A SOIL CONTAMINATION SURVEY OF TIMBISHA SHOSHONE TRIBAL LANDS WITHIN CLOSE PROXIMITY TO THE NEVADA TEST SITE

TUPIPPUH PROJECT
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INTRODUCTION

The Citizen's Monitoring and Technical Assistance Fund, or MTA Fund, was established as the result of a 1998 court settlement between DOE and 39 non-profit peace and environmental groups. The fund oversees $6.25 million which was set aside "to provide monies to eligible organizations to procure technical and scientific assistance to perform technical and scientific review and analyses of environmental management activities at DOE sites" and disseminate the results of these studies.

Because this funding was available to non-profit, non-governmental organizations and tribes to conduct independent research, raise the consciousness of communities in the area, and to promote environmental justice, the Tupippuh Project, a non-profit Western Shoshone organization, applied for and was awarded funding (www.mtafund.org).

Tupippuh Project

The Tupippuh Project (PO Box 108, Death Valley, CA 923328) consists of members and descendents of the Western Shoshone Nation's Timbisha Shoshone People whose traditional homeland includes the area that is now the vicinity of Death Valley National Park, CA and north including Beatty, NV and Lida, NV. This was part of the land base delineated by the boundaries set forth in the 1863 Treaty of Ruby Valley between the people and government of the United States and western bands of Shoshone.

The mission of the Tupippuh Project is to preserve and strengthen traditional Western Shoshone cultural values for future generations. The elders of the Project are helping to revitalize Timbisha Shoshone lifeways and to recover the language of the Timbisha people. Toward this goal, the Project leads educational programs that encourage the culturally appropriate use and management of their land's fragile ecosystem. They are re-establishing native plants and mesquite trees as part of their effort to restore the natural environment, and they are investigating the health of traditional wildlife like the chuckawalla and big horn sheep.

The homelands of the Timbisha Shoshone – including Scotty's Junction, Death Valley Junction, Lida, Death Valley and Centennial -- are close to the Nevada Nuclear Weapons Test Site (NTS). Some parcels, lying to the south and west of the NTS are about 60 miles from detonation sites. Because the U.S. Department of Energy (U.S. DOE) models have shown that radioactive clouds traveled mostly north and southeast, the Western Shoshone have never been included in the list of "downwinders." Despite 100 atmospheric nuclear tests and 928 underground nuclear tests, soil and vegetation from the Timbisha Homeland has never been tested for the presence of radionuclides.

The objectives of this study were: 1) to perform soils analyses of the parcels to determine if radioactive contamination is present; 2) to conduct interviews with elders who may have relevant knowledge of contaminant pathways in the soil, air, plants, and wildlife during the nuclear era; 3) to gather, review and analyze available scientific reports, evaluations, special studies and projected contamination patterns and models of NTS contamination; 4) to collaborate with the Yomba Shoshone Tribe of Nevada's monitoring initiative, by sharing information and equipment; 5) to develop a final report for the project, which will include the results of the archival research, elder interview summaries (with confidentiality restrictions), soil contamination survey results and analyses; and 6) to disseminate the results of this report to tribal members, tribal governments and organizations, and public and private organizations with a vested interest in this region or this subject matter.

BRIEF HISTORY OF THE WESTERN SHOSHONE

For thousands of years, the Western Shoshone lived a nomadic hunter-gatherer lifestyle in the Great Basin desert, traveling between present day Idaho, California, Nevada, and Utah, hunting wild game and harvesting the pine nut of the pinyon tree, a dietary staple, as well as other plant foods and medicines (Clemmer, 1972). After 1850 more and more Anglos appeared on Western Shoshone traditional lands, passing through on their way to California where gold had been discovered. With them came small pox, tuberculosis, and other diseases which ravaged the Western Shoshone. The settlers destroyed many of the traditional hunting areas, and frequent hostilities arose.

Because the US was in the midst of the Civil War and needed gold from the west, the cost in money and manpower to defend against the Shoshone attacks was expensive. Therefore in 1863 the United States negotiated a Peace and Friendship treaty with the Western Shoshone, guaranteeing safe passage of whites with their trains and wagons and the allowance of a fort and settlements to be developed around small gold and silver mines. The treaty was unique in that it ceded no land, but only permitted safe passage through the land. The treaty clearly delineated the boundaries of the Western Shoshone Nation. The boundaries of Newe Sogobia (the Western Shoshone Nation) extend throughout most of eastern Nevada, parts of Idaho, Utah, and into California to the Mojave Desert (See Map 1).

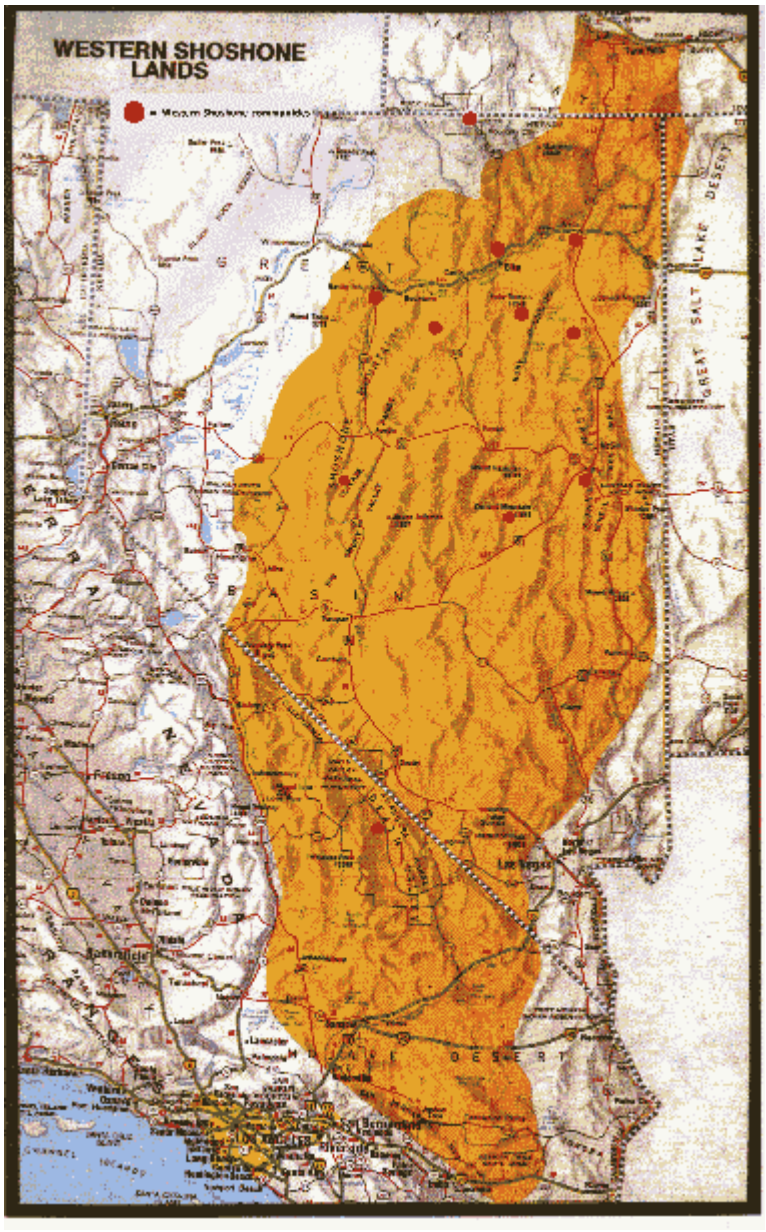
By the turn of the century much of the Western Shoshone land was devastated by the large number of settlers. Pinyon forests were cut down for use in mining and smelting operations. Wild life was destroyed by hunters and trappers. Round-ups and forced marches killed many of the young and elderly. The treaty, still in effect, was ignored by the US government and its citizens. To this day the U.S. government, despite frequent court challenges, has never been able to find specific documentation on how they gained control of the land, how they overturned a ratified treaty without the consent or knowledge of the people.

Starving, some Western Shoshone had moved near ranching and mining settlements to work for Anglos. Taking advantage of this situation, the US began to assert more control over Western Shoshone families. In the late 1920's and 1930's, using the Indian Reorganization Act, the federal government urged the formation of tribal governments on what they deemed as land held in federal trust. Although no reservations were ever established in Nevada as provided by the Ruby Valley Treaty of 1863, small parcels claimed illegally by the US government as "trust lands," came to be commonly referred to as reservations. This was done without the consent of the Western Shoshone Nation's traditional government (Bobb, 1999).

Traditional and Tribal Governments

A distinction needs to be made between tribal governments and traditional governments. Tribal governments were authorized by the federal government under the Indian Reorganization Act of 1934. The power of the tribal government extends only to

Map 1. NEWE SOGOBIA – THE WESTERN SHOSHONE NATION



lands claimed to be held in trust by the U.S. government for that particular group of Indians. Tribal Councils were assisted in writing Constitutions, and enacted their own laws, subject to approval by the U.S. Secretary of the Interior, their "trustee." There are

several so-called Western Shoshone “reservations” located within the 1863 treaty boundaries: Wells, Battle Mountain, Elko, Yomba, Duckwater, Ely, and the Timbisha Homelands. The land base of the trust lands takes up less than 1% of the total Western Shoshone Nation treaty land.

The traditional government of the Western Shoshone Nation has existed for thousands of years. In its present form, the governing body is known as the Western Shoshone National Council, made up of representatives of traditional communities. The traditional government’s area of influence is approximately 60,000,000 to 70,000,000 acres of land, with the exception of trust lands having their own tribal jurisdiction (Clemmer, 1972).

Maintaining a Subsistence Life Style

In the past, Western Shoshone lived in a synchronistic relationship with nature, harvesting and hunting at appropriate times throughout the year. In their migratory patterns, they established temporary camps in summer and returned to winter homes. Currently the Bureau of Land Management and the U.S. Forest Service claim most of Nevada as public land. A majority of this public land is then fenced off and used by gold and silver mines and by the U.S. Department of Energy and Department of Defense, making it inaccessible.

Despite being restricted from parts of their own treaty land, many Western Shoshone have never abandoned their traditional lifeways. They gather pine nuts, wild foods and medicines, and hunt game. Willow is used to create baskets, cradleboards, and tools which are still used (Clemmer, 1972). Native spiritual and healing ceremonies are common, and a variety of medicinal plants are gathered for use (Bobb, 1999).

According to a 1999 examination of Western Shoshone acculturative resistance (Bobb, 1999), Western Shoshone appear to have retained the heritage of a hunter-gatherer society. Approximately 64.7% of Western Shoshone fish for trout, 49% hunt jackrabbit, 47.1% hunt deer, and 47.1% hunt cottontail. Other native wild foods include sage hen, squirrel, antelope, groundhog, chuckawalla, chukar, crawdads, carp, whitefish, coot, and chub.

For comparison, while 70.59% of Western Shoshone hunt or fish, of this number, 52.78% are men and 47.22% are women. Of the total United States population, age 16 and older, approximately14% of men and 1% of women hunt or fish. Of this number, 92% are men and 8% are women. In rural areas of the West, only 10% of residents hunt and fish (Department of Commerce, Bureau of Census, 1991).

Similarly, there is a preference for native foods when it is available. Pine nuts are consumed by 86.3% of Western Shoshone. Deer are eaten by 76.5%, trout by 64.7%, cottontail by 56.9%, and sage hen by 49.0% (Bobb, 1999).

Undomesticated native plants continue to be gathered for food, medicine, and art. Western Shoshone still gather pine nuts (84.3%), Indian tea (64.7%), wild onions (49.0%), choke cherries (43.1%), willows (43.1%), and sage brush (39.2%). Other wild plants used include buckberry, doza, pine pitch, juniper, rabbit brush, yomba, tule, greasewood, willow, Indian tobacco, and bishop (Bobb, 1999).

Approximately 25%-35% of Western Shoshone engage in traditional arts. In the study, 35.3% of Western Shoshone know how to make blankets, drums, and other items from hides, 25.5% know how to tan hides, 29.4 know how to do basketry, 29.4% weave willow baskets or cradle boards (Bobb, 1999).

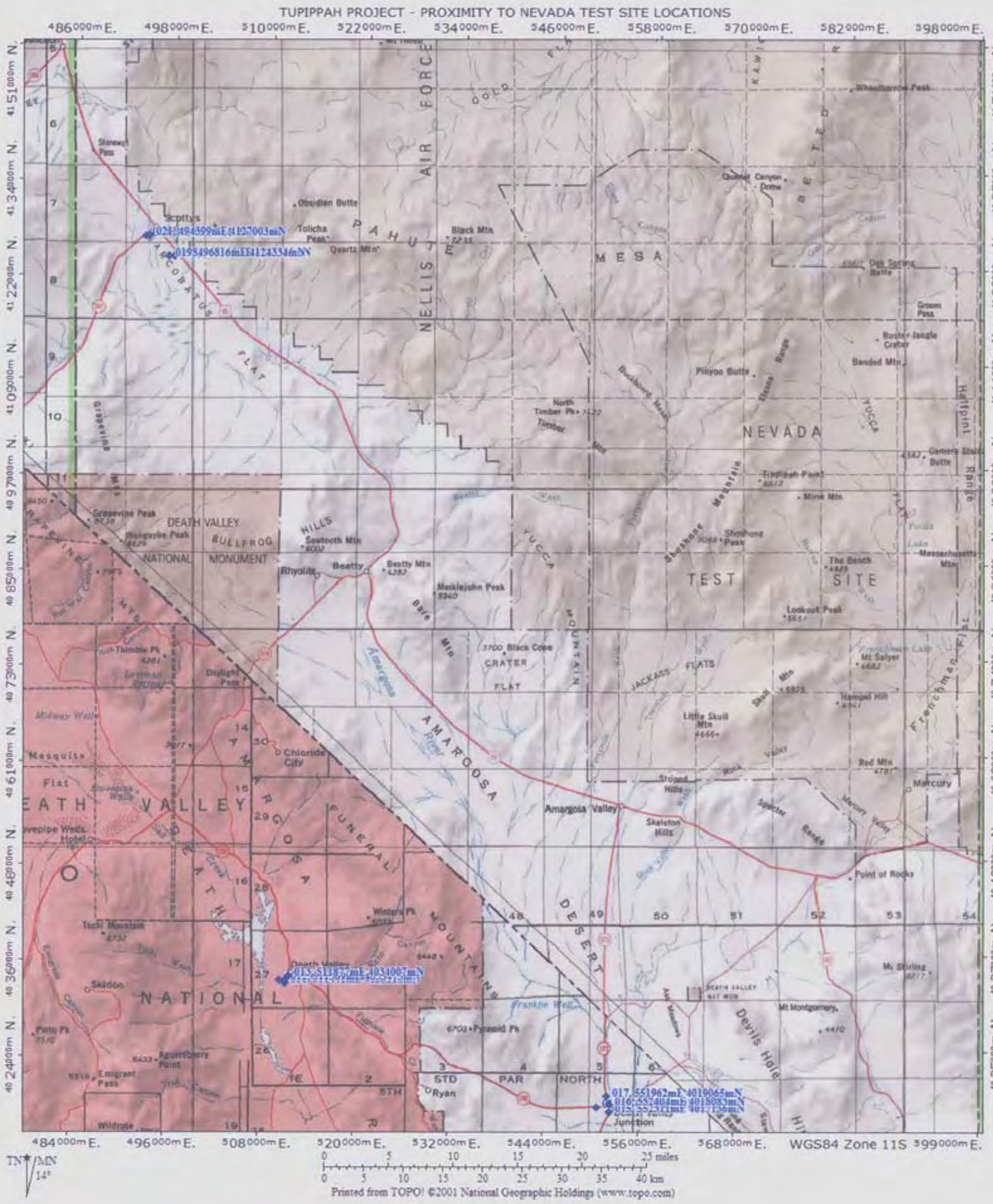
Timbisha Shoshone People

The Timbisha Shoshone People were known for their fine basketry which was used for carrying and boiling water, trapping birds, and carrying food. They would move from the valley floor into the mountains during the hot summer months, then return to the valley for the winter. Mesquite provided beans and flour for food as well fuel for fires. Pine nuts were collected in the mountains in the fall.

In the 1880's and 1890's Western Shoshone dominated the Lida area. There was a butcher shop, and a store. The present day Lida Ranch was an Indian camp of approximately 400 Shoshone living in the area. But after the coming of the non-Indians, this number was reduced to just a handful due to small pox. The Shoshone believe the disease was intentionally brought on the blankets that were given to them. Use of the land that is now the NTS is widely documented (Holz & Beck, 2000; Stoffle, Zedano, & Halmo, 2001), and Western Shoshone families lived throughout that nearby region until they were moved off by the U.S. government. Many areas of spiritual importance have been noted, including Yucca Mountain,

In the mid-1920's and 1930's, the Pacific Coast Borax Company and the National Park Service forced Timbisha who lived in Death Valley to move four times. The development of Furnace Creek Resort and Ranch pushed Timbisha further off their land. Following an agreement between the Bureau of Indian Affairs and the National Park Service, the Timbisha Indian Village was created in 1936. Nine adobe homes, a trading post, and a wash house were built. In 1983, the Tribe received federal recognition, although it did not receive a land base.

With the passage of the Timbisha Homelands Act in November, 2000 (Public Law 106-423), the Timbisha Shoshone Tribe obtained the return of a portion of the Homeland totaling 7,754 acres. Four parcels – Scotty's Junction, Death Valley Junction, Lida Community and Furnace Creek parcels – lie to the south and west and within 60 miles of the Nevada Test Site (NTS) (See Map 2). Despite 100 atmospheric nuclear tests and 928 underground nuclear tests at the NTS, soil or vegetation from the Timbisha parcels has never been tested for the presence of radionuclides.



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Brief History of the Nevada Test Site

Site Selection

Shortly after the end of World War II, a joint task force of Army and Navy personnel chose the Marshall Islands, which had been granted as a U.S. trust territory, as the site for several nuclear tests. Native residents of the Bikini Atoll were removed to Rongerik, an island about 130 miles away. Operation Crossroads was to consist of three explosions, Able, Baker, and Charlie. Able was exploded on June 30, 1946. But, the second test, Baker, exploded July 24, 1946, resulted in massive contamination. As a result, the third test, Charlie, was cancelled (Cheney, 1996).

The Atomic Energy Commission (AEC) was established on August 1, 1946 by President Harry Truman to supervise the development and civilian and military use of atomic energy, including nuclear reactors and nuclear weapons production and testing. The AEC's mandate was to safeguard the health and safety of the public by regulation of nuclear products (Fradkin, 2004).

Around the same time, the National Security Act of 1947 allowed decisions, policies, and actions deemed to be in the "national interest" to be taken with limited congressional oversight and without the knowledge or approval of the public (Beck & Green, 2004). In 1947, David E. Lilienthal, director of the AEC, approached President Truman to convince him that continued testing of nuclear weapons was critical. He preferred the Marshall Islands sites, labeled the Pacific Proving Grounds, because their isolation would allow testing to be unobserved by the Soviets (Fradkin, 2004). But this was an expensive venture, as weapons made at Los Alamos as well as over 10,000 workers would have to be shipped approximately 9,000 miles to the Marshall Islands for the tests (Beck & Green, 2004).

Project Nutmeg, a secret study authorized by the AEC, investigated continental United States sites and presented its final report in January 1949. The sites were analyzed for potential effects on plants, animals, and photographic film, but not humans. These sites included the Nevada Bombing and Gunnery Range, locations on the coast of Texas, the Trinity site, Dugway Proving Grounds in Utah, the Aleutian Islands, Churchill on the Hudson Bay in Canada, the Australian Desert, the Galapagos Islands, and North Carolina between Cape Fear and Cape Hatteras. The plan for the North Carolina sites was to have resulting radiation diluted in the waters of the Atlantic Ocean (Crandall & Dames, 1951; Fradkin, 2004).

On August 29, 1949, the Soviets exploded a nuclear bomb in Siberia. Fearing the spread of communism, in January, 1950, President Truman ordered the development of a hydrogen bomb. That summer, an engineering study was conducted at the Nevada site. The Nevada site had the ideal "climate, remoteness, the low population density in the area, and the fact that the adjoining Nellis Air Force Base Bombing and Gunnery Range…minimized risk to public safety while providing added security" www.v.doe.ov/nts.html, 1995) .

On December 12, 1950, the AEC approved the site, and approval followed from the National Security Council on December 15. Truman approved the site by executive order on December 18, 1950 (Fradkin, 2004). The area that is now the Nevada Test Site was first known as the Nevada Proving Grounds conforming in title with the Pacific Proving Grounds (Beck & Green, 2004). Testing still continued in the South Pacific at Bikini, Enewetak, Johnston Island, Christmas Island (U.S. DOE, 1994).

The Era of Continental Nuclear Testing

The first nuclear test at the Nevada Proving Grounds was a 1 kiloton airdrop known as Able at Frenchman Flat on January 27, 1951. It was part of Operation Ranger. The next shot Baker, went higher and sent shockwaves over the mountain and into downtown Las Vegas, where the windows of downtown Fremont Street stores were blown out (Beck & Green, 2004). But, there is no mention of objections from casinos probably because of the increased income from the new tourist attraction, coupled with a sense of patriotism.

Bleachers were set up north of Mercury, overlooking Frenchman Flat for technicians from Los Alamos, the Air Force and private contractors like EG&G, REECo, and General Electric to observe the tests. Because of the broken windows and dust and dirt, most tests were moved to Yucca Flat. Yucca Flat was used by Los Alamos Scientific Lab and the Lawrence Radiation Lab, and was divided into 11 areas for different types of testing. A dry lake bed at the south runs to the foothills, and shock waves were absorbed by the surrounding mountains (Beck & Green, 2004).

As part of the testing at Yucca Flat and Frenchman Flat, a maximum of 6,000 army personnel at a time were brought to Camp Desert Rock, south of Mercury. The camp was mostly tents, but cement structures were later built. Only the slabs remain today. “The Atomic Energy Commission was reluctant to let the military engage in the tests in the first place. This has been documented. The military more or less said they wouldn’t participate unless they could put the troops in relatively close ranges, much closer than the AEC recognized to be safe” (Lerager, 1988). Some of these soldiers would later form a group know as the “Nuclear Atomic Veterans.” News media were invited to Yucca Flat in 1952 and one test was televised. The area became known as News Nob (Beck & Green, 2004).

Above-ground testing continued from January 27, 1951 through October 31, 1958, when a moratorium went into effect. When the Soviet Union resumed testing in September, 1961, the U.S. also returned to testing on September 15, 1961. The last atmospheric test at the NTS was Little Fellar I on July 17, 1962.

On August 5, 1963, the U.S. and the Soviet Union signed the Limited Test Ban Treaty, prohibiting atmospheric, ocean, and space tests. On October 2, 1992, the U.S. began another moratorium which lasted until August 11, 1995 when President Clinton made a decision to negotiate a comprehensive nuclear test ban. On September 24, 1996,

the Comprehensive Nuclear Test Ban Treaty was signed, “prohibiting any nuclear weapon test explosion” by any State party. The AEC was discontinued on October 11, 1974, and replaced by 2 agencies: ERDA (Energy Research and Development Administration) and NRC. When the DOE was created in 1977, it absorbed the functions of ERDA (U.S. DOE, 2000).

The U.S. has tested a total of 1,054 nuclear tests in several locations with 1,149 detonations. A total of 928 nuclear tests have taken place at the Nevada Test Site. Of these tests, 100 were atmospheric tests (U.S. DOE, 2000). These figures do not include ongoing sub-critical tests.

Despite the large number of nuclear tests with accompanying fallout and the statistics (enumerated above) showing that Western Shoshone have never given up a foraging subsistence existence, there have been few studies of off-site soil contamination and no studies of residual fallout on Western Shoshone land or on the vegetation used by them. No studies could be found that studied the effects of radionuclides on traditional foods like pine nuts or berries. There have been no studies of health effects, nor any base line studies of overall health in the area – either of Western Shoshone or any other population.

RADIATION MONITORING AT NTS

From 1951 until January, 1975, the AEC managed the activities at the NTS. In 1975, the U.S. Energy Research and Development Administration took over for two years, until they merged with other agencies to become the Department of Energy (DOE). An off-site monitoring program managed by Los Alamos Scientific Laboratory and the U.S. Army, was replaced in 1954 by the U.S. Public Health Service’s Offsite Radiological Environmental Monitoring Program (OREMP). Following its creation in December, 1970, the U.S. Environmental Protection Agency (EPA) took over administration of the OREMP through its Environmental Monitoring Systems Laboratory in Las Vegas (Douglas, 1983). Since 1995, the EPA has operated the OREMP through its Office of Radiation and Indoor Air, Radiation and Indoor Environments National Laboratory in Las Vegas. The objectives of this scaled-down program were to assure public health and safety of residents living near the NTS, measure environmental levels of radiation in prior testing areas, maintain readiness to resume testing, obtain data to verify regulatory compliance (Davis et al., 1999).

Due to decreased funding and reported lack of findings beyond background, off-site garden and other soil sampling, and on- and off-site wildlife sampling were cut in 1995. Routine assessments using pressurized ion chambers, thermoluminescent dosimeters for air, water, and milk sampling, and long-term monitoring wells remained. Results from 1997 monitoring reportedly showed no radiation directly attributable to current activities (Davis et al., 1999).

The offsite thermoluminescent dosimetry network of 39 fixed monitors and 18 offsite personnel was established to measure changes in ambient gamma radiation and alleviate the fears of the public. Annual exposures were calculated by dividing each quarterly rate by the number of days deployed to obtain a daily rate, then multiplying by 365.25. Annual exposure rate in 1997 ranged from 61 mR/ year at Pahrump, NV to 161 mR/year at Blue Jay, NV with a mean of 99 mR/year. Areas closest to the Tupippah Project parcels were Beatty, NV with 112 mR/yr, Amargosa Center, NV with 76 mR/yr, Furnace Creek, CA with 75 mR/yr, Goldfield with 95 mR/yr, Sarcobatus Flats, NV with 121 mR/yr, Tonopah, NV with 120 mR/yr. The personnel readings ranged from 74 mR/yr at Indian Springs, NV to Beatty with 147 mR/yr with a mean of 96 mR/yr. The personnel closest to Tupippah Project parcels were Beatty at 147 mR/yr and 116 mR/yr and 120 mR/yr both at Tonopah (Davis et al., 1999).

The network of 15 pressurized ion chambers in Nevada and Utah measure low-dose exposures of gamma radi ation. Annual exposures ranged from 71 mR/yr to 155 mR/yr. The report concluded that these exposures are within background levels based on the BEIR report determination of background to vary between 49 mR/yr and 247 mR/yr. Areas closest to the Tupippah Project parcels were Beatty, NV with 143 mR/yr, Amargosa Center, NV with 97 mR/yr, Furnace Creek, CA with 86 mR/yr, Goldfield with 135 mR/yr, Tonopah, NV with 154 mR/yr. (Davis et al., 1999).

The Air Surveillance Network consists of 20 continuously monitoring sampling stations, six of which are high volume air samplers within 220 miles of the NTS. The quantity of gamma was reported as mostly neglible, with average annual activity of 1.5 x 10^{-13} μC/mL, slightly less than on-site. Gross beta exceeded the minimum detectable concentration, averaging 1.5 +/- 2.2 x 10^{-4} Bq/m^3 somewhat lower than on-site. Gross alpha average was 2.0 x 10^{-15} μC/mL, slightly higher than on-site. Plutonium was detected at about ¼ the on-site rate (Davis et al., 1999).

The Milk Surveillance Network included commercial dairies and family farm cows and goats within 186 miles of the NTS. Samples were analyzed for Strontium. Only one dairy in Moapa had a result above the minimum detectable concentration (Davis et al., 1999).

ANIMAL STUDIES

In 1964 a 36-acre farm was built in Area 15 to test the effects of radiation on crops and animals by examining plants and soils. Crops were planted and a dairy built with open paddocks, shaded stalls and a milking barn. Thirty Holstein cows, 100 Hereford beef cattle, horses, pigs, goats, and chickens were raised. The farm closed in 1981. All radiation was reported to be within acceptable levels and there were no effects of exposure (NTS News and Views, 1993).

Studies (Smith & Andrews, 1981; Smith, Giles, & Bernhardt, 1981) measured levels of strontium-90 and cesium-137 in cattle, deer, and bighorn sheep living around

and near the NTS since 1956. and found tissue concentrations were from global fallout rather than from testing. One deer was found with 2,900 pCi/kg of cesium-137 in the liver, 5 weeks after a cratering experiment. The DOE-funded study claimed daily consumption of 500 grams of the tissue would result in an annual dose of only 6.4% of the guidelines for the general population. There was no impact on cattle.

MONITORING TODAY

As reported above, soil sampling of off-site gardens stopped in 1995 due to lack of funding and no significant findings. This researcher attempted to find maximum contaminant levels for soil off-site, but could find none. While there are ground water and air MCL's, there are no consistent soil MCL's other than on-site or for specific contaminated locations for cleanup.

A closer inspection and more careful reading of DOE National Nuclear Security Administration documents concerning radiological monitoring of plants and animals shows that game animals "are sampled annual from known contaminated sites on the NTS to estimate hypothetical doses to hunters (i.e., the public) and determine if NTS plants and animals themselves are exposed to radiation levels harmful to their populations (www.nv.doe.gov/emprograms/biota/monitoring.htm)." Their goal is to "determine if the potential dose to humans consuming game animals from the NRS is less than 100 mrems per year, the limit set by DOE Order 5400.5." (www.nv.doe.gov/emprograms/biota/monitoring.htm).

Off-site direct monitoring of surrounding communities within 240 miles of the NTS is still conducted and overseen by the Desert Research Institute. There has been no evidence of offsite radiation from the NTS and are reported to be within normal background radiation levels (www.nv.doe.gov/emprograms/radiation/radoffsite.htm.)

METHODOLOGY

The research project had two components. First, Western Shoshone who were alive and resided in the Homeland area during the nuclear testing era were interviewed concerning their memories of that time period, including where they were, what they were doing, and how food was obtained. Second, those areas described as traditional use areas were examined for presence of radioactivity, soil samples were collected, and sent to a laboratory for analysis. Results were analyzed and compared.

PARTICIPANTS

Participants were obtained through the referral of Project members. Participants were selected to be interviewed if they had been living in or using the parcel areas for at

least some time during the period 1951 to 1958, were old enough at that time to have memories of the testing, and were willing to participate.

A total of seven participants (3 female, 4 male) ranging in age from 67 to 92, were interviewed. The interviewer was known to the participants. Participants were contacted by the interviewer and appointments were scheduled. All interviews took place at the home of each participant or at the home of one of their family members. The nature of the study was briefly explained and confidentiality was assured.

Participants were asked to describe their memories of nuclear testing. A list of questions (INTERVIEW QUESTIONNAIRE) served as a baseline for guiding the discussion (Appendix). Questioning style was casual and open-ended with the interviewer using probing questions as needed (e.g. Could you tell me a little more about that? I'm not familiar with that area, could you tell me again, how would I get there today?). The interviewer took notes on a laptop computer of the responses. Responses were recorded word for word, as much as possible. The responses were later summarized.

EQUIPMENT

Community members who served as field technicians were trained in the use of a Garmin Etrex Legend hand-held GPS unit, and an Inspector Nuclear Radiation Monitor. Clear glass 125 ml standard sampling jars with lids, protective work gloves, and separate aluminum scoops were obtained.

PROCEDURE

Community members who agreed to serve as field technicians were trained by the consultant on procedures including purpose of the study, sample design, sample site selection, use of a hand-held GPS monitor, use of a hand-held radiation monitor, sampling technique, data recording, and the importance of chains of custody.

The Project did not choose to conduct random soil sampling. Because of the high cost of soil analyses, the vast area to be covered, and the limited amount of funding, the goal of sampling was to choose areas with the highest probability of having residual radiation.

Several elders attended the soil sampling events and pointed out specific use areas. Areas were initially examined using a hand-held nuclear radiation monitor capable of detecting low levels of radiation (alpha, beta, gamma) through a 2-inch round Geiger-Mueller tube, or "pancake tube." As radiation passes through the tube causing ionization, an electric current is generated. The monitor was set to measure the most direct unit of measure, counts per minute (CPM), every 3 seconds. Milliroentgens per hour were not chosen as a measure because they are calculated using a conversion factor optimized for Cesium-137, and therefore result in less accurate measurement for other radionuclides.

INTERVIEW QUESTIONNAIRE

During the time period 1951 to 1968, the US conducted many above ground tests at the Nevada Nuclear Weapons Test Site. We are going to ask you questions about your memories of that period.

Nuclear testing began at the Nevada Test Site on January 27, 1951. Where were you living at that time?

Did you often travel for work, visiting friends, because of the heat, or for other purposes?

What about food gathering, hunting, that sort of thing? Did you travel during certain seasons or times of year to collect plants or hunt?

Did you move away from here? If so, when and where did you go?

Do you remember seeing a nuclear cloud? If so, where were you and what were you doing when you saw it? Please describe your memory of what it looked like, what you heard or felt. (If participant saw more than one cloud, ask about each one).

Did you know what it was when you first saw it?

Can you remember who else was living here in the valley and where their house was?

Did you hear stories or people talking about the nuclear tests?

How did you find out what the tests were? Did the government notify you?

Were people warned about them or told to do or not do anything to protect themselves?

How did you get your food at that time? What were you eating?

Were you advised not to drink milk or water? Did they warn you about not eating wild game or native plants?

Do you remember any areas where plants died, or grew differently, or did not grow back? Please describe the area enough so I could get there today.

Where else were you traveling or moving about to at the time? For example, did you go somewhere a lot to pick willows or pine nuts or to get medicine? Describe the area so I could get there today.

Did you hunt? What did you hunt? What parts of the animal did you eat? Where did you hunt?

What natural or wild foods did you eat or use at the time? Where did you go to gather the foods?

Did you have a garden?

Did you have farm animals like a cow or goats or sheep, chickens?

Where did you get your water for drinking, cooking, and bathing?

Did you eat fish from around here? Where did you fish?

Did you spend more time outdoors than you do now? About how many hours per day did you spend outside?

Were you working at jobs? Where? Doing what? How much time did you spend outdoors working?

Did you do any work with animal hides or skins? Did you use the skins or hides for anything around the house?

Do you remember having or hearing about any bad health effects related to the nuclear testing? For example, one person told us she knew someone who died within one year of witnessing a nuclear test. He had never been sick before.

What did you do when you or someone got sick? Were there doctors, or Indian doctors? What kind of health services were available for you?

Does anyone in your family or relatives or friends have cancer or leukemia or did they die of cancer or leukemia? If so, where did they have the cancer? How old was the person when he or she became ill? How long before they passed on?

Did the person smoke or do anything else that the cancer could have come from?

Do you or any relatives or friends with thyroid disease or thyroid cancer?

Did more women seem to miscarry around that time period? Were there any children born with birth defects?

Field technicians held the monitor with the alpha window facing and within 1-12 inches above the soil surface.

Areas that appeared to be undisturbed by cattle, traffic, or development were chosen. Locations with counts above 100 per minute were recorded, and the highest of the samples chosen. The site was measured with the GPS instrument, and the field technician filled the sample jar using an aluminum scoop. Samples were taken from the surface 1 inch of soil. The GPS location, including altitude, were marked in a data manual. Both the lid and the jar were marked with a sample number.

Twenty-one samples were collected. Chains of custody forms were filled out including project name and contact information, lab-assigned project number, media type, date and time of collection, analyses requested, and custody signatures. The samples were packaged and sent by UPS to the laboratory for analysis. Maps were produced from the GPS locations using the National Geographic map system.

SELECTION OF ANALYTES AND LABORATORY

Many of the fission products from nuclear weapons tests were from short-lived radionuclides (Anspaugh, 2000). Thus many of the radionuclides from nuclear testing over 50 years ago would be undetectable. Gross measures of radioactivity were tested to determine the general activity levels of sites. Because gross radiation measures cannot distinguish between radionuclides, specific analyses were performed in addition to gross alpha, gross beta, and gamma detection.

Radionuclide analytes were chosen that were products of nuclear weapons testing and had a relatively long half-life. The number of analytes chosen was limited by available funding.

Severn Trent Laboratory (STL), the same laboratory that performs the Hanford, WA testing was chosen for sample testing. Several laboratories were approached by the consultant, but STL offered the best price and was the most helpful and responsive. Quality assurance reports were satisfactory.

The analyses requested were:

Alpha Spectroscopy
- Americium-241 by method RICH-RC-5087;
- Isotopic Plutonium by method RICH-RC-5087

Gamma Spectroscopy
- Gamma by method RICH-RC-5017

Gas Proportional Counting
- Gross Alpha by method RICH-RC-5020
- Gross Beta by method RICH-RC-5020
- Total Strontium by method RICH-RB-5006

Liquid Scintillation
- Tritium Analysis by method RICH-RC-5037

The analytical result for each analysis performed included a minimum of one laboratory control sample, and one reagent blank sample analysis.

Plutonium

Plutonium is formed when uranium absorbs an atomic particle. Extremely small amounts may occur naturally, but most, in the form of Pu-239 and Pu-240, enters the environment as a byproduct of nuclear weapons testing or accidents at nuclear facilities. Pu-238 and Pu-239 decay into Uranium-234 and U-235, releasing alpha and beta articles and gamma radiation. Plutonium isotopes have very long half-lives. Pu-238 has a half life of 87 years; Pu-239 has a half-life of 24,065 years, and Pu-240 has a half-life of 6,537 years.

Plutonium adheres to soil particles and may be inhaled or swallowed and, any amount not excreted continues to expose the body, predominately lungs, bones, and liver, and increases risk of cancer and leukemia. Plutonium has reproductive effects in that it concentrates in the testicles, and easily crosses the placenta. It is the most carcinogenic substance on earth. Latency periods of 30 years occur between exposure and cancer or leukemia diagnosis. Plutonium concentrates in the top 5 cm of soil, but can migrate 25 cm deep (U.S. EPA, 2000).

Tritium

Tritium occurs in low concentrations naturally, produced when cosmic rays strike nitrogen molecules in the upper atmosphere. Most enters the environment through nuclear weapons explosions, where it is used in the triggering mechanism in thermonuclear explosions, or as a byproduct of nuclear reactors. It can be inhaled or ingested in water and causes increased risk of cancer, as it goes directly into the soft tissues and organs (http://www.epa.gov/radiation/radionuclides/tritium.htm).

Strontium

With 16 known isotopes, four of which are stable, strontium is found naturally as a non-radioactive element. Twelve isotopes are radioactive, strontium-90 being the most significant. Strontium-90 is a byproduct of the fission of uranium and plutonium in nuclear weapons and reactors. Large amounts were produced in nuclear tests and dispersed throughout the world. Its half-life is 29.1 years.

Because it behaves like calcium, it is taken into the bones, bone marrow, and teeth. It forms compound easily and moves through the environment and while it can be inhaled on dust, it easily enters the food chain. Bone cancer, cancer of the soft tissue and leukemia result (http://www.epa.gov/radiation/radionuclides/strontium.htm).

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Cesium

Radioactive cesium 137 is produced when uranium and plutonium absorb neutrons and undergo fission in reactors and weapons. Its half-life is 30.17 years. It decays by emission of a beta particle and relatively strong gamma rays to barium 137. Cesium easily becomes airborn and walking in soil with cesium, exposes a person to inhalation of gamma. Cesium becomes distributed fairly uniformly in soft tissue and retains in muscle, increasing the risk of cancer. In high external exposure, it causes burns and death (http://www.epa.gov/radiation/radionuclides/cesium.htm).

Americium

Americium is a man-made isotope produced when plutonium absorbs neutrons in nuclear reactors and weapons detonations. Most environmental americium is a result of nuclear weapons testing. All americium isotopes are radioactive, but the most important is Americium-241 which releases alpha and gamma upon decay into radioactive neptunium-237. The half-life of Americium-241 is 432.7 years.

A person may become exposed to Americium-241 by walking on contaminated soil, inhaling resuspended, contaminated dust, or drinking contaminated water. Americium-241 concentrates in lungs, bone, liver, and muscle and increases risk of cancer in all organs due to gamma radiation. (http://www.epa.gov/radiation/radionuclides/americium.htm.)

RESULTS

ORAL HISTORY INTERVIEWS

In 1951, most Shoshones who lived in the Death Valley Village, followed a seasonal cycle of moving out of the village around June or July because of the heat, and returning in September or October (Interview 1). Some Shoshone traveled to the Panamints and lived there for the summer hunting big horn sheep and small game and gathering medicinal plants and pine nuts before returning home (Interviews 3, 4) . Some Shoshone camped at Death Valley Junction or Beatty to elude the high temperatures (Interviews 1, 3, 4). Most time was spent out of doors except in cool evenings.

Because of the war, there were few jobs, so some Shoshone traveled to Beatty, Lone Pine, or elsewhere for work, but most stayed and took part time jobs with Citicoast Borax Company or took work related to the tourist industry after the Furnace Creek Ranch and Scotty's Castle became attractions. Some had moved to Tonopah for mining

jobs or Fish Lake Valley to work in the hayfields. There was no grocery store or post office in the Valley (Interviews 3, 4).

But, returning to the village and family was important to most Shoshone given their history at the Death Valley village. The 1950's and earlier were regarded as the "tough years". The National Park Service and the county wanted to move the Death Valley Shoshone out of their homes, probably to make way for the tourists. They notified Shoshone that they were living illegally and should leave. When the people resisted, the NPS ordered rent to be paid. Some paid the rent but others resisted saying they knew their rights. Many old people were frightened and said "I better move and get a tent in Beatty. When county workers came and said they needed to do an assessment of the adobes, most of the Villagers would not open their doors. The NPS came eventually and bulldozed some of the houses and set fire to others. Six houses were burned. But the people fought with lawyers and won the right to stay in the village (Interview 1).

Lack of Notification

It is clear that the communities were never notified of testing, nor were they told that the radioactivity might be dangerous, or how to protect themselves (Interview 1). No Shoshone recalls any warnings and no one was invited to witness a test. Most found out through radio or newspaper reports following a test or through talking to friends. They remember these media telling them that the Germans had already tested the hydrogen bomb, so we had to do the same. Some could not remember how they found out. Some assumed it was bombing but did not know it was radioactive. One Shoshone said, "They made it sound safe so we wouldn't panic, but later on, everyone knew (it was dangerous)." The same woman (Interview 1)'s mother, when told of the testing, said "Why? The war's over. They don't need more bombs." She didn't think bombing and destroying people and things was right, but, at that time, she didn't know how dangerous it was.

Memories of the Tests

Descriptions of the tests are vivid. In warm weather , most of the time, the Shoshone slept outdoors under the trees and thus, witnessed the tests.

"The first time everybody felt it. After that the walls of the adobe houses all cracked. We saw the light then there was a faint rumbling, then the dust was in the air. The brilliant lights came before anything else. They were colorful, outstanding, really sharp, the lit up the whole sky, then just faded away. Then east of here you could see the mushroom. It went up wide, then tapered down. It was real fast something like lightning, but there were different colors and they mix and there were streaks of different colors. Then the rumbling. We could feel it shake and mother said, 'Get out of here, the house might crumble.' After that we slept outside. Even Scottie's Castle cracked from the explosions (Interview 1)."

"We saw light, the flash over there on top of the mountains, then we would hear a rumbling, kind of fadiing away, then see the cloud go up. We didn't know what it was. Later, we knew it was the army testing their bombs. Sure we were scared, our house quivered! Early in the morning, mom would say 'Let's get out of here," and we'd go outside (Interview 4)"

"It was early in the morning and my mother was up and I was just getting up. I can't remember the year. The earth started shaking and the house started creaking. My father had put the house together with old boards. And when it started, I ran out I was so scared. The creaking! I thought it (the house) would come down. My kids were still in the house, so I went and woke them and we ran outside and just stood there. The earth felt like it was going to crack open. My step-dad was looking over this way (points north) said, 'Hey look at that cloud!' There was a big old cloud like this over Panamint Range. 'What in the world is that?' That was it. It was kind of yellowish-sun-clay, dirty clay, cloud color. After it died away, we all went in and forgot about the cloud. We didn't know. It was a funny looking cloud. They were cooking and we went in and maybe it's good we did. Most times we stayed out (Interview 2)."

Her children were crying as the cloud traveled toward Nevada and Utah. She remembers it being a clear day. A couple days later when she returned to work, she found out over the radio. "Oh my God, that's why. What are they trying to do, open the earth?" There were other explosions after that, but not as bad. Early in the morning, before or at sunrise, they felt the earth shake and the windows rattle, and knew it was another test. The tremors were felt in Lone Pine, 107 miles away, where windows cracked and pots and pans fell from shelves. These all occurred in the 1950's. Some people in Southern California thought the rumbling was earthquakes. One person recalled being in Las Vegas and feeling the ground shake and doors flapped open and shut (Interview 4). "They tested every time the wind blew from the south, not the north (Interview 2)."

Hunting and Gathering Food and Medicine

"We ate lots of rabbits, mostly in season. Greenwater Valley had the best. We would go hunting and bring back the rabbits and distribute them to everyone. We got big horn sheep a few times, but National Park Service controlled that, so hunting came to a halt, especially in the Panamints where they patrolled. So we had no pine nuts, deer, or sheep. We were told not to bother the plants. We didn't know about the treaty. Then we found out because other Shoshones in NV made it clear that the whites were taking over the land, so they started talking and by word of mouth, and flyers, we started to get organized (Interview 1)."

Food sharing was common. Some villagers went out to Greenwater area to get bighorn sheep, even after testing. "We didn't just get one, we'd get two, butcher them and distribute meat to the whole village (Interview 4)."

"We ate the usual stuff -- rice, beans. In the 1950's we were eating wild foods and trapping because we weren't allowed to use guns here. The men used guns elsewhere. In the sixties, they were still testing above ground and it started to leak out

that it was dangerous. We ate rabbits -- head, neck and limbs too. Then we saw lots of disease in the rabbits. We thought it had to do with what they ate, eating white man's stuff like alfalfa." Now she thinks it was both alfalfa and radiation (Interview 2).

"We used to do a lot of rabbit hunting. There was one rabbit, a big one, a big jack rabbit. And he had boils all over. That was in summer, my son was about 11 or 12. He was born in 1948, so it was about 1957. After two big explosions -- we did not think. We didn't know it was going to be bad and hurt people. We didn't think about it. They said they were testing, it's not going to hurt you (Interview 2)."

Some people summered in the Ash Meadows areas, where relatives had gardens with vegetables and beans (Interview 1).

To this day, the soil, water, and vegetation has not been tested in the area. One day, during an ethnographic meeting, an elder took pitch off the pine trees and made a big ball to bring home. One of the ethnographers said she shouldn't take it, it was going to make her sick. (GG) One day her son was at an NTS ethnographic project and picked some pinenuts and put them in his pocket. The leader told him to throw them away and not eat them because of the radiation. They had never been told that before (Interview 2).

Another elder (Interview 7) recalled how miners came into the area to explore the area outside Tonopah for uranium. Because of the Cold War, uranium production and self-sufficiency were encouraged. Many mining claims were filed because of high Geiger counter readings. Despite repeated digging, the miners found no uranium. The high readings were apparently from a radionuclide with a very short half-life that had covered the fields.

Changes in Animals and Plants

"Lot of plants have been lost and to this day we keep looking. They were destroyed by their own environment. I keep looking, others too, for this small winged insect that deposits a glue-like substance we used to mend things. I began to miss it in 1953 (Interview 2)."

"I heard about a deer that looked like it had abnormally huge racks. He came through Daylight Pass as you're going into Beatty. You could smell him real bad. People thought he was abnormal and someone said he had migrated from the Test Site (Interview 2)."

"In 1958 or 1957 I was picking pine nuts with my mother, she was raised in Wild Rose. She wanted a plant for medicine. Get some before we go back. She knows where there's a lot. So we stopped on the way back. It was green and had leaves. It was good for a lot of things. We'd make tea. We never found it. What happened to it. It always grew here. We, my sister and I, always picked it here. Her leg was amputated. She said the same thing. She picked pine nuts with us. She couldn't go pick, but she told us where it

was. It was gone. Birds, no. They went away after testing. There were bluejays in the mountain. Other little birds. Now they're coming back. Pinyon birds. Before...they were all over when we were kids, birds were all over, all kinds Interview 2.)"

"King snakes were always on the road going toward water. I never seen a king snake since this happened. Maybe the water is no good. Even my mother before she passed away, she said the same thing. Tarantulas disappeared for how long, we never saw them again. I can't remember. They used to be on the road all the time. Now maybe you see one or two, but not many like we used to. Animals, rabbits, mainly rabbits disappeared. Now they seem to be coming back (Interview 2)."

Several Shoshone described certain berries that were made into jam that are not seen any longer. And everyone said that mesquite which is supposed to be sweet like honey, is now bitter and the bean pods are dry.

One elder in his ninety's remembered killing some diseased deer. He described foul-smelling black balls, about as big as a dime, inside some deers' muscles. He feared it "might destroy the pinenuts too. That stuff is no good. Kills all the plants, nothing grows now. That's what kills the plants and animals. They don't die right away but eventually (Interview 5)."

Talking about the plants and animals, he observed, "More people died off, and the animals disappeared with them. Lizards, squirrels, rabbits, doves, they never come back. They used to have doves come in the valley here. It killed the doves. The pine nut birds was good. Don't know how they died, don't think they're any good now. Plants even died off. My dad told me that when all the Indians (Shoshone) die, the food will go right with them. They won't have nothing. Everything will die off (Interview 5."

Illnesses and Deaths

Two persons discussed a relative's grandmother who had lived in Death Valley and moved to Beatty when she became ill. She died there. When they tried to move her, the skin fell off her bones. They couldn't move her (Interview 1).

"After or during those years, we didn't really try to find out why people died. We didn't even have a phone or electricity. When people were in pain, they had to travel to the doctor on their own. If you had no money, you were stuck. Sometimes we helped one another or got an Indian doctor to come."

Several Shoshone observed that children need more specialized medical and eye care than before. "The kids today are weak, they can't fight off diseases. They need specialists. The elders talk about it, they are constantly going to the doctor… We never needed glasses. We studied with coal oil lamps. My daughter got glasses at 12. She had trouble seeing when she was 5 or 6 (Interview 2)."

One woman broke out with an itchy rash around her ankles and hip joints. The doctor gave her ointment that helped a little. But, she complained, “To this day, I get it behind my knees and on the sides of my thighs. This has happened since 1973 (Interview 1).”

Another man described seeing approximately 50 clouds appear over the mountains in front of his house at the far west end of the Valley, near Centennial during the 1950’s and 1960’s. He lost three small children under the age of 8 to leukemia in those years (Interview 6).

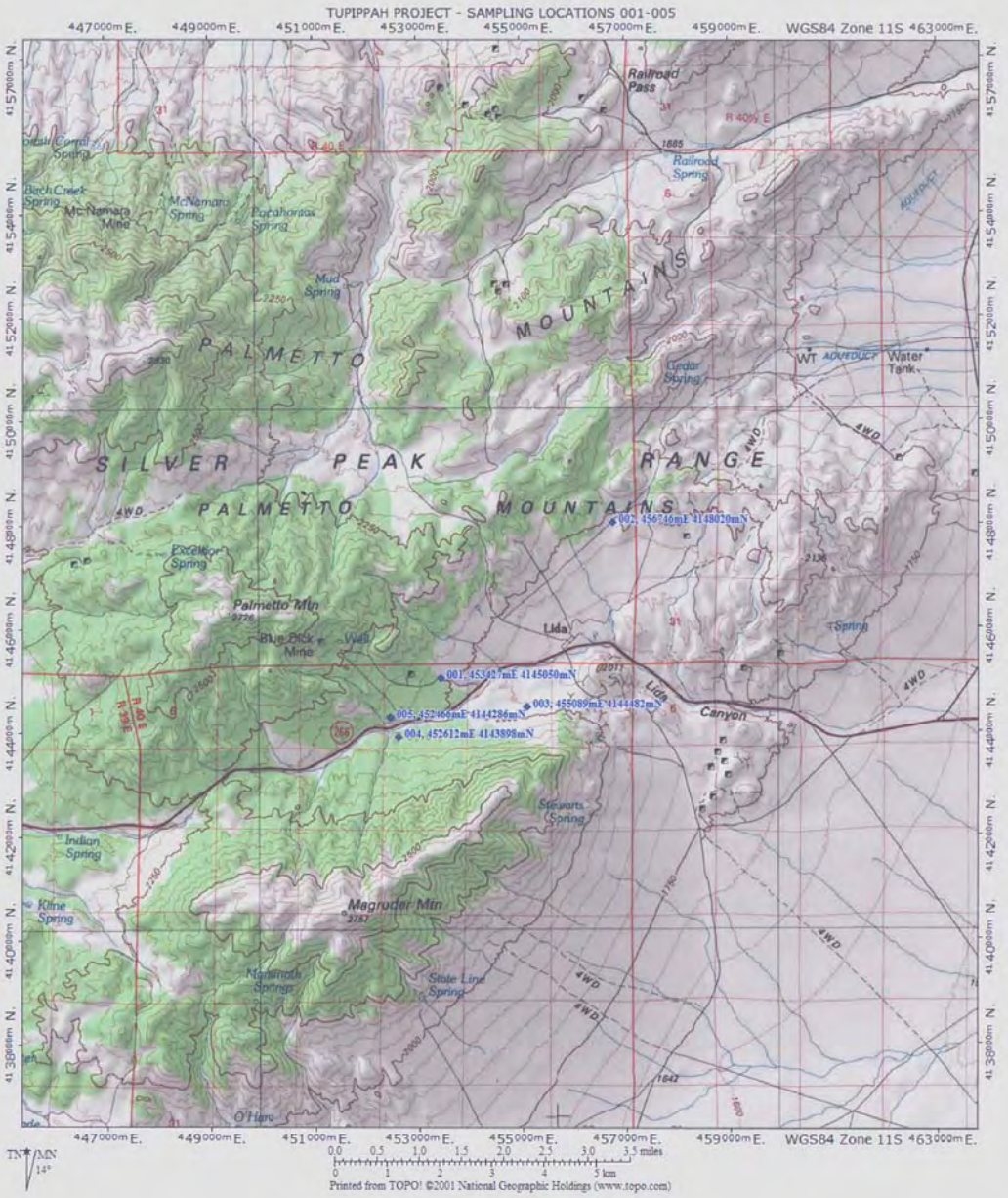
Asked to recount any unusual diseases, one Shoshone said that they had that Esmeralda and Nye Counties had the highest rates of breast cancer in Nevada. “Those are the counties where we were, but I don’t know of anyone with breast cancer (Interview 1).” One elder died of brain cancer in the last few years, she had lived in Beatty and went to the Yucca Mountain Area a lot. One woman died who used to work in the Valley. She had no symptoms, but passed away in her early 60’s. Thyroid problems and rheumatoid arthritis were named as well. “One person went deaf and is still deaf to this day.” They described others who had died with bulging, watering eyes, who got very hoarse and couldn’t talk because they felt like they were choking. One man died of prostate cancer last year who hunted near Black Mountain and Timber Mountain. As a child he lived in the mountains near Beatty, then would travel this way for pine nuts and hunting.

They remember people living longer before. One Shoshone’s mother died of an aneurism at 97, another from heart disease at 104 and 105. The appearances of diseases like bird flu in birds and diabetes in humans indicate to them that something is wrong. One elder recalled, “People sometimes lived to 115, but now they’re dying earlier and they’re obese from not being active. I blame that on the government. They closed off our dreams and goals of what we could achieve. They came in and old us we can’t own land and kicked us off from ranching. Then they gave us commodities and boarding school. Now they might destroy our pine nuts too. They killed all the plants and nothing grows now (Interview 5).”

One oldest man to be interviewed related how his father also told him that so many people would come that they would, “step on each other, fight and kill each other. It will ruin everything, even the water.” He said the world is “just like a human, it’s alive too (Interview 5).”

SOIL SAMPLING RESULTS

Twenty-one (21) soil samples were obtained. Sample locations are listed in Table 1 and following Maps. Soil sampling results for gross alpha, gross beta, and gamma radiation and for strontium, tritium, plutonium-238, 239/240 and americium-241 are found in Table 2. The complete laboratory report can be found in the Appendix.



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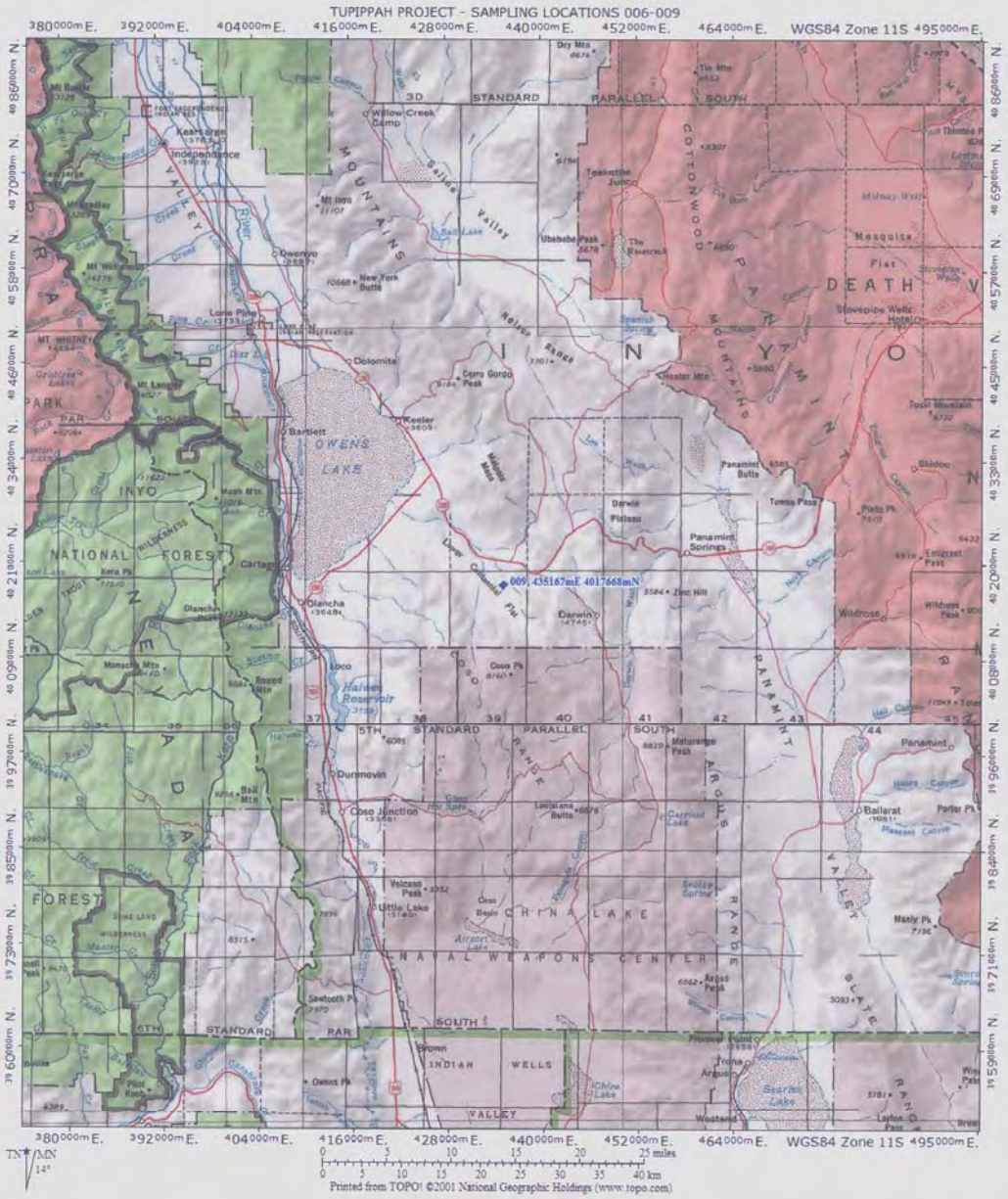

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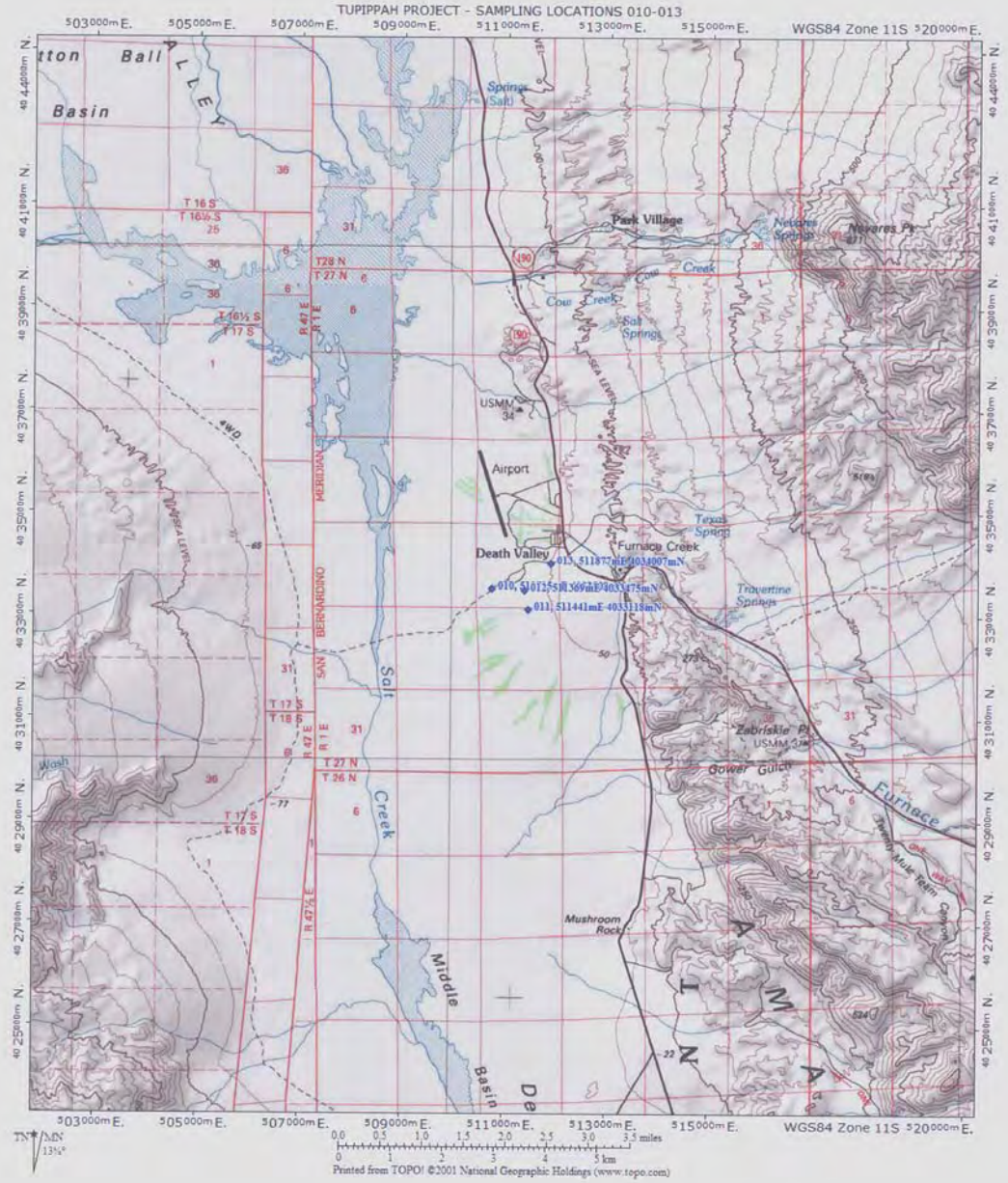

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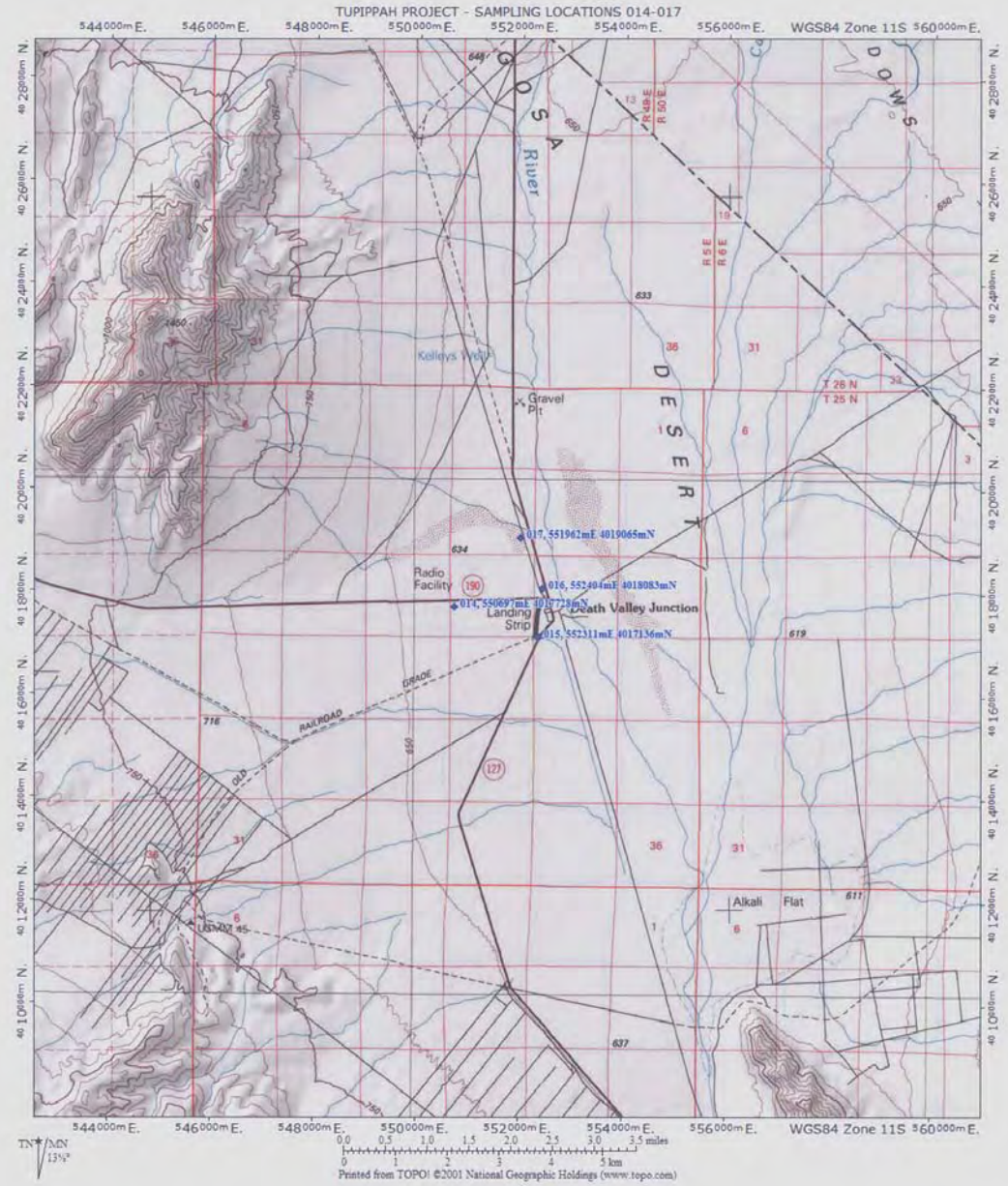

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Gross Alpha Activity

All of the soil samples were positive for alpha activity. Gross alpha results ranged from 3.83 pCi/g (Sample #10) to 24.70 pCi/g (Sample #9). Two samples (#10 and #17) were below the MDA, and 3 samples (#11, #12, and #13) were below the reporting limit. Thus 76.2% of samples were above the MDA.

Gross Beta Activity

All (100%) of the soil samples analyzed were positive for beta activity. Beta results ranged from 22.60 pCi/g (Sample #13) to 50.00 pCi/g (Sample #18). Furthermore, all of the activity levels were well above the MDA. By lab standards, these samples may be considered radioactive waste, but not at a hazardous level.

Tritium

All (100%) soil samples were positive for tritium, but at levels below the MDA. Results ranged from 0.00836 pCi/g (Sample #16) to 0.08210 pCi/g (Sample #21).

Strontium

Strontium results ranged from -0.6050 pCi/g (Sample #6) to 0.6620 pCi/g (Sample 21). Five of the soil samples (#3, #6, #11, #19, #20) showed negative strontium activity, and all samples were below the MDA.

Plutonium-238

Plutonium-238 results ranged from -0.00910 pCi/g (Sample #7) to 0.03660 pCi/g (Sample #3). Six of the soil samples (#1, #7, #8, #14, #17, #21) showed negative plutonium-238 activity, and all samples were below the MDA.

Plutonium-239/-240

Plutonium-239/-240 results ranged from -0.00301 pCi/g (Sample #10) to 0.23500 pCi/g (Sample #1). One soil sample (#10) showed negative plutonium-239/-240 activity, 6 samples (#1, #3, #4, #5, #9, #20) were below the reporting limit and all other samples were below the MDA.

Americium-241

Americium-241 results ranged from -0.00657 pCi/g (Sample #16) to 0.11600 pCi/g (Sample #5). Three soil samples (#9, #11, #16) showed negative americium-241 activity, two samples (#4, #5) were below the reporting limit and all other samples were below the MDA.

Cesium-137

Cesium-137 ranged from 0.01360 pCi/g (Location #16) to 1.41000 pCi/g (Location #3). Six soil samples (#1, #3, #4, #5, #20, and #21) or 26.8% showed positive cesium-137 activity. Two soil samples (#10, #15) show negative cesium-137, four samples (#7, #8, #9, #13) are below the reporting limit, and all other samples are below the MDA.

Three of the lowest results occurred in Sample #16 and 2 in Sample #10. Two of highest results occurred in Samples # 21 and #3.

TABLE 1. TUPIPPUH PROJECT SAMPLING LOCATIONS

LOC #	UTM	ELEVATION (ft)
1 Top of mountain Lida	11SO453432 UTM4145055	6,616
2 Above Volk ranch	11SO456746 UTM4148020	6,517
3 SE of Volk dead trees	11SO455089 UTM4144482	6,430
4 Lida camp	11SO452612 UTM4143898	6,413
5 Lida camp	11SO452466 UTM4144286	6,709
6 Centennial	11SO434991 UTM4017612	4,848
7 Centennial	11SO435012 UTM4017557	4,854
8 Centennial	11SO435193 UTM4017596	4,840
9 Centennial	11SO435167 UTM4017668	4,842
10 Furnace Creek	11SO510725 UTM4033508	-233
11 Furnace Creek	11SO511441 UTM4033118	-211
12 Furnace Creek	11SO511369 UTM4033475	-224
13 Furnace Creek	11SO511877 UTM4034007	-201
14 Death Valley Junction	11SO550697 UTM4017728	2,061
15 Death Valley Junction	11SO552311 UTM4017136	2,030
16 Death Valley Junction	11SO552404 UTM4018083	2,020
17 Death Valley Junction	11SO551962 UTM4019065	2,027
18 Cottontail	11SO497556 UTM4124316	3,987
19 Cottontail	11SO496816 UTM4124334	3,992
20 Cottontail	11SO493928 UTM4126794	4,035
21 Cottontail	11SO494399 UTM4127003	4,028

CONCLUSIONS

LIMITATIONS OF THIS STUDY

This study does not deal in depth with the cultural history of the Western Shoshone people or with the complex and spiritual relationship of the Western Shoshone people to their land. Identification of specific medicine plants and their uses will not be discussed. The study is not intended as a dose reconstruction, and will not make conclusions about the source of the radionuclides. Further the research will not directly deal with Native American opposition to nuclear testing, although several respondents asked that the opposition at least be mentioned.

DOE'S MOST RECENT SOIL STUDIES (2001)

In 2001, the Ely BLM Office released a signed Decision of Record for a prescribed burn of over 3 million acres of pinyon-juniper forest in White Pine, Lincoln, and northern Nye County. Because of concerns expressed by Western Shoshone, Goshute, and Paiute tribes, organizations, and individuals about resuspension of residual radiation, Robert Abbey, State Director, Bureau of Land Management, Nevada State Office, contacted DOE to obtain baseline information on residual radiation from nuclear testing at the Nevada Test Site for use in the NEPA analysis of prescribed burns (Izell, 2001).

Larry M. Franks, Supervising Radiation Physicist, Deputy Food and Drug Commissioner, of the Radiological Health Section of the State Bureau of Health Protection Services, and Kenneth Hoar, Director, Environment, Safety, and Health Division, National Nuclear Security Administration, Nevada Operations Office conducted soil sampling in the areas of Caliente, Elko, and Ely, NV in July 2001. Franks and Jim Larson, PHE-III also collected soil from areas in southern Nevada as "non-fallout" comparisons (Franks, 2001).

The research question was "How do we determine if a BLM firefighter or anyone else who breaths smoke from burning vegetation in areas known to have been contaminated by fallout is at an increased health risk from radiation exposure? (Franks, 2001)."

Thirty-four soil and 11 vegetation samples were collected from fall-out and "non-fallout" areas for comparison. Samples from potential fallout areas east of Caliente, northeast of Ely, southwest of Cherry Creek and northeast of Battle Mountain, potential prescribed burn areas, were collected. Samples were also taken from non-prescribed burn areas – Intersection of Hwy 95/168, Highway 229/93 intersection, Lages, Spring Creek, and Lund. Non-fallout areas were locations along Hwy 160, Pahrump, Death Valley Junction, Amargosa Valley, Beatty, and Scotty's Junction. A commercial lab analyzed the samples for alpha, beta, and gamma radiation (Izell, 2001).

Franks averaged the laboratory findings from fallout and non-fallout samples separately for each analyte (alpha, beta, gamma). No significant difference was found between fallout and non-fallout samples. The study concluded "Consequently, an individual exposed to smoke from burning vegetation in the Caliente, Ely, and Elko areas, would be at no increased radiological risk than from smoke in southern Nevada or other areas of the United States." Natural and man-made radionuclides were at minimum detectable amounts "or well within averages for other areas of the United States (Franks, 2001)."

Critique of the 2001 Study

The methodology of the 2001 study was a four paragraph rationale which exemplifies the non-scientific approach and assumptions used in DOE and DOE-contracted studies.

"Air Sampling: The immediate solution appears to be straight forward. Take air samples of the smoke in those areas and see if NTS fallout is present, and if so, how much. Upon further examination, numerous technical challenges become evident that make this approach difficult if not impossible to pursue (September 10, 2001, report to Kenneth Hoar from Larry M. Franks)."

Although the research was performed by the Bureau of Health Protective Services of the State of Nevada, the challenges enumerated had nothing to do with the safety of the public or the uninformed use of the public in a simple before-after experimental design (i.e. Condition A - measure of ambient air contaminants -- Fire as experimental treatment -- Condition B measure air contaminants, then compare results for increase, decrease, or finding of no difference). Perceived challenges amounted to cost, not of human health, but of air sampling pumps, filters, vehicles to carry samplers, and personnel. Further, they asserted that there would definitely be radioactivity in the smoke because fallout is still detectable throughout the United States. They stated that air samples would have to be taken from NY and California for comparison. It is unclear whether this means that all such prescribed burns and wildfires are redistributing radiation from the NTS, and this theory should be investigated further (Franks, 2001).

Further, the non-fallout samples were taken from areas where fallout was known to have occurred. To justify, the "non-fallout" areas, DOE used the iso-exposure contour map of the original monitor readings from a 1959 report by Gordon Dunning, Chief, Radiation Effects of Weapons Branch, Division of Biology and Medicine, AEC.
The map of "Estimated Radiation Doses" is unclear and without detail. The map shows radiation in roentgens in only 6 locations (St. George is not measured; no measures south of the test site) and only includes radiation from detonations through 1959. Therefore, the map does not include nuclear releases from 1960-1962, including one of the most powerful, Sedan, or the recently 55 recently declassified off-site releases (Schoengold, DeMarre, & Kirkwood (1996). Dunning's figures included a 25% reduction due to estimated time spent indoors (www.cad.med.utah.edu/Papers/SU_1/SUHP.html).

This is the same Gordon Dunning who at a meeting in 1957 before the Joint Committee Hearings on Radiation, said that radioactive atmospheric release could be reduced, but our freedom would be threatened

> "However, if we continue to reduce the fraction we are willing to release, we eventually reach a cost of control which makes the operation prohibitive. the dilemma is that we must weigh the degree of undesirability of radioactive fallout against the advantages which may be anticipated from activities which are inevitably accomplished by fallout."

At the same meeting, Dunning also denied that iodine-131 did damage to the thyroid, despite the fact that he had received Public Health Service press releases warning of the damage. According to the radiation compensation case reports, Dunning had been involved in much of the cover-up of health damage and animal deaths resulting from nuclear testing (Fradkin, 2004).

This outdated map may not apply given the more recent studies and mapping of the distribution of fallout (Miller, 1986). In addition, in 2001, research studies had been pointed out to BLM concerning the finding of environmental and health damage from radiation redistributed and resuspended by fire following Chernobyl's nuclear accident. These studies were ignored.

The 2001 DOE/NV study is also not of sufficient scientific quality because it is not replicable. Only the "fallout" areas were located by GPS, the "non-fallout" areas are listed as vague locations (e.g. "State Route 160 M-M CL13" "Amargosa Rest Stop, St. Rt. 373 and US 95, 200 yards south of junction.") If these locations are on the side of the road, they were not in undisturbed areas as the "fallout" areas of the forest might be. Road construction and run-off may have moved the residual radiation. The areas are directly in areas that were crossed many times by fallout (Miller, 1986). To call these areas "non-fallout" areas is similar to the errors of measure following the bombing of Hiroshima and Nagasaki where the center of the explosion (fallout area) was compared to an area 10 miles away (non-fallout area), and the results used to set radiation standards for nuclear workers. There is no true baseline in the southern Nevada area.

The DOE findings for gross alpha (which are averaged) were 7.79 +/-28.05 in fallout soil, and 6.30 +/- 26.06 in non-fallout soil. Gross beta was 26.18 +/- 23.98 in fallout soil and 26.63 +/-23.80 in non-fallout soil. Cesium-137 was 0.36 +/-0.45 in fallout soil and 0.10 +/-0.62 in non-fallout soil. Individual site results were averaged to get these numbers. This is a questionable technique because there were so few samples over such a huge land mass of differing terrain and weather conditions.

Franks (2001) concluded "there is no significant difference between samples taken in the fallout vs non-fallout areas." A more accurate conclusion would have been that whatever amount of fallout is in the southern locations, a slightly higher amount is present in the burn areas. The conclusion hints that an analysis of variance was performed on the results from the two sampling areas, but any ANOVA calculations are not

presented. If ANOVA was performed, no levels of statistical significance were given. although the results were claimed to be not significant. There is, in fact, no reason to believe, and no justification was provided, to show that the two sampling areas are different or a listing of factors considered. The correct initial statistical assumption would have been that the two areas were equal, and the study would investigate the alternative hypothesis that there was significant difference.

The conclusion is not that firefighters and the public are safe, but rather that risk from exposure is slightly higher in the burn areas than in the non-burn areas.

Comparison to Present Study

The difference in results between DOE's sampling and the Tupippuh Project sampling is quite large. In the east of NV (known areas of fallout) alpha ranged from 2.39 pCi/g to 17.30. Gross alpha in the "non-fallout" areas ranged from 0.00 pCi/g to 16.10 pCi/g. Tupippuh's results (3.83 pCi/g to 24.70 pCi/g) were larger, even though some of the areas overlap with DOE "non-fallout" sites.

Beta in the fallout area of eastern NV ranged from 12.20 pCi/g to 38.40 pCi/g. Beta in the "non-fallout" areas ranged from 5.15 pCi/g to 42.10 pCi/g. Thus, some of the "non-fallout" areas were higher than "fallout" areas. The results on the Tupippuh parcels ranged from 22.60 pCi/g to 50.00 pCi/g, higher than either fallout or non-fallout areas in the DOE study.

Gamma radiation measured by cesium ranged from 0.12 pCi/g to 0.69 pCi/g in the fallout areas of the DOE study. Cesium results ranged from 0.0 to .27 pCi/g in "non-fallout" areas. The Tupippuh study ranged from a low of -0.02070 pCi/g to 1.41 pCi/g. Some results at least double the fallout sites of DOE.

It is unclear what has caused the large difference in findings, particularly because of the lack of descriptive methodology of the DOE study. Three possibilities could be explored:

1. The Tupippuh study sampled from the top 1 inch of soil in undisturbed areas. The DOE study does not describe its technique. It is possible that the DOE study used samples taken below 1 inch of soil and that there is more radiation on the soil surface from wind, Brownian movement, or characteristics of the radionuclide.

2. It is possible that significant radiation from NTS traveled further to the south and west than previously considered. This could be from unknown meteorological factors such as wind traveling in opposing directions at different trajectory levels. The possibility of unknown, unmapped hot spots should be investigated.

3. It is possible that lower results were obtained in the DOE study because the

southern non-fallout sample sites were possibly in previously disturbed areas. However, this needs further investigation because some of the “non-fallout” samples are higher than the “fallout” samples.

Critique of Other DOE Studies

DOE’s reliance on models and inferences from those models does not match observations. The observations are not merely anecdotal evidence, but biostatistical studies, for example the 80,000 cases of leukemia observed by the Center for Disease Control and the National Cancer Institute. These epidemiological studies do not appear to be taken into consideration in the mechanistic models of DOE.

The DOE Off-Site Radiation Exposure Review Project (ORERP) which developed a model for risk, is one such model. From 1979 to 1994 the ORERP re-evaluated the off site dose from above ground testing during the period 1951-1963. The radionuclides of concern were Cesium-137, Strontium-90, Iodine-131, and Plutonium-239/240. Data were obtained by observations from tracking planes that followed the nuclear clouds till they disappeared and from data monitors like gummed paper, ion chambers, Geiger counters, and film badges.

Next an exposure pathway model was developed. The DOE conducted interviews with 500 downwinders in the 1950’s and 1960’s to develop a lifestyle survey. People were asked about their milk consumption, where they worked and spent their time, how much time was spent outdoors. The results were used to classify people by lifestyle: Newborn, infant, preschool, elementary student, secondary students, homemaker, employed outdoors, employed indoors, and shepherd.

No Native American person was included in this survey. However, Native people were classified according to the “shepherd” lifestyle. The shepherd representative figure was a Caucasian male, of approximately 134 pounds, between the ages of 20 and 30, who was outside except at night, and who had the same type of residential construction as a non-Indian person. This model, which is still used today, does not address the increased cancer risk to women, infants, small children, or native peoples. All monitoring systems used for collection of data in the model measured external, not internal, doses.

Frohmberg (1994) was the first to express scientific concern for the increased risk of health effects from radiation on the Western Shoshone and Paiute peoples living near the NTS. In his thorough examination, he found that there were no studies of differential effects to native people. He hypothesized that internal radiation exposure was underestimated due to their lifestyle and cultural ways. In a participatory research study using local Western Shoshone and Paiute community members, Frohmberg, Goble, Sanchez, and Quigley (2000) affirmed significant differences in lifestyle. Western Shoshone and Paiute were found to have been significantly impacted by Iodine-131 from eating all parts, including the thyroids, of small game such as rabbits.

The “shepherd” lifestyle does not account for Native American lifeways and cultural uses of the land. Western Shoshone, and undoubtedly Paiute hunters, wandered through the NTS area searching in their traditional locations for game and plant foods and medicines, exposing themselves and their families to increased levels of radiation that are unaccounted for in any ICRP model. Native American food consumption patterns were not included in the “shepherd” lifestyle, as many Shoshone reported eating rabbit or other wild game in some form every day. They collected wild food and medicines from the same areas and used the plants and animal parts in their artwork, basketry, and buckskin work.

In addition to Western Shoshone wandering through NTS lands, migration patterns of deer and other game were not considered in the model. From 1975 to 1981 DOE traced 2 deer that left the NTS and moved 75-125 away. This is probably typical, especially if the deer were in search of food in the winter. Perhaps obvious visible signs, like the black bubbles reported, or tumors had not developed at the time they were killed and eaten. This would have increased the internal dose to Western Shoshone. Also, if radiation fell on the fur of wild game, and Western Shoshone used the hide, they would have increased external exposure. It appears that deer, mountain sheep, and other wild game were allowed to roam freely on and off of the NTS area. And there are no dose standards for animals. Perhaps that is why many Shoshone report seeing fewer animals and birds than in the old days. Animals would have eaten other contaminated animals and would have drunk contaminated water.

Most of the monitors collecting data for the ICRP study were placed in towns and near highways. Some ranchers in less accessible locations were given film badges. No Shoshone interviewed was provided with a film badge. Western Shoshone, like those from Yomba Shoshone Tribe or Timbisha people of the Tupippuh Project, lived in extremely isolated areas where there were no monitors. They spent much of their lives in mountainous areas, which are more likely to have fallout. They traveled, and still travel, extensively in search of wild food and to meet with relatives and friends at ceremonies and celebrations. Western Shoshone spent most of their time out of doors in poorly insulated homes, exposing them to even more radiation. None of these factors is taken into consideration in the DOE ICRP models.

This is but one underlying assumption (that Native Americans fit the “shepherd” profile) that should be explored and investigated. In addition the following observations and suggestions are made:

a) Local knowledge has been ignored. For example, the elegant studies by Nuclear Risk Management for Native Communities, part of the Frohmberg et al. (1994, 2000) studies, rely on indigenous communities. The community knows itself and is quick to see changes in health or environment and should be on the frontline of making decisions concerning the missing gaps in data or prioritization of research. Far from being biased, some native communities will only open up to people they know. Researchers from the community know what cultural information is inappropriate to share publicly. But they can use their complex knowledge to ask the important questions.

b) The concept of “downwinder” implies an assumption of plume direction. Most DOE studies are based on the majority of plumes traveling north and east. But is this correct? Wind patterns cannot be predicted. While most wind moves west to east, currents at 10,000 feet may move differently than those at 20,000 or 30,000 feet. Oceans, polar and tropical air masses can move the funnel the wind in unpredictable ways (Miller, 1986). Both the Yomba and the Tupippuh Project study results indicate radiation has moved west and south. Doses from the west were higher than doses in the assumed fallout areas. If the AEC/DOE did not place monitors in these areas, because of the assumption of wind patterns, downwinders and radiation went unnoticed. Or is the fallout from another source, such as Project Shoal or Chernobyl or other testing arenas than the NTS? This should be investigated. Perhaps there are more “downwinders” who should be compensated.

c) Many federal studies have only tracked the increase in cancer and leukemia in areas and have not focused on immune system breakdown. There are few studies of non-cancerous outcomes, fetal death, infant mortality, etc. There are no studies of combined effects of other pollutants with radiation. For example, if radiation weakens the immune system, what happens when the person is then exposed to an endocrine disrupter, such as a pesticide. Pesticide spraying for noxious weeds is common in Nevada. What are the health effects from this multidimensional health risk model? There are no studies on differential effects for a fetus, infants, small children, women, Native people, who may be at higher risk. There has been no study of decreased birth rate, birth weight, or increased teratological issues.

d) Many studies do not differentiate between external and internal exposure. Badge and monitor data have little to do with internal dose. And what exactly is a rem? If it is a measure of absorbed dose to tissue, how much damage is that? To what tissue? This concept of measure should be reconsidered. Bioaccumulation in specific organs is not addressed. Many of the studies rely upon data from health effects of Hiroshima and Nagasaki. Results of external acute radiation exposure cannot be extended to the level of internal chronic exposure from point sources. Consideration of the temporal lag between exposure and cancer development or genetic damage and the bioaccumulation effects of low dose exposure are ignored.

e) The concept of background radiation needs clarification. Some studies define background radiation as all non-man-made productions of radiation. Other studies define it as all radiation except that from the NTS making Chernobyl normal background radiation.

f) There is lack of confidence in DOE operations and studies. Most radiation research is funded by U. S. governmental agencies, primarily DOE, that support, defend, and promote nuclear programs. These agencies have the option to classify documents in the “national interest” and declassify them at their whim. A recently declassified DOE document lists all the radiological effluents released from US testing. The document was prepared in 1996, but only became publicly available within the last year. This report lists

at least 52 off-site releases from 433 under-ground tests before 1992. Findings related to the subject area are listed in Table 4.

How does this information change any of the previous health studies? For example, the iodine-133/thyroid studies does not include exposures after 1971. And is this document accurate? According to the original Black, Smith, & Costa (1986) report, the maximum detected concentration of xenon-133 following the Mighty Oak incident was 550 pCi/m^3. However the 1996 declassified document lowers that concentration to 450 pCi/m^3. Is this a typographical error, and are there other errors that could not be verified without access to original documents. According to Anspach (2000), DOE makes it a practice not to refer to classified documents, so that they remain out of the public view. The declassification of the effluent release document is critical to all health studies. An oversight or review committee needs to keep information regarding health open to independent researchers.

g) Most importantly, is it ethical to continue an operation which results in genetic damage or death without the informed consent, with insufficient accurate information and with no opportunity to participate in decision making or to opt out. What about the environmental effects and effects on animals. It is an inescapable situation.

Suggestions for Further Study

A database of raw data should be collected and preserved for the future. Control of data and laboratory testing should be wrested from DOE, due to conflict of interest. Available raw data should be released for re-examination by independent experts. Existing research should not be used for any meta-analytic studies because of potential errors in assumptions and unaddressed confounds. False or questionable assumptions should be pointed out and addressed. Using the precautionary principle, radiation standards should not be relaxed unless and until supporting evidence is found in the new studies and an independent panel examines the scientific status of radiation knowledge.

CONCLUDING REMARKS

The related studies of the Tupippuh Project (2007) and the Yomba Shoshone Tribe bring to mind thoughts of environmental justice. Environmental justice is the concept that no minority or low income population should suffer greater significant and adverse impact from an activity than any other group. Indeed this was an issue from the earliest testing on the Marshall Islands, when native people were removed from their homes without the knowledge that they could never return to their homeland. Certainly the Western Shoshone from this study, and of course, the Paiute and other Indian nations and tribes who lived in nearby areas were most adversely impacted. With little information and with little voice, they were left out of the any decision making, they were unwilling and unwitting subjects who did not give their consent to participate in one of the biggest experiments of all time. And so were we all, so were the animals, so was the environment.

And the legacy we leave still remains to be seen. Discussions of a return to nuclear testing by the U.S. and other developing countries and storage of the nuclear waste that has been created and will remain for tens of thousands of years is unspeakable. But none of us will have a voice until the veil of secrecy is lifted from the DOE and related governmental groups and until they are forced to declassify and make public the findings that protect only them.

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APPENDIX

TABLE 2. TUPIPPAH RESULTS – GROSS ALPHA, GROSS BETA, GAMMA RADIATION (pCi/g)

SAMPLE	GROSS ALPHA (pCi/g)	GROSS BETA (pCi/g)	CESIUM-137 (pCi/g)
1	17.10 +/- 7.12	41.30 +/- 7.14	0.74800 +/- 0.1550
2	12.70 +/- 5.79	38.00 +/- 8.82	0.02640 +/- 0.0520
3	20.20 +/- 7.76	44.40 +/- 7.53	1.41000 +/- 0.2630
4	19.90 +/- 7.73	39.60 +/- 6.95	0.42500 +/- 0.1190
5	10.70 +/- 5.55	35.20 +/- 6.63	0.85400 +/- 0.1620
6	12.70 +/- 5.89	35.20 +/- 6.34	0.02500 +/- 0.0876
7	15.40 +/- 6.93	37.00 +/- 6.72	0.16600 +/- 0.0634
8	17.60 +/- 7.31	38.00 +/- 6.70	0.17600 +/- 0.0721
9	24.70 +/- 9.08	35.20 +/- 6.30	0.13500 +/- 0.0646
10	3.83 +/- 3.63	30.70 +/- 6.75	-0.02750 +/- 0.0799
11	7.97 +/- 4.58	22.80 +/- 4.92	0.04990 +/- 0.0487
12	9.24 +/- 5.10	24.00 +/- 4.98	0.00665 +/- 0.0440
13	7.70 +/- 4.76	22.60 +/- 4.79	0.14000 +/- 0.0549
14	12.00 +/- 6.00	26.60 +/- 5.53	0.06620 +/- 0.0422
15	11.30 +/- 5.52	30.90 +/- 6.62	-0.02070 +/- 0.0625
16	10.70 +/- 5.73	29.70 +/- 5.65	0.01360 +/- 0.0514
17	5.27 +/- 4.02	28.20 +/- 5.46	0.01640 +/- 0.0764
18	14.20 +/- 6.20	50.00 +/- 8.18	0.07830 +/- 0.0686
19	19.70 +/- 7.73	36.50 +/- 7.74	0.01620 +/- 0.0603
20	19.30 +/- 7.53	39.50 +/- 7.10	0.30600 +/- 0.1010
21	24.00 +/- 8.76	45.10 +/- 7.61	0.20600 +/- 0.1070

TABLE 2 (continued). TUPIPPUH RESULTS – STRONTIUM, TRITIUM, PLUTONIUM 238, 239/240 AMERICIUM-241(pCi/g)

SAMPLE	STRONTIUM (pCi/g)	TRITIUM (pCi/g)	PLUTONIUM-238 (pCi/g)	PLUTONIUM-239/240 (pCi/g)	AMERICIUM-241 (pCi/g)
1	0.0336 +/- 0.354	0.06630 +/- 0.0166	-0.00164 +/- 0.00328	0.23500 +/- 0.09530	0.02250 +/- 0.02830
2	0.0768 +/- 0.702	0.03090 +/- 0.0121	0.01890 +/- 0.03800	0.00751 +/- 0.03980	0.06700 +/- 0.07170
3	-0.2050 +/- 0.653	0.05100 +/- 0.0301	0.03660 +/- 0.05440	0.20700 +/- 0.13100	0.06530 +/- 0.06990
4	0.1600 +/- 0.842	0.03730 +/- 0.0135	0.01240 +/- 0.03290	0.21000 +/- 0.12200	0.05370 +/- 0.06260
5	0.4140 +/- 0.773	0.06900 +/- 0.0188	0.01580 +/- 0.03460	0.22000 +/- 0.12900	0.11600 +/- 0.09680
6	-0.6050 +/- 0.691	0.02670 +/- 0.0137	0.01010 +/- 0.04060	0.04110 +/- 0.05660	0.01800 +/- 0.03600
7	0.0578 +/- 0.782	0.02390 +/- 0.0132	-0.00910 +/- 0.00830	0.06050 +/- 0.07930	0.02930 +/- 0.04670
8	0.3940 +/- 0.788	0.02230 +/- 0.0119	-0.00287 +/- 0.00409	0.06830 +/- 0.07220	0.01350 +/- 0.03460
9	0.3940 +/- 0.752	0.02850 +/- 0.0139	0.01260 +/- 0.03350	0.11000 +/- 0.08920	-0.00336 +/- 0.00675
10	0.1790 +/- 0.408	0.04550 +/- 0.0298	0.00000 +/- 0.03100	-0.00301 +/- 0.00352	0.01680 +/- 0.02670
11	-0.1990 +/- 0.306	0.02940 +/- 0.0141	0.00758 +/- 0.01940	0.00941 +/- 0.01890	-0.00160 +/- 0.00321
12	0.0419 +/- 0.328	0.04720 +/- 0.0164	0.00000 +/- 0.02040	0.01650 +/- 0.02350	0.01490 +/- 0.02380
13	0.1210 +/- 0.331	0.02840 +/- 0.0132	0.00512 +/- 0.01780	0.00678 +/- 0.01730	0.00877 +/- 0.01760
14	0.2700 +/- 0.772	0.05870 +/- 0.0155	-0.00441 +/- 0.00885	0.00000 +/- 0.05360	0.01700 +/- 0.03420
15	0.2840 +/- 0.775	0.05190 +/- 0.0319	0.00000 +/- 0.04630	0.01880 +/- 0.03770	0.01400 +/- 0.03570
16	0.0737 +/- 0.729	0.00836 +/- 0.0131	0.00000 +/- 0.05910	0.00000 +/- 0.05870	-0.00657 +/- 0.00937
17	0.0707 +/- 0.339	0.02560 +/- 0.0177	-0.00194 +/- 0.00389	0.03270 +/- 0.03940	0.00671 +/- 0.01720
18	0.5020 +/- 0.797	0.02400 +/- 0.0120	0.01810 +/- 0.03640	0.03600 +/- 0.05120	0.01770 +/- 0.03560
19	-0.1580 +/- 0.717	0.04200 +/- 0.0158	0.00000 +/- 0.05350	0.00000 +/- 0.05310	0.00000 +/- 0.04360
20	-0.1720 +/- 0.695	0.05930 +/- 0.0206	0.00000 +/- 0.04810	0.11700 +/- 0.09710	0.04660 +/- 0.05850
21	0.6620 +/- 0.780	0.08210 +/- 0.0247	-0.00341 +/- 0.00684	0.03380 +/- 0.04820	0.01730 +/- 0.03460

OFFSITE EFFLUENTS FROM UNDERGROUND TESTING AT NTS (Adapted from Schoengold, et al., 1996).

TEST	DATE	LOCATION	CLOUD DIRECTION	MAX AIR ACTIVITY Picocuries/cubic meter	MAX DISTANCE	ISOTOPES IDENTIFIED
Antler	09/15/61	U12e.03	N over Hwy 25, Reed, Diablo, Warm Springs, NV	28 pCi /cm gross beta at Diablo, NV	1.5 mR/h at 21.1 mi ne of junction Hwy 6 and Hwy 25	I-131, -133,-135, Ba-140/ La-140
Feather	12/22/61	U12b.08	SW over Death Valley Junction, CA (E of Carrara, NV, S of Carrara path changed to SE over Death Valley, to Ash Meadows, NV	440 pCi/cm gross beta Bettle's Farm, NV	0.01 mR/h at 1.5 mi. W to 1 mi S of Death Valley Junction	Ru-103, I-131,-133, -135, La-140 Ce-141
Pampas	03/01/62	U3al	NE over Hwy 25 NV	1,700 pCi/cm gross beta at Penoyer, NV	.08 mR/h at 17.7 mi N of Hwy 25 in Sand Springs, NV	Nb-95, Ru-103, I-131,133, 135, La-140, Ce-141
Danny Boy	03/05/62	U18a	N over Hwy 6, W of Warm Springs, NV	1,000 pCi/cm gross beta at Warm Springs, NV	0.02 mR/h at Carver's Restaurant, NV	Sr-91, Ru-103, I-131, -133, -135, Te-132, Ba-140/La-140
Platte	04/14/62	U12k.01	N over Hwy 25	34,000 pCi/cm gross beta at Queen City Summit, NV	0.01 mR/h at 28.1 mi NE of Currant, NV	K-40, Zr-95/Nb-95, Ru-103, Ru-105, I-131, -133, -135, Te-132, Ba-140/La-140, Ce-141, Ce-144
Eel	05/19/62	U9m	N toward Eureka	3,400 pCi/cm gross beta at Currant, NV	0.02 mR/h at 19 mi W of Ely, NV	Zr-95/Nb-95, Ru-103, Ru-106, Rh-105, I-131, -133, -135, Te-132, Ba-140/La-140, Ce-141, -144
Des Moines	06/13/62	U12j.01	NE over Queen City Summit, NV	15,000 pCi/cm gross beta at Queen City Summit, NV; 5,900 pCi/cm at Diablo, NV	0.6mR/h at 18.6 mi W of Ely, NV on Hwy 50 (approx. 163 mi from the detonation site)	Ru-103, Ru-106/Rh-106, I-131, -133, -135, Te-132, Ba-140/La-140
Sedan	07/06/62	U10h	NE	13,000 pCi/cm gross beta at Diablo, NV	0.7 mR/hr near McGill, NV	Be-7, Na-24, Mn-56, Ru-103, I-131, -132, -133, -135, Te-132, Ba-140/La-140, W-181, W-187, W-188, and tracers
Johnnie Boy	07/11/62	Area 18 Atmospheric	N, divided in two, lower went slightly W of N to Hwy 6 between Tonopah and Warm Springs, then E of N after assuming a width of 25-30 mi; higher at 11,000 ft went E of N	23,000 pCi/cm gross beta at Twin Springs Ranch, NV	3.0 mR/h at 11 mi NE of Lockes, NV	I-131, -133, -135, Te-132, Ba-140/La-140

TEST	DATE	LOCATION	CLOUD DIRECTION	MAX AIR ACTIVITY	MAX DISTANCE	ISOTOPES IDENTIFIED
Small Boy	07/14/62	Area 5 Atmospheric	NE, crossed Hwy 93, S of Alamo, NV	140,000 pCi/cm gross beta at Elko, NV	0.02 mR/h at 7 mi S of Parowan, UT on Hwy 143	Zr-95/Nb-95, RU-103, I-131, Te-132, Ba-140/La-140
Little Feller I	07/17/62	Area 18 Atmospheric	N	4,200 pCi/cm gross beta at Twin Springs, NV	0.1 mR/h at Lockes, NV	Zr-95/Nb-95, Ru-103, I-131
Bandicoot	10/19/62	U3bj	N for lower part of cloud, SSW for upper portion over Mercury, Cactus Springs, Indian Springs, Lathrop Wells, grew to 9 miles wide when it crossed Hwy 95, SW to Los Angeles	52,000 pCi/cm gross beta at Death Valley Junction, CA	0.01 mR/h at 14.5 mi S of Shoshone, CA	Zr-95/Nb-95, Ru-103, I-131, -133, -135, Te-132, Ba-140/La-140
Double Tracks	05/15/63	NAFR surface	N/A	12.1 disintegrations/min Per cubic meter at Scotty's Junction	Alpha detected in Beatty, NV and Scotty's Junction, NV	Test of Plutonium Dispersal
Clean Slate I	05/25/63	NAFR surface	N/A	0.32 disintegrations/min per cubic meter alpha at Lathrop Wells, NV	Hiko, Lund, Mesquite, Pioche, Tonopah, Warm Springs, Las Vegas, Furnace Creek, Lathrop Wells small concentrations	Test of Plutonium Dispersal Pu-239 component
Yuba	06/05/63	U12b.10	N/A	No fresh fission products detected	Two miles offsite at Lathrop Wells, NV	Kr-88, I-131, -133, -135, Xe-135, Cs-138
Clean Slate III	06/09/63	NAFR surface	N/A	Not above background	47.8+/-1.5 disintegrations per min per sq ft of Pu-239, -240 at Springdale, UT	
Eagle	12/12/63	U9av	SW over Death Valley and Central S. CA, about 140 mi from point of release	24 pCi/cm gross beta at Death Valley Junction	Death Valley Junction	Sr-89, -91, -92, Mo-99, Ru-103, I-132, -133, -134, -135, Te-132, Xe-135, Cs-138, Ba-140/La-140
Oconto	01/23/64	U9ay	N	No gross beta above normal levels	Hancock Summit, NV	Xe-133, -135, I-131, -133
Pike	03/13/64	U3cy	SE over Cactus Springs and Las Vegas, over CA and AZ next day	76,000 pCi/cm gross beta 5 mi W of Cactus Springs	0.03 mR/h at 17.8 mi SE of junction of Boulder Hwy and Sahara, Las Vegas, NV; fresh fission products 341 mi from ground zero	I-131, -133, -135

TEST	DATE	LOCATION	CLOUD DIRECTION	MAX AIR ACTIVITY	MAX DISTANCE	ISOTOPES IDENTIFIED
Alva	08/19/64	U2j	N	No fresh fission products detected	St. George, UT	Xe-133, -135, I-131, -133
Drill (Source-Lower)	12/05/64	U2ai	S, East of Lathrop Wells, NV	0.62 pCi/cm gross beta Death Valley Junction, CA; 1.6 pCi/cm Lathrop Wells	0.01 mR/h at 17 mi south of Lathrop Wells, NV, Hwy 29	Mn-56, Kr-87, -88. Rb-88, I-131, -133, -135, Te-132, Xe-133, Xe-133m, -135, -138, Cs-137, -138, La-142
Parrot	12/16/64	U3dk	N over Hwy 25, NV. Leak lasted for 8 days	74 pCi/cm gross beta at 12 mi NW of Hancock Summit, NV	0.015 mR/h at 22 mi S of Sunnyside, NV on Sunnyside Rd	Kr-85m, I-131, -133, -135, Xe-135, -138. Cs-138, traces of iodine
Sulky	12/18/64	U18d	N, between Clark Station and Nyala, NV. Lasted for 35 days	No fresh fission products detected	0.02 mR/h on Hwy 6, 19 mi W of Lockes, NV	Kr-85m, -87, -88, Sr-89, -91, Y-91, I-131, -132, -133, -134, -135, Xe-133, -135, -138, Cs-138, Ba-139, Ba-140
Alpaca	02/12/65	U2a	S to Hwy 95	19 pCi/cm gross beta at Barstow	0.004 mR/h at Johnnie's Mine, NV	Kr-89, Sr-89, Rb-89, I-131, -133m -135, Xe-133, -135, -137, -138, Cs-137, -138
Palanquin	04/14/65	U20k	N to Pine Creek Ranch, NV	23,000 pCi.cm gross beta Clark Station, NV, 87,000 pCi/cm at Hwy 6, 8 mi E of Tonopah Test Range Road	0.03 mR/h at Council ID	Sr-91, Y-91m, Zr-95/Nb-95, Zr-97/Nb-97, Mo-99, Tc-99, I-131, -133, -135, Xe-135, Ba-140/La-140
Tee	05/07/65	U2ab	S to Hwy 95	28 pCi/cm gross beta 4 mi E of junction Hwy 95 and Mercury turnoff	0.05 mR/h at 14 mi S of Mercury turnoff of Hwy 95	Na-24, Kr-87, -88, -91, Sr-91, Sb-122, -124, I-131, -133, -135, I-132/Te-132, Xe-133, -135, -139, -140, Cs-138, Ba-139, Ba-140
Diluted Waters	06/16/65	U5b	NE to Hwy 25	7.6 pCi/cm gross beta Nyala, NV	0.02 mR/h off Test Range Complex	Mo-99, Ru-103, -105, I-131, -133, -134, -135, Te-132, Xe-135, Cs-138, Ba-139, Ba-140/La-140, Ce-141, kryptons
Red Hot	03/05/66	U12g.06	NE	0.69 pCi/cm gross beta Elko, NV	Not above background at ground level, activity in Dubuque, IA	Krypton, xenons, I-131, -133, -135
Fenton	04/23/66	U2m	Releases 24.4 days	Fresh fission products not detected	Detected by aerial monitoring at Baker, CA	I-131, -133, -135, Xe-133, -135

TEST	DATE	LOCATION	CLOUD DIRECTION	MAX AIR ACTIVITY	MAX DISTANCE	ISOTOPES IDENTIFIED
Pin Stripe	04/25/66	U11b	NE, winds shifted by 4/27 and radiation detected in Indio, CA	25,000 pCi/cm gross beta at Ash Springs, NV; 50,000 pCi/cm 6.5 mi W of Hancock Summit, NV	0.05 mR/h at Pioche, NV	Kryptons, xenons, I-131, -133, -135
Double Play	06/15/66	U16a.03	NE about 200 mi	0.83 pCI/cm gross beta at Hiko, NV	None above background level	Noble gases, radioiodides
Derringer	09/12/66	U5i	NE about 150 mi	No fresh fission products detectable	0.003 mR/h at Hancock Summit, NV and 10 mi SE of Coyote Summit, NV	I-131, -133, -135, kryptons, xenons
Nash	01/19/67	U2ce	SW	2.6 pCi/cm gross beta Nyala, NV (attributed to Chinese test 12/27/66	0.01 mR/h Diablo Mainenance Station, NV	Kr-87, -88, I-131, -133, -135, Xe-133, -135
Midi Mist	06/26/67	U12n.02	N	No fresh fission products detectable	N, toward E side of crest of Belted Range, just off NTS	Kr-85, -88, Rb-88, I-131, -133, -135, Xe-133, -135
Umber	06/29/67	U3em	SW, tracked 90-100 mi	0.25 pCi/cm gross beta 10 mi E of Lathrop Wells, NV	0.03 to 0.1 mR/h at Death Valley Junction and Shoshone, CA	I-131, -133, -135, Xe-133, -135
Door Mist	8/31/67	U12g.07	N, tracked 60 mi	0.08 pCi/cm gross beta Diablo, NV	0.003 mR/h Clark Station, NV	Ru-103, -106, Rh-106, I-131, -133, -135, Xe-135
Hupmobile	01/18/68	U2y	SW, tracked to Death Valley, CA	1,100 pCi/cm gross beta Dansby's Ranch, NV	0.7 mR/h near Dansby's Ranch in Amargosa Farm Area, NV	Kr-87, -88, Rb-88, I-131, -133, -134, -135, Xe-133, -135
Cabriolet	01/26/68	U201	N, into S. ID, NE to Big Timber Mountain, MT	33,000 pCi/cm gross beta Stone Cabin Ranch, NV	Wells, NV	Kr-87, -88, Rb-88, Sr-91, I-131, -133, -134, -135, Te-132, Xe-133, -135, W-187
Buggy-A, -B, -C, -D, -E	03/12/68	U30a-e	N, tracked to MT	12,000 pCi/cm gross beta Warm Springs, NV	0.15 mR/h Hwy 40 Wells, NV	Sr-91, I-131, -133, -135, Te-132, Ba-140, W-187
Schooner	12/08/68	U20u	NE across UT, CO; base went N to ID, E across MT, ND	280,000 pCi/cm W-187 Clark Station, NV	0.2 mR/h Delta, UT	Mn-54, Ru-106, I-131, Cs-137, W-181, -187
Pod-A, -D	10/29/69	U2ck, U2cj	S, tracked 35 mi	No fresh fission products detected	4 mi N of Pahrump	I-131, -133, -135, Xe-135, Cs-138
Scuttle	11/13/69	U2bh	N/A	No fresh fission products detected	5 mi SE of Lathrop Wells, NV	Rb-88, I-133, Xe-135, Cs-138

TEST	DATE	LOCATION	CLOUD DIRECTION	MAX AIR ACTIVITY	MAX DISTANCE	ISOTOPES IDENTIFIED
Snubber	04/21/70	U3ev	NE, tracked 90 mi from ground zero	6.0 pCi/cm gross beta Coyote Summit, NV	Ground tracked to Koyne's Mill, NV; by air to N. Central AZ about 200 miles	I-131, -133, -135, Xe-133, -135, -138
Mint Leaf	05/05/70	U12t.01	E	6,000 pCi/cm Xe-135 on Hwy 25 NV, go gross beta	0.02 mR/h at Queen City Summit, NV	Kr-85m, I-131, -133, -135, Xe-133, -133m, -135
Diagonal Line	11/24/71	U11g	SW toward Amargosa Desert, NV	Fresh fission products not detected	6 mi SE of Lathrop Wells, NV	Kr-85m, -87, -88, I-131, -132, -133, -135, Xe-131m, -133, -133m, -135
Riola	09/25/80	U2eq	N/A	34 pCi/cm Xe-133 and 360 pCi/cm Xe-135 at Lathrop Wells, NV	None above background levels	Kr-85m, -87, -88, Xe-133, -133m, -135, -135m, tritium, tritiated water
Misty Rain	04/06/85	U12n.17	N/A	47+/-10 pCi/cm Xe-133 at Reed Ranch Road, NV; 11+/-5 pCi Xe-133 at Rachel, NV	None above background levels	Xe-133, Xe-133m, Xe-135
Glencoe	03/22/86	U4i	N/A	N/A	84 pCi/cm if Xe-133 at Lathrop Wells, NV	Xe-133, -135, I-131, -133
Mighty Oak	04/10/86	U12t.08	N/A	430+/-15 pCi/cm Xe-133 Medlins Ranch, NV	None above background levels	Kr-85, I-131, Xe-133

Feather	12/22/61	U12b.08	SW over Death Valley Junction, CA (E of Carrara, NV, S of Carrara path changed to SE over Death Valley, to Ash Meadows, NV	440 pCi/cm gross beta Bettle's Farm, NV	0.01 mR/h at 1.5 mi. W to 1 mi S of Death Valley Junction	Ru-103, I-131,-133, -135, La-140 Ce-141
Bandicoot	10/19/62	U3bj	N for lower part of cloud, SSW for upper portion over Mercury, Cactus Springs, Indian Springs, Lathrop Wells, grew to 9 miles wide when it crossed Hwy 95, SW to Los Angeles	52,000 pCi/cm gross beta at Death Valley Junction, CA	0.01 mR/h at 14.5 mi S of Shoshone, CA	Zr-95/Nb-95, Ru-103, I-131, -133, -135, Te-132, Ba-140/La-140
Double Tracks	05/15/63	NAFR surface	N/A	12.1 disintegrations/min Per cubic meter at Scotty's Junction	Alpha detected in Beatty, NV and Scotty's Junction, NV	Test of Plutonium Dispersal
Clean Slate I	05/25/63	NAFR surface	N/A	0.32 disintegrations/min per cubic meter alpha at Lathrop Wells, NV	Hiko, Lund, Mesquite, Pioche, Tonopah, Warm Springs, Las Vegas, Furnace Creek, Lathrop Wells small concentrations	Test of Plutonium Dispersal Pu-239 component
Eagle	12/12/63	U9av	SW over Death Valley and Central S. CA, about 140 mi from point of release	24 pCi/cm gross beta at Death Valley Junction	Death Valley Junction	Sr-89, -91, -92, Mo-99, Ru-103, I-132, -133, -134, -135, Te-132, Xe-135, Cs-138, Ba-140/La-140
Drill (Source-Lower)	12/05/64	U2ai	S, East of Lathrop Wells, NV	0.62 pCi/cm gross beta Death Valley Junction, CA; 1.6 pCi/cm Lathrop Wells	0.01 mR/h at 17 mi south of Lathrop Wells, NV, Hwy 29	Mn-56, Kr-87, -88. Rb-88, I-131, -133, -135, Te-132, Xe-133, Xe-133m, -135, -138, Cs-137, -138, La-142
Hupmobile	01/18/68	U2y	SW, tracked to Death Valley, CA	1,100 pCi/cm gross beta Dansby's Ranch, NV	0.7 mR/h near Dansby's Ranch in Amargosa Farm Area, NV	Kr-87, -88, Rb-88, I-131, -133, -134, -135, Xe-133, -135