WHAT IS THE NATIONAL NUCLEAR SECURITY SITE/NEVADA TEST SITE?

A BRIEF HISTORY

The National Nuclear Security Site (NNSS) is a land area of approximately 1,360 square miles (larger than the state of Rhode Island) and is one of the largest restricted access areas in the United States. The December 13, 1950 meeting of the Atomic Energy Commission approved the Nevada Test Site as a continental nuclear weapons proving ground, but only for emergency uses. Over 100 Shoshone families were removed from their traditional lands with no compensation.

However, the “emergency” was quickly justified by the invasion of North Korean troops into South Korean territory. On January, 21, 1951, a month after the AEC meeting, in a test code-named Able, a two kiloton atomic bomb was airdropped to the floor of the Nevada desert at the Las Vegas-Tonopah Gunnery Range, marking the first of five atomic tests conducted that spring and the first of over one thousand tests eventually conducted there. The U.S. War Department (now Defense Department) deemed it necessary for a domestic nuclear weapons testing location. The operation to determine a continental location for nuclear weapons testing is documented in the “Nutmeg” papers, which reveal a process in which stated safety criteria for site selection gradually gave way to unstated sociological and political criteria. Despite assurances from the government about the lack of danger to the general public the Nevada Test Site was chosen because its populations were politically powerless and its landscape was judged expendable, not because it was the safest area in terms of fallout risks. However, there were and remain populations “downwind” of the site, which were impacted by radioactive fallout.

CURRENT ACTIVITIES

Weapons design and development was and remains primarily the responsibility of the U.S. national laboratories primarily at Los Alamos New Mexico (birthplace of the first nuclear weapon). The NNSS (Nevada Test Site) has been
the proving grounds taking the brunt of the environmental and human health impacts; however, fallout affected people far beyond the boundaries of the Nevada Test Site.

From 1951 to 1962 100 atmospheric nuclear explosions occurred at the Nevada Test Site with an overall explosive power of ~1,327 kt (1 kt = 1,000 tons TNT equivalent) and releasing millions curies (a curie is a unit of activity, representing 37 billion radioactive particles per second) of radioactivity into the atmosphere. In 1963 the US government signed the Limited Test Ban Treaty, which ended ground and air nuclear explosions, but nuclear weapons explosions testing continued underground until 1992, when President Bush announced a nuclear test moratorium. President Clinton continued the moratorium and on September 24, 1996, signed the Comprehensive Nuclear Test Ban Treaty which prohibits “any nuclear weapons test explosion” by any State Party; however, this treaty has yet to be ratified by Congress. The below ground testing resulted in 828 underground tests, (consisting of 921 weapons detonations) releasing in excess of 132 million curies (from 1994 inventory) of radioactive particles; some within the groundwater.

Current activities at the Nevada Test Site (NTS) still revolve around weapons experimentation. The primary mission of the NNSS is to support “nuclear weapons stockpile reliability through subcritical experiments.” This means to assure that US nuclear weapons can deliver the explosive power expected without failure. To do so “special nuclear materials” such as plutonium are needed in a variety of experiments to verify computer modeling and enhance the understanding of these materials under the physical condition leading up to a nuclear explosion (conditions just prior to criticality, so subcritical). The Nevada Test Site remains an integral part of the U.S. nuclear weapons complex and in the development of new nuclear weapons.

The Nevada Test Site also serves as a waste disposal site, which includes low-level radioactive waste (LLW), mixed low-level radioactive waste (MLLW), transuranic (TRU) waste, mixed TRU waste, hazardous waste, asbestos and polychlorinated biphenyl (PCB) wastes, hydrocarbon-contaminated soil and debris, and solid wastes such as construction debris or sanitary solid waste. Some of this waste is generated on-site, but the preponderance is from other government facilities transporting waste to the NTS since 1997. These shipments vary in radioactivity considerably and have amounted to about 18 million cubic feet from 2000 through 2010 to date. An average of 1,550 (this figure varies widely) shipments per year have been arriving at the Nevada Test Site truck using route shown to the right and is dumped in unlined trenches at the Nevada Test Site. A independent technical review in 2008 has recommented DOE “review the merits of both lined and unlined landfills for future applications at NTS.”

In addition the Nevada Test Site supports other research, development, and testing programs related to national security. In addition it provides opportunities for various environmental research projects including the development of commercial-scale solar energy systems, as well as innovative solar and other renewable energy technologies.

**Historical Radioactive Contamination**

There are three main sources of radioactive contamination from the nuclear testing period (1951 – 1992): 1) above ground weapons tests, below ground weapons tests, and safety tests. The above ground tests resulted in enormous
amounts of air borne radioactivity, which then fell out over “downwind” areas often as far away as New York state. In 1997 the National Cancer Institute and national Institutes of Health published fallout maps for radioactive Iodine-131 and dose estimates. These maps yield a sense of the scope of impact from the above ground testing period. Scores of other kinds of radioactive particles were released as well, some disintegrating almost immediately, but others persist today.

The below ground tests have created pockets of radioactive rock where the nuclear explosion occurred, and for those tests conducted below or at the groundwater level some radioactivity has migrated into the groundwater. The full extent of this is still not clear. Safety tests, which used depleted uranium and plutonium as tracers, did not involve nuclear explosions but rather high explosives that spread large amounts (in terms of the toxicity of uranium and plutonium) in the Nevada desert. These tests were done in the northern most portion of the Nevada Test Site and just north in the Nevada Test and Training Range, and the Tonopah Test Range.

**SURFACE CONTAMINATION**

The Nevada Test Site has a “Soils Program” to determine the extent of surface contamination and develop mitigation plans for these areas, which may involve soil removal. There are approximately 100 radioactive soils sites, where the hot spots have been from the safety tests, “plowshares” test (Sedan Crater area), and some above ground test areas. An estimated 20-25 million cubic feet of plutonium contaminated soil exists at the NTS (prior to 2006) and the adjacent Tonopah Test Range. However, extent to which these areas have been cleaned up is unclear. The figure to the right indicates locations of the radioactive soils sites.

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It is estimated by NNSA/NV that about 3,000 acres is contaminated with plutonium at levels in excess of 40 pCi/g (with some areas in excess of 12,000 pCi/g) due to the safety tests. In a 2003 document all of the safety tests areas were to have been cleaned up by 2006 to a “target level” of 200 picograms plutonium per gram of soil (a picogram is one-trillionth of a gram). While this level seems very small it is still 4 times the clean-up level for Rocky Flats. Over time some of the longer lived radioactive particles have been taken up by plants in the area or concentrated in drainage gullies. In any event the recent Site Wide Draft Environmental Impact statement for the NTS does not clarify if these sites have been cleaned up, but does state a target date of 2022 for all the soils sites to be “closed.” Unfortunately, DOE does not provide the level of clean-up that is associated with a closed site in its general documents for public information.

**Groundwater Contamination**

Currently the greatest risk to the public is the contamination of the groundwater from the numerous underground nuclear explosions. Of the radioactive atoms, tritium (radioactive hydrogen) has been identified as the most likely to present a public health threat. It is the tests conducted at Pahute Mesa (see map on following page) that are nearest to the boundary of the Nevada Test Site and where groundwater is flowing in the direction of drinking water wells. Tritium detected in 2009 at the off-site well ER-EC-11 at a level of 12,000 picocuries per liter (60% of the EPA standard), which is about 11 miles from the nearest drinking water wells. The half-life of tritium is about 12.3 years, which means that it will remain in the environment and a potential hazard for about 200 years. The plan of the Dept. of Energy (DOE) has been to monitor groundwater and supply replacement water if the tritium reaches drinking water sources. The only other method of remediation is to install a series of pump-back wells inside the boundary of the NTS to prevent the tritium from traveling off-site. This procedure has been done in other places, and it is very expensive. DOE has not suggested this kind of action, and most likely considers it to be infeasible. Although to reach such a conclusion it is necessary to know the scope of the tritium plume, which DOE has not revealed to date.

In addition to tritium is a whole host of other radioactive isotopes (types of atoms) have the potential to migrate in the groundwater. When an underground nuclear explosion occurs a large amount of the rock is liquefied, and as a liquid the rock takes up less space. Once the test area cools the liquefied rock solidifies in a “glass ball” leaving a large air space above it, which typically collapses to some extent, leaving what is called a “subsidence crater” on the surface. It has been assumed that most of the radioactive atoms are trapped in the “glass ball,” with tritium and a few other radioactive isotopes leaching out over time. So, DOE remains focused almost entirely on tritium as a public health risk. Yet there is data that other isotopes have migrated out of these nuclear explosion areas (test shots). Most notable was the appearance of plutonium 1.3 kilometers from the “Benham” test shot in Pahute Mesa in ~30 years, reported in 1999. Up to that point it had been assumed that plutonium could not travel in the ground water at that rate, but there is a mechanism previously not considered involving microscopic clay particles that “taxied” the plutonium. Plutonium like other radioactive isotopes such as cesium-137 may be a greater long-term threat since they have much longer lifetimes (plutonium-239 has a half-life of 24,000 years, and cesium-137 30.1 years, so hazard life times of about 200,000 to 300,000 and 300 to 400 years respectively).
The first formal work to understand groundwater contamination began around 1972 with the EPA’s Long Term Hydrological Monitoring Program (LTHMP), DOE, Nevada Operations Office, and later in 1989 the Underground Test Area Project (UGTA) was created. According to the DOE, “The UGTA program evaluates the extent of radionuclide groundwater contamination due to past underground nuclear testing through hydrogeologic investigation and characterization, groundwater flow and transport modeling, and groundwater sampling and monitoring.” This has not included the full characterization of the radioactive isotope plume from a single underground nuclear explo-
sion. It has been assumed that “exclusive of tritium, much of the radioactivity released during an underground nuclear test remains confined in the melted and fused rock in the detonation cavity, particularly the refractory isotope species, such as plutonium, rare earth elements, zirconium, and alkaline earth elements.” To our knowledge the DOE has only within the past few years been directly testing this assumption, and only for one test area, Yucca Flat. Differences in water chemistry and the geologic formations surrounding test shots could lead to variations in the leaching of radioactive isotopes, so each unique hydrogeologic system should be analyzed for radioactive isotope migration. The ER-EC-11 well (where tritium was found above background levels) is stated to be along a groundwater “flow path.” Does this mean that there is a tracking from a specific test shot, or is the flow-path more general? The bottom line is that with the exception of radioactive hydrogen (tritium) there is little data (or at least data that is publically available) on the extent of radioactive contamination in the ground water in and around the underground test areas. Lacking knowledge of the extent of migration of radionuclides from underground test shots points to a lack of complete understanding of the future risk to the public. The groundwater monitoring network maybe sufficient, but DOE needs clarify that is known and what is unknown.

**Aspects Of The NTS To Consider**

- There are many aspects to consider about this vast area of land, given it’s complex history, range of conditions and the very varied government programs that are conducted there. For example, there are large tracts of land particularly on the west side of the NTS that are not contaminated and could be returned to the public. Due to the limited human intrusion into these areas, wilderness designation is likely to be appropriate and would preserve the lands.
- Should uncontaminated lands be returned to the public and local tribes when possible?
- Is the existing mission(s) of the NTS in line with your values?
- Which programs do you think are of greatest benefit to the public?
- Should there be a greater emphasis on clean-up of contaminated areas?

**Additional NNSA/DOE Information That Could Assist the Public’s Understanding**

- Clearly identify surface contamination at the NTS, areas to be cleaned-up, and to what level.
- Create maps of the extent of groundwater contamination, including identification of radioactive isotopes.
- Identify uncontaminated areas of the NTS and discuss the potential to return these areas to public use.
- Disclose the level of radioactivity and radioactive isotope breakdown in waste shipments to the NTS.
- Analyze and disclose the merits of lined versus unlined trench nuclear waste disposal at NTS.

**General Information Sources**

**NNSA/DOE:**
http://www.nv.doe.gov
P.O. Box 98518
Las Vegas, NV 89193-8518
702-295-3521

**Nevada Division of Environmental Protection**
**Bureau of Federal Facilities**
http://ndep.nv.gov/boff
2030 E. Flamingo Rd. Suite 230
Las Vegas NV 89119
(702) 486-2850; FAX 486-2863
STATE OF NEVADA

Nevada Agency for Nuclear Projects
http://www.state.nv.us/nucwaste/
nwpo@nuc.state.nv.us
1761 E. College Parkway, suite 118
Carson City, NV 89706-7954
(775) 687-3744; FAX 687-5277

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http://www.h-o-m-e.org
http://healingourearth.org/wordpress/

7. National Cancer Institute, National Institutes of Health, Estimated Exposures and Thyroid Doses Received by the American People from Iodine-131 in Fallout Following Nevada Atmospheric Nuclear Bomb Tests, October 1997.
8. Depleted uranium is mostly uranium-238 called depleted since the uranium-235 is mostly exhausted. Uranium-238 is much less radioactive than the 235 isotope and poses a very small radiation hazard, but is still very toxic as a heavy metal.
11. pCi is a pico curie, which represent 37 radioactive particles emitted per second.
13. In general the clean-up level for NTS locations is based on an annual dose of 100 mrem (millirem), which is roughly equivalent to 10 chest x-rays.

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