C Ancillary Buildings and Structures; and CAU 577, Area 5 Chromium Contaminated Waste Disposal Cells. Their closures will occur prior to the end of the EM Nevada Program mission, which is currently planned for 2030.

NTTR/TTR Long-Term Stewardship Transfer

In 2020, following NDEP approval and EM Nevada post-closure activity, long-term stewardship of 70 sites on the NTTR/TTR was transferred to the DOE Office of Legacy Management.

Radiological Monitoring of Groundwater

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.

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

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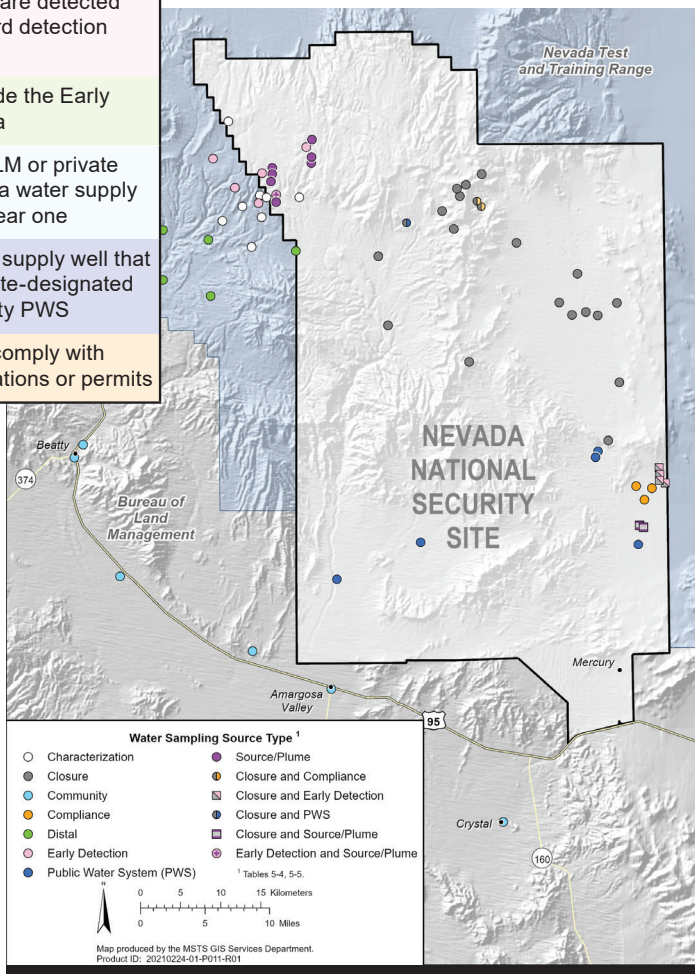
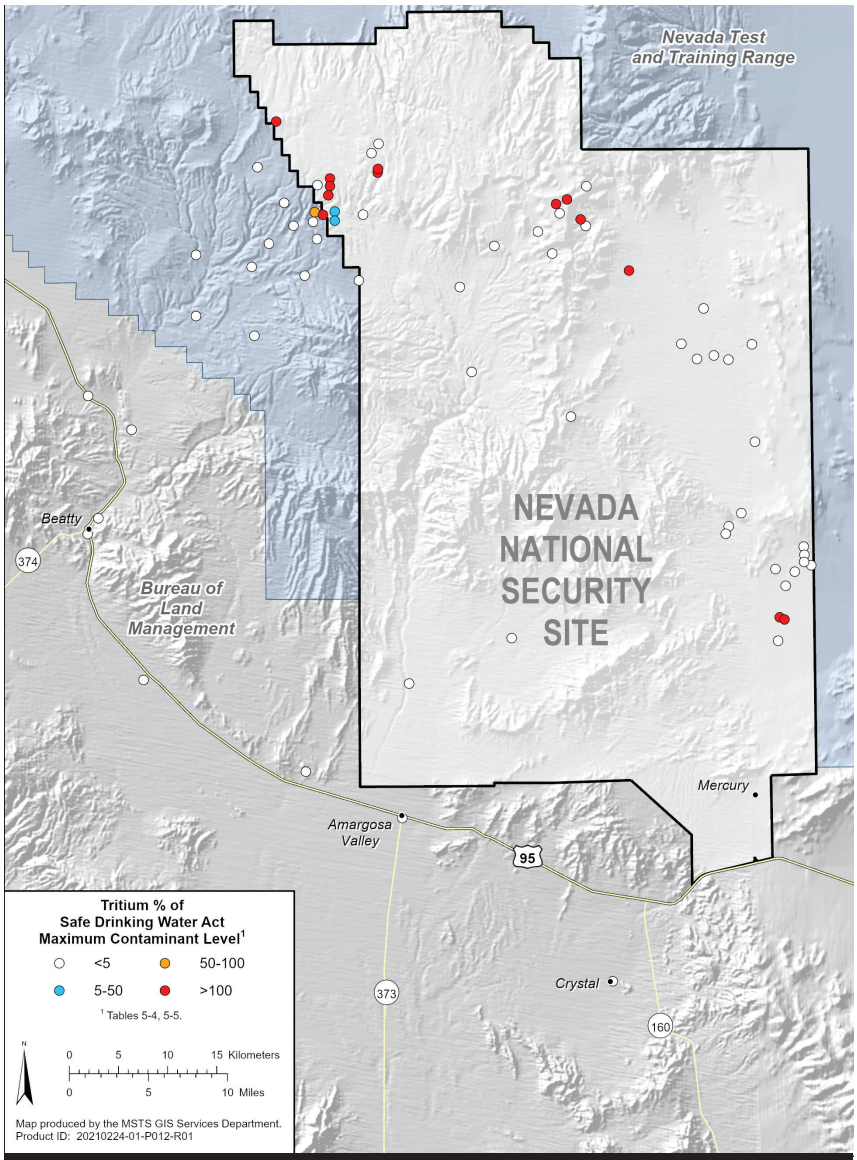


NNSA/NFO and EM NV Program Water Sampling Network

NNSS Scientists collect water samples at Well ER-20-1, a 2,065 feet deep early detection well on Pahute Mesa.



Tritium in NNSA/NFO Groundwater Monitoring Wells

CAUs in the closure stage is described within the closure reports. Groundwater sampling on the NNSS for compliance is performed according to the 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 13 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

Continued on Page 21 ...

just west of the NNSS is the only offsite well in the network that has tritium concentrations greater than 10,000 pCi/L (coded yellow 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.

Community Environmental Monitoring Program

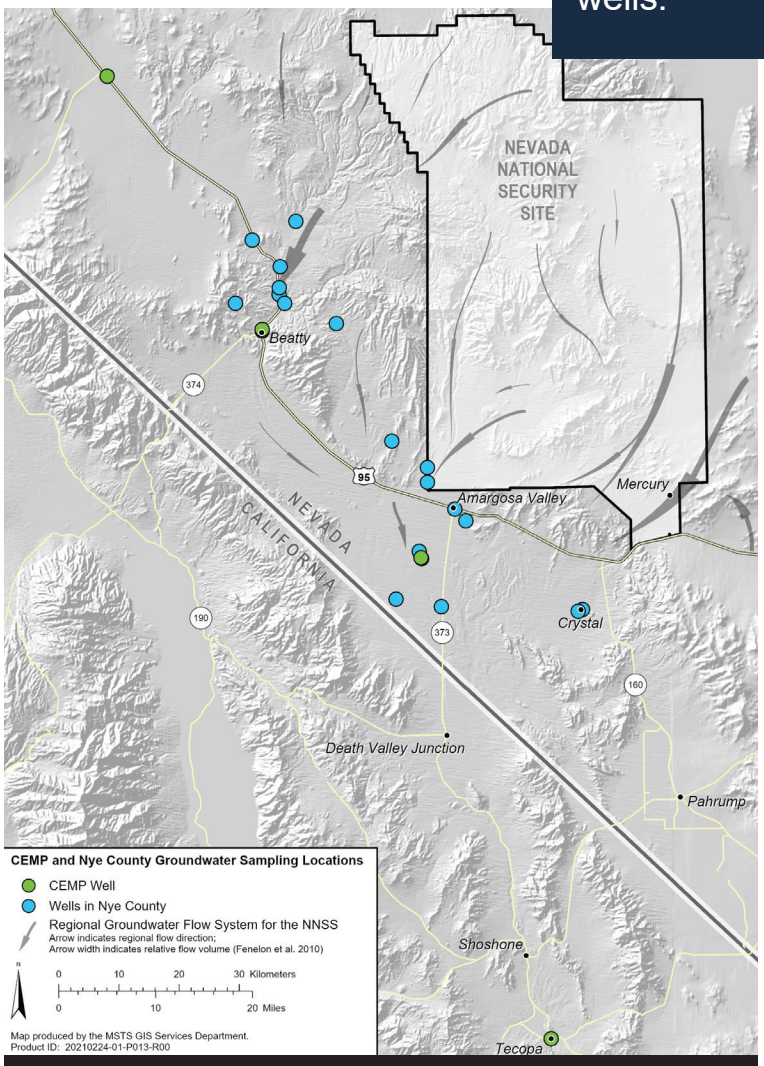
Offsite water supply wells are also monitored for the presence of tritium by the independent Community Environmental Monitoring Program (CEMP), which is coordinated by the Desert Research Institute (DRI) of the Nevada System of Higher Education under contract with NNSA/NFO. The CEMP provides the public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

In 2020, 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 tritium. EM Nevada Program issued a 7-year grant to Nye County to monitor tritium annually in 10 wells downgradient from the NNSS in the first year and up to 20 wells annually thereafter. 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 2020. 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.



2020 CEMP and Nye County Water Monitoring Locations

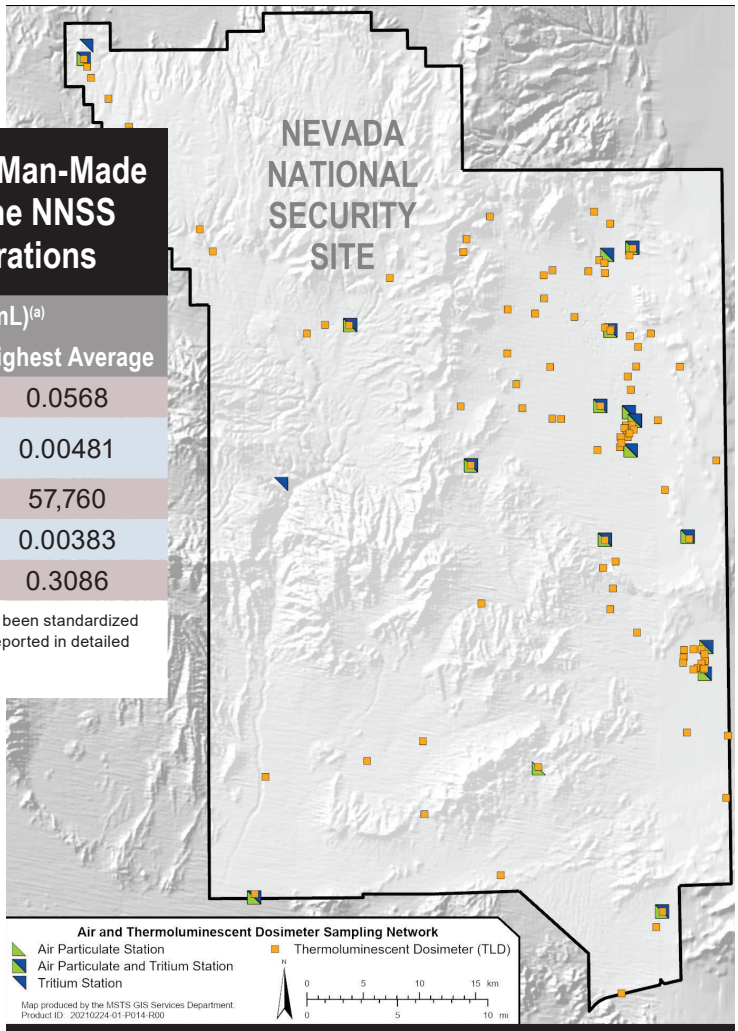
Radiological Monitoring of Air

Range in Average Concentrations of Man-Made Radionuclides in Air Samples on the NNSS in 2020 Attributable to NNSS Operations

Radionuclide	Concentration (10^{-15} µCi/mL)[a] Limit[b]	Lowest Average	Highest Average
^{241}Am	1.9	-0.00005	0.0568
^{137}Cs	19	-0.00374	0.00481
^{3}H	1,500,000	-60	57,760
^{238}Pu	2.1	-0.00319	0.00383
$^{239+240}$Pu	2.0	0.00013	0.3086

(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.



2020 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 19 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 used in 2020 (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 TLDs, gamma radiation exposure rates using pressurized ion chamber (PIC) detectors, and meteorological (MET) parameters using automated weather instrumentation.

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Several man-made radionuclides were detected at NNSS air sampling stations in 2020: none exceeded concentration levels established by the Clean Air Act. The highest average levels of ^{241}Am were detected at the Plutonium (Pu) Valley station in Area 11, ^{238}Pu at the DoD station in Area 5, and $^{239+240}$Pu at the Pu Valley station, 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 three samples during the second quarter at levels from 14.7% to 33.6% above their MDCs.

Estimated Quantity of Man-Made Radionuclides Released into the Air from the NNSS in 2020 (in Curies)

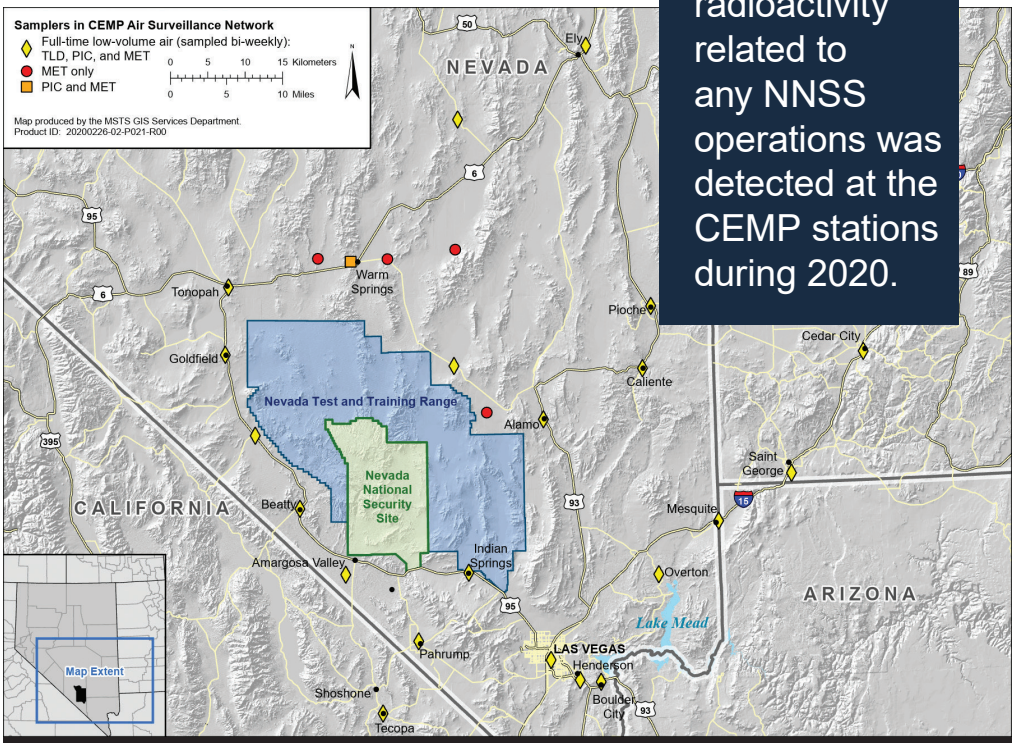
	Tritium (^{3}H)	Americium (^{241}Am)	Plutonium (^{238}Pu)	Plutonium ($^{239+240}$Pu)	Noble Gases	Other Radionuclides	
	60.82	0.070	0.039	0.29	106	0	25.4
Half-life*	12 years	432 years	88 years	>6,500 years	<11 years	<3 hours	>3 hours

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

CEMP air monitoring station located in Cedar City, Utah.

The total amount of man-made radionuclides emitted to the air was estimated to be 193 Ci. All radionuclides detected by environmental air samplers in 2020 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 2020.



2020 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 2020, the mean measured background level from the 10 stations was 121 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.

The CEMP offsite TLD and PIC results remained consistent with previous years' background radiation levels and are also well within the range of variation in background levels observed in other parts of the U.S. and with the 121 mR/yr level measured on the NNSS. The highest annual gamma exposure measured off site, based on the PIC detectors, was 173 mR at Warm Springs Summit, Nevada. The lowest offsite exposure rate, based on the PIC detectors, was 75 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

2020 NNSS Background Gamma Radiation

121 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 2020 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	200
Las Vegas, Nevada CEMP PIC station	2,030	92
NNSS – 17 Waste Operation TLD stations	3,176–4,021	139
NNSS – 10 Background TLD stations	2,755–5,938	121
Bloomington Hills, St. George, Utah CEMP PIC station	2,706	125
Pahrump, Nevada CEMP PIC station	2,639	75
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

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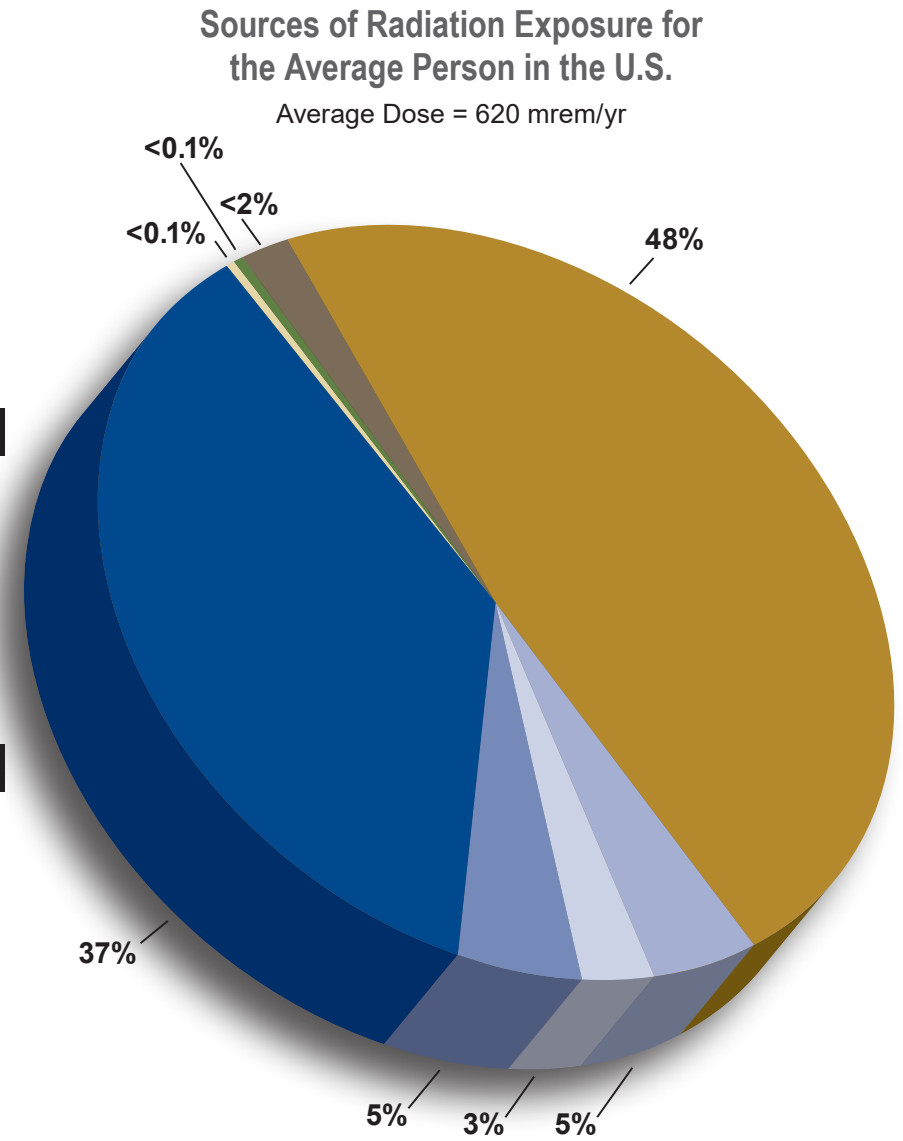
Man-made Sources

- Industrial
- Occupational
- Consumer products
- Medical diagnostic procedures

Natural Background Sources

- Internal
- Terrestrial
- Cosmic
- Radon and thoron



scientifically, regulators take 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.

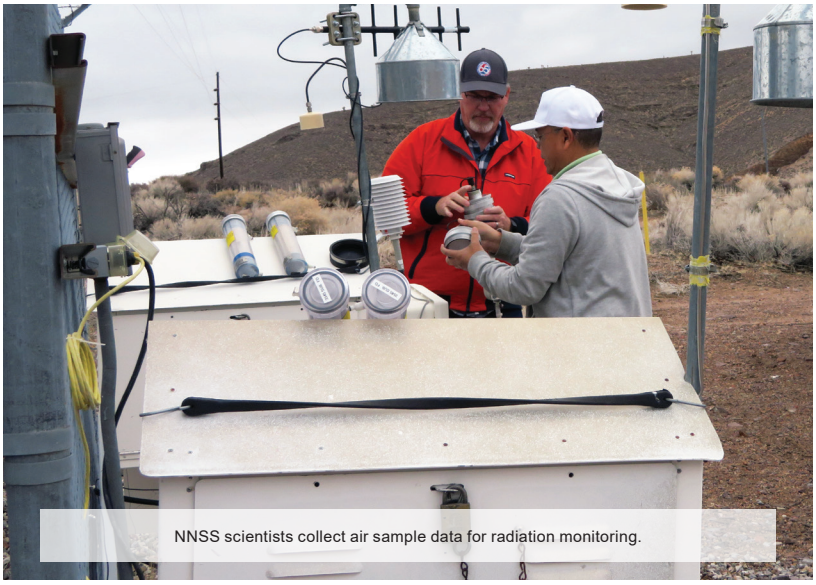
Estimating Dose to the Public from NNSS Operations

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 2020 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 2020 NNSS source were modeled using the Clean Air Package, 1988 model from EPA. The highest value is predicted to be a person residing in Amargosa Valley and received a predicted dose of 0.063 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

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harvested and 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 mSv) 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 2020.

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 2020, tissue or blood samples were collected from three jackrabbits from the Sedan site (Area 10), two cottontail rabbits from the control location (Area 16), one composite small mammal sample each from the Area 3 RWMS ax/bl Cover and its control location (treated as surrogate jackrabbit samples in the dose calculations), one composite small mammal sample each from the Area 5 RWMC 92-Acre Area cover and its control location (also treated as surrogate jackrabbit samples in the dose calculations), one feral burro killed by a vehicle in Area 5 (treated as a surrogate mule deer sample in the dose calculations), five mule deer that were all study animals fitted with GPS collars in 2019 (one died from unknown cause, three died from predation, and one was taken by a hunter), three pronghorn, one

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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, and no drinking water wells on the NNSS have measurable levels of man-made radionuclides.

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 to contaminated soil or water on the NNSS, have moved off the NNSS, and have then been hunted.

NNSS scientists collect plant samples at Cane Springs.

killed by a vehicle in Area 1 and two study animals fitted with GPS collars in 2019 (one that died from a predation attack in Area 14 and one that died from unknown cause in Area 1). Based on data from these samples, an individual who consumes one animal of each sampled species from each location may receive an estimated dose of 1.0 mrem based on the averages. To put this dose in perspective, it is about the same dose received from naturally occurring cosmic radiation during a 2-hour airplane flight at 39,000 feet. Consuming 35.4 kg of meat with concentrations observed in the burro sampled in Area 5 would result in a dose of 0.49 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 2% of limits set to protect populations of plants and animals.

The 2020 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

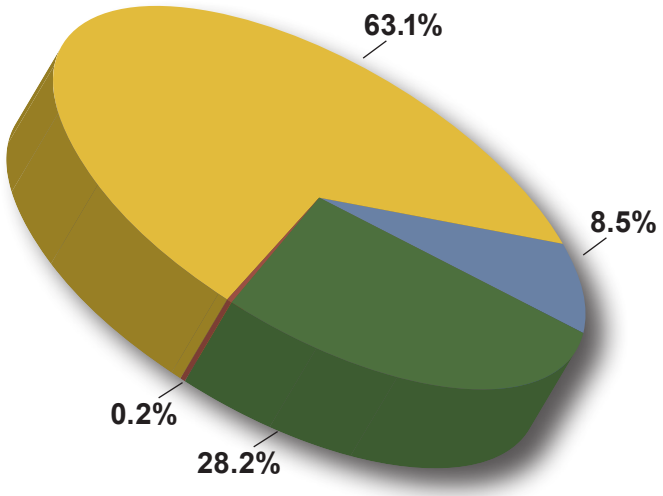
No members of the public are expected to receive direct gamma radiation that is above background levels as a result of NNSS operations. Areas accessible to the public, such as the main entrance gate, had direct gamma radiation exposure rates comparable to natural background rates from cosmic and terrestrial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



- Dose from cosmic and terrestrial radiation at Indian Springs, 102.1 mrem/yr
- Dose from inhalation of decay products from natural radon, 229 mrem/yr
- Dose from natural radionuclides in body, 31 mrem/yr
- Dose from NNSS emissions to air and consumption of wildlife, 0.55 mrem/yr

2020 Dose to the Public from All Pathways

0.55 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 4.92 tons of criteria air pollutants and 0.01 tons of HAPs were released on the NNSS in 2020. The majority of the emissions were volatile organic compounds. No emission limits for any air pollutants were exceeded.

Estimated Quantity of Pollutants Released into the Air from NNSS Operations in 2020

Criteria Air Pollutants:	Tons
Particulate Matter[a]	0.20
Carbon Monoxide	0.10
Nitrogen Oxides	0.34
Sulfur Dioxide	0.02
Volatile Organic Compounds	4.26
Hazardous Air Pollutants (HAPs)	0.01

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

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 2020 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.

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 2020 for biological oxygen demand, pH, and total suspended solids. All sewage lagoon water measurements were within permit limits.

NNSS Drinking Water

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

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, with the exception of the Manganese result from the ER-12-1 well sample, were within the threshold limits. The exceedance was reported as required by the permit.

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 is implemented by DRI to meet this requirement.

In 2020, 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 266 acres and identified/recorded 27 cultural resources, 25 of which were determined to be eligible for the National Registry of Historical Places (NRHP). Documented cultural resources consist of prehistoric and historic sites, buildings, and structures. 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 2020, DRI completed an inventory for the proposed expansion of the U1a modernization project in Area 1 of the NNSS. The U1a Complex is an underground laboratory used for subcritical and physics experiments. The inventory area totaled 138 acres DRI documented two newly recorded resources, both World War II (WWII) training targets associated with the Tonopah Bombing and Gunnery Range and WWII military training in southern Nevada. One of the air-to-ground gunnery targets was determined eligible to the NRHP for its association with the Tonopah Bombing and Gunnery Range and WWII military training in southern Nevada.

DRI conducted an architectural survey for the identification and evaluation of 14 resources scheduled for demolition in the Area 6 Control Point and in its vicinity. Eight historic properties scheduled for demolition are either individually eligible for listing on the NRHP or are contributing accessories to historic properties. Six resources are NRHP eligible as contributing elements to the unrecorded historic district.

Tribal participants in front of Big Hole drilling bits at the Area 1 Subdock yard

An archaeologist recording the EMAD main Control Room

Other important Section 106 projects included the architectural surveys of two buildings located in the Area 1 Subdock. These buildings are proposed for removal and were documented and evaluated for eligibility for the NRHP. The Subdock Office Building and the Drilling Operations Building are both associated with big hole drilling that supported nuclear testing activities from 1985 to

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1992. Although not individually eligible to the NRHP, the buildings are contributing resources to the unrecorded Area 1 Subdock Historic District and their demolition will result in an adverse effect to the district.

At the end of 2020, the U.S. Department of Energy and the Nevada State Historic Preservation Office executed a Memorandum of Agreement (MOA) regarding corrective actions and demolition of the Engine Maintenance Assembly and Disassembly Facility (EMAD) and the Test Cell C Historic District. EMAD and Test Cell C are major components of the Nuclear Rocket Development Station (NRDS). Per the MOA, DRI completed an architectural survey of the NRDS for a historic district National Register evaluation.

Tribal participants at the Geoglyph Site during an NNSS field visit

Pursuant to Section 110 of the NHPA, DRI evaluated three sites in Area 5 associated with the Grable Test, or event. Grable was the first and only firing of a nuclear projectile in a U.S. Army tactical nuclear weapon system. This system, commonly referred to as Atomic Annie or the Atomic Cannon, was the first of its kind. This recording focused on the main firing site; one of seven outlying observation stations; and the troop trenches used for Exercise Desert Rock V. Both the main firing site and the troop trenches are eligible for the NRHP at the national level of significance related to the Nuclear Testing and Cold War era. All three resources are contributing elements to the Frenchman Flat Historic District.

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, in 2020, DRI completed research, building surveys, and required mitigation documentation for the Craft Shops Building, the Power and Communications System, the Bus Parking Lot, the Mercury Street System, the Mercury Stormwater Drainage System, and the Electrical (Tap and Meter) Substation Foundation.

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.

NNSA/NFO's American Indian Consultation Program (AICP) serves to facilitate government-to-government consultation with 16 Tribes culturally affiliated with 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 2020 NNSA/NFO supported the goals of the AICP by:

- interacting with the AICP Coordinator to identify topics of interest and enhance communications with Tribal representatives
- participating in the annual Tribal Update Meeting, which assembles Tribal representatives from the 16 culturally affiliated Tribal governments. Note: due to the COVID-19 pandemic the 2020 meeting was cancelled.
- participating in Tribal Planning Committee meetings
- supporting two NNSS visits to the Ammonia Tanks site, the Petroglyph and Power Rock site, the Mushroom Rock site, and the Geoglyph and Arch site
- continuing to support a tribal revegetation project at the Area 5 RWMC.

In 2020, 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, 241 birds, and 23 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. In 2020, no desert tortoises were accidentally injured or killed at a project site, nor were any found, captured, or displaced from project sites. There were 41 sightings of desert tortoises on roads on the NNSS. Of the 41 sightings, two were roadkills, one was a predation, and 32 of the tortoises, thought to be in harm's way, were moved.

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 2020, 18 of the 60 juveniles were still alive.

In 2020, biological surveys for the presence of sensitive and protected/regulated species and important biological resources on which they depend were conducted for 34 projects. A total of 364 acres were surveyed for these projects. Some of the sensitive species and important biological resources found included three sensitive plant species, burrowing owl habitat, western red-tailed skink habitat, Joshua trees, Mojave yucca, pine trees and many cactus species.

Surveys of sensitive and protected/regulated animals in 2020 focused on birds, bats, feral horses, mule deer, pronghorn antelope, desert bighorn sheep, and mountain lions. Field surveys for sensitive plants were conducted for Cane Spring suncup, Clarke phacelia, Kingston Mountain bedstraw, Pahute Mesa beardtongue, Sanicle biscuitroot, Weasel phacelia, and white bearpoppy.

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 and tracking transmitter

NNSS biologists found feral horse distribution was similar in 2020 to 2019 with concentrated activity around Camp 17 Pond and Gold Meadows Spring especially during the hot, dry summer months. With monitoring limited to opportunistic observations and data from camera traps, a total of 21 individuals were identified including three juveniles and five foals.

Eighteen pronghorn and 23 mule deer were captured and collared in 2019 and 16 antelope and all 23 mule deer continue to be tracked to determine distribution, abundance and range.

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 2020, the Energy Management Program completed the fiscal year (FY) 2021 NNSA/NFO Site Sustainability Plan, which reported the 2020 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.

Energy Efficiency and Management

- Energy intensity (energy use per square foot of building space) increased 4.51% above the FY 2015 baseline – the goal is a 30% reduction from the baseline by FY 2025.
- Based on a 2019 assessment of appropriate buildings, 81% of buildings are metered for electricity, 93% for natural gas, 0% for chilled water, 30% for potable water, and 0% for Chiller water – the goal is for all individual buildings to be metered where cost-effective and appropriate. Continued working toward the goal: 2 water meters were installed.
- 42 energy audits/assessments were conducted – meeting the goal to ensure that all eligible facilities under Section 432 of the Energy Independence and Security Act are assessed once every 4 years. Efficient Mobile Audit Technology was used in the field and allowed the successful upload of facility information, pictures, and notes.

Water Efficiency and Management

- Water intensity (gallons used per total gross square feet [gsf] of facility space) was 35.47% below the FY 2007 baseline – the FY 2020 goal was met, however, there was a gradual increase in water usage due to site activities.
- Non-potable water production was 113% above the FY 2010 baseline.

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

Fleet Management

- Use of alternative fuel was 159% above the FY 2005 baseline – exceeds the goal of a 10% increase above the FY 2005 baseline by FY 2015, maintaining a 10% increase thereafter.
- Use of petroleum was 73% less than the FY 2005 baseline – exceeds the goal of a 20% decrease from the FY 2005 baseline by FY 2015, maintaining 20% reduction thereafter.
- 96.60% (824) of all light duty vehicle purchases were alternative fuel vehicles – exceeds the goal of 75%.

Clean and Renewable Energy

- "Renewable Electric Energy" requires that renewable electric energy account for not less than 7.5% of a total agency electric consumption by FY 2013 and each year thereafter. The current status is 4% from a combination of solar energy, off-grid solar, and purchased Renewable Energy Credits..

Pollution Prevention and Waste Minimization

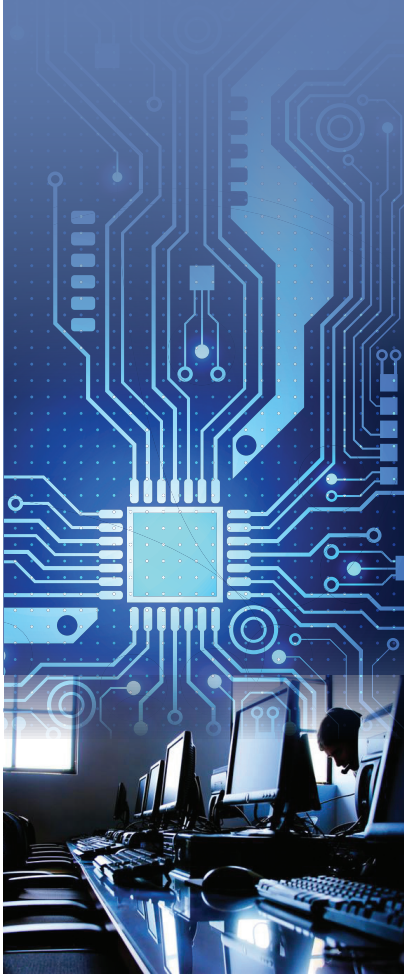
- 33% of non-hazardous solid waste generated at NNSA/NFO facilities was diverted from landfills – the goal is 50%.
- 5% of construction materials were diverted from landfills – the goal is 50%.

High Performance Sustainable Buildings (HPSBs)

- There are 13 facilities of NNSS building inventory totaling 441,378 gsf that are HPSB certified, meeting the goal that at least 15% (by count) of owned existing buildings are compliant with the revised Guiding Principles for High Performance Sustainable Buildings (HPSBs) by FY 2020, with annual progress thereafter.

Electronic Stewardship and Data Centers

- 100% of electronic equipment that passed excess screening criteria were sold for reuse for their original intended use or e-recycled.
- The data center Power Utilization Effectiveness goal of less than 1.5 for existing data centers was not met.



Greenhouse Gas (GHG) Emissions

- FY 2020 Scope 1 and 2 GHG emissions were 52% lower than the FY 2008 baseline – the goal is a 50% reduction by FY 2025.
- FY 2020 Scope 3 GHG emissions were 71% less than those of the FY 2008 baseline – on track to meet the goal of a 25% reduction by FY 2025.

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.

Climate Change Resilience

- Regional risks to NNSA/NFO facilities are flooding, wildland fires, facility power and water supply disruptions, and extreme weather events. Program and site evaluations are conducted, policies and procedures updated, and areas for improvement identified to ensure that NNSA/NFO missions and activities are resilient to climate change in accordance with the goals of DOE's Climate Change Adaptation Plan.

Green Awards and Outreach

Mercury Modernization and E-Recycling

The NNSS received two awards in 2020:

1 The **NNSS Asset and Material Management Team** received the 2020 Department of Energy Sustainability Award for Strategic Partnership in the Sustainability category for their e-recycling efforts with the Blind Center of Nevada. One hundred percent of used electronic equipment was either sold for reuse for their original intended use or recycled with Blind Center of Nevada or other services and was diverted from Las Vegas landfills. In addition, approximately 270 items valued at $830,000 were transferred to other groups or directorates instead of purchasing new materials or products.

2 The **Mercury Modernization Building 1 Team** received an NNSA Excellence Award in June 2020. The team "exemplified teamwork and collaboration to overcome obstacles…and delivered the first new construction net-zero energy facility within the NNSA complex." Building 23-460 also achieved both green building goals of Leadership in Energy and Environmental Design Gold certification in April 2020 and HPSB certification through the Green Business Certification, Inc. third party process in November 2020.

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2020 Sustainability and Outreach Events

Earth Day events in 2020 included a major milestone celebration with its 50th year Anniversary. Due to the COVID-19 pandemic, the NNSS Sustainability Program, Health and Productivity, and DOE Headquarters collaborated to offer employees the opportunity to celebrate the 2020 50th Earth Day virtual activities from home. The Earth Day activities included a month-long Earth Day Mile challenge where employees joined with other participants from across the world to collectively walk or run 24,901 miles, which is equivalent to the circumference of the earth at the equator; by the end of the challenge, participants logged a total of 51,023 miles. Other Earth Day activities included a Zero Waste Countdown podcast, a Sustainability Treasure Hunt, along with attending the Smithsonian Garden virtual tours.

Earth Day 2020

Activities for **Energy Action Month** in October included a Lunch and Learn event on recycling co-hosted by a speaker from the local recycling company, Republic Services, an e-waste recycling event and a water bottle challenge. Through these annual employee outreach events, along with the site's quarterly participation with Safe Nest, site employees managed to divert a total of 2,290 pounds of clothing items and 175 pounds of e-waste from the landfill. These two major outreach activities continued the efforts to provide NNSS employees with educational opportunities on how to embrace and integrate sustainability into their day to day activities while still working from home.

Document Availability

Available for sale to the public from:

U.S. Department of Commerce
National Technical Information Service
5301 Shawnee Road
Alexandria, Virginia 22312

Phone: **1-800-553-6847**
Fax: **(703) 605-6880**
E-mail: **info@ntis.gov; customerservice@ntis.gov**
Downloadable (no charge) at: **https://classic.ntis.gov/search/**
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Available, in paper, for a processing fee to the U.S. Department of Energy and its contractors from:

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Phone: **(865) 576-8401**
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E-mail: **reports@osti.gov**

The information presented in this document is explained in greater detail in the ***Nevada National Security Site Environmental Report 2020*** (DOE/NV/03624--1210). A compact disc of this document is included on the back inside cover. This document can also be downloaded from the U.S. Department of Energy, National Nuclear Security Administration Nevada Field Office at **http://www.nnss.gov**.

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