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# OFF-SITE ENVIRONMENTAL MONITORING REPORT FOR THE NEVADA TEST SITE AND OTHER TEST AREAS USED FOR UNDERGROUND NUCLEAR DETONATIONS

January through December 1977

by

Monitoring Operations Division
Environmental Monitoring and Support Laboratory
U.S. ENVIRONMENTAL PROTECTION AGENCY
Las Vegas, Nevada 89114

July 1978

This work performed under a Memorandum of
Understanding No. EY-76-A-08-0539
for the
U.S. DEPARTMENT OF ENERGY

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## PREFACE

The Atomic Energy Commission (AEC) used the Nevada Test Site (NTS) from January 1951 through January 19, 1976, as an area for conducting nuclear detonations, nuclear rocket-engine development, nuclear medicine studies, and miscellaneous nuclear and non-nuclear experiments. Beginning on January 19, 1976, these responsibilities were transferred to the newly-formed U.S. Energy Research and Development Administration (ERDA), which was later merged with other energy-related agencies to form the U.S. Department of Energy on October 1, 1977. Atmospheric nuclear tests were conducted periodically from 1951 through October 30, 1958, at which time a testing moratorium was implemented. Since September 1, 1961, all nuclear detonations have been conducted underground with the expectation of containment except for four slightly above-ground or shallow underground tests of Operation Dominic II in 1962 and five nuclear earth-cratering experiments conducted under the Plowshare program.

The U.S. Public Health Service (PHS), from 1954 through 1970, and the U.S. Environmental Protection Agency (EPA), from 1970 to the present, have maintained facilities at the NTS or in Las Vegas, Nevada, for the purpose of providing an Off-Site Radiological Safety Program for the nuclear testing program. In addition, off-site surveillance has been provided by the PHS/EPA for nuclear explosive tests at places other than the NTS. Prior to 1953, the surveillance program was performed by the Los Alamos Scientific Laboratory and U.S. Army personnel.

The objective of the Program since 1954 has been to measure levels and trends of radioactivity in the off-site environment surrounding testing areas to assure that the testing is in compliance with existing radiation protection standards. To assess off-site radiation levels, routine sampling networks for milk, water, and air are maintained along with a dosimetry network and special sampling of food crops, soil, etc., as required. For the purpose of implementing protective actions, providing immediate radiation monitoring, and obtaining environmental samples rapidly after a release of radioactivity, mobile monitoring personnel are also placed in areas downwind of the NTS or other test areas prior to each test.

Analytical results showing radioactivity levels above naturally occurring levels have been published in reports covering a test series or test project. Beginning in 1959 for reactor tests, and in 1962 for weapons tests, surveillance data for each individual test which released radioactivity off site were reported separately. Commencing in January 1964, and continuing through December 1970, these individual reports for nuclear tests were also summarized and reported every 6 months. The individual analytical results for all routine or special milk samples were also included in the 6-month summary reports.

In 1971, the AEC implemented a requirement (now referred to as the DOE Manual, Chapter 0513) for a comprehensive radiological monitoring report from each of the several contractors or agencies involved in major nuclear activities. The compilation of these various reports since that time and their entry into the general literature serve the purpose of providing a single source of information concerning the environmental impact of nuclear activities. To provide more rapid dissemination of data, the monthly report of analytical results of all air data collected since July 1971, and all milk and water samples collected since January 1972, were also published in Radiation Data and Reports, a monthly publication of the EPA which was discontinued at the end of 1974.

Beginning with the first quarter of 1976, air and milk sample data have been reported quarterly. Dosimetry data were included beginning with the third quarter 1976.

Since 1962, PHS/EPA aircraft have also been used during nuclear tests to provide rapid monitoring and sampling for releases of radioactivity. Early aircraft monitoring data obtained immediately after a test are used to position mobile radiation monitoring personnel on the ground, and the results of airborne sampling are used to quantify the inventories, diffusion, and transport of the radionuclides released. Beginning in 1971, all monitoring and sampling results by aircraft have been reported in effluent monitoring data reports in accordance with the DOE Manual, Chapter 0513.

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## ACKNOWLEDGMENT

I would like to acknowledge the contribution of Mr. Philip C. Nyberg, who prepared the section of this report pertaining to the Dosimetry Network.

## INTRODUCTION

Under a Memorandum of Understanding, No. EY-76-A-08-0539*, with the U.S. Energy Research and Development Administration (ERDA) and the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), Environmental Monitoring and Support Laboratory-Las Vegas (EMSL-LV), continued its Off-Site Radiological Safety Program within the environment surrounding the Nevada Test Site (NTS) and at other sites designated by the DOE during CY 1977. This report, prepared in accordance with the DOE Manual, Chapter 0513, contains summaries of the EMSL-LV dosimetry and sampling methods and analytical procedures, and the analytical results of environmental samples collected in support of the DOE nuclear testing activities. Where applicable, dosimetry and sampling data are compared to appropriate guides for external and internal exposures to ionizing radiation. In addition, a brief summary of pertinent, including demographical, features of the NTS and the NTS environs is presented for background information.

### NEVADA TEST SITE

The major programs conducted at the NTS in the past have been nuclear weapons development, proof-testing and weapons safety, testing for peaceful uses of nuclear explosives (Project Plowshare), reactor-engine development for nuclear rocket and ram-jet applications (Projects Pluto and Rover), basic high-energy nuclear physics research, and seismic studies (Vela Uniform). During this report period these programs were continued with the exception of Project Pluto, discontinued in 1964, Project Rover, which was terminated in January 1973, Project Plowshare nuclear tests which were terminated in 1970, and Vela Uniform studies which ceased in 1973. All nuclear weapons tests since 1962 were conducted underground to minimize the possibility of the release of fission products to the atmosphere.

#### Site Location

The Nevada Test Site (Figures 1 and 2) is located in Nye

*Previously, this memorandum was with the U.S. Energy Research and Development Administration (ERDA). On October 1, 1977, the ERDA was merged with other energy-related agencies to form the DOE.

County, Nevada, with its southeast corner about 90 km northwest of Las Vegas. The NTS has an area of about 3500 km² and varies from 40-56 km in width (east-west) and from 64-88 km in length (north-south). This area consists of large basins or flats about 900-1200 m above mean sea level (MSL) surrounded by mountain ranges rising to 1800-2100 m above MSL.

The NTS is surrounded on three sides by an exclusion area collectively named the Nellis Air Force Range. The Range, particularly to the north and east, provides a buffer zone between the test areas and public lands. This buffer zone varies from 24-104 km between the test area and land that is open to the public. Depending upon wind speed and direction within the accepted range of testing criteria, this provides a delay of from 1/2 to more than 6 hours before any accidental release of airborne radioactivity could pass over public lands.

## Climate

The climate of the NTS and surrounding area is variable, primarily due to altitude and the rugged terrain. Generally, the climate is referred to as Continental Arid. Throughout the year, there is not sufficient water to support tree or crop growth without irrigation.

The climate may be classified by the types of vegetation which grow under these conditions. According to Houghton et al. (1975), this method, developed by Koppen's classification of dry conditions, is further subdivided on the basis of temperature and severity of drought. Table 1, from Houghton et al., summarizes the different characteristics of these climatic types in Nevada.

TABLE 1. CHARACTERISTICS OF CLIMATIC TYPES IN NEVADA

| Climate Type | Mean Temperature °C (°F) Winter | Summer | Annual Precipitation cm (inches) Total* | Snowfall | Dominant Vegetation | Percent of Area |
|---|---|---|---|---|---|---|
| Alpine tundra | -18° - -9° ( 0° - 15°) | 4° - 10° (40° - 50°) | 38 - 114 (15 - 45) | Medium to heavy | Alpine meadows | -- |
| Humid continental | -12° - -1° (10° - 30°) | 10° - 21° (50° - 70°) | 64 - 114 (25 - 45) | Heavy | Pine-fir forest | 1 |
| Subhumid continental | -12° - -1° (10° - 30°) | 10° - 21° (50° - 70°) | 30 - 64 (12 - 25) | Moderate | Pine or scrub woodland | 15 |
| Mid-latitude steppe | -7° - 4° (20° - 40°) | 18° - 27° (65° - 80°) | 15 - 38 ( 6 - 15) | Light to moderate | Sagebrush, grass, scrub | 57 |
| Mid-latitude desert | -7° - 4° (20° - 40°) | 18° - 27° (65° - 80°) | 8 - 20 ( 3 - 8) | Light | Greasewood, shadscale | 20 |
| Low-latitude desert | 4° - 10° (40° - 50°) | 27° - 32° (80° - 90°) | 5 - 25 ( 2 - 10) | Negligible | Creosote bush | 7 |

*Limits of annual precipitation overlap because of variations in temperature which affect the water balance.

As pointed out by Houghton et al., 90 percent of Nevada's population lives in areas with less than 25 cm of rain per year or in areas which would be classified as mid-latitude steppe to low-latitude desert regions.

According to Quiring (1968), the NTS average annual precipitation ranges from about 10 cm at the 900-m altitude to around 25 cm on the plateaus. During the winter months, the plateaus may be snow-covered for periods of several days or weeks. Snow is uncommon on the flats. Temperatures vary considerably with elevation, slope, and local air currents. The average daily high (low) temperatures at the lower altitudes are around 10° (-4°) C in January and 35° (12°) C in July, with extreme daily averages of 44° and -26° C. Corresponding temperatures on the plateaus are 2° (-4°) C in January and 26° (18°) C in July with extremes of 38° and -29° C. Temperatures as low as -34° C and higher than 46° C have been observed at the NTS.

The direction from which winds blow, as measured on a 30-m tower at an observation station on Yucca Flat, the location of many past nuclear tests, is predominantly northerly except for the months of May through August when winds from the south-southwest predominate. Because of the prevalent mountain/valley winds in the basins, south to southwest winds predominate during daylight hours during most months. During the winter months southerly winds have only a slight edge over northerly winds for a few hours during the warmest part of the day. These wind patterns may be quite different at other locations on the NTS because of local terrain effects and differences in elevation (Quiring, 1968).

## Geology and Hydrology

Geological and hydrological studies of the NTS have been in progress by the U.S. Geological Survey and various other organizations since 1956. Because of this continuing effort, including subsurface studies of numerous boreholes, the surface and underground geological and hydrological characteristics for much of the NTS are known in considerable detail. This is particularly true for those areas in which underground experiments are conducted. A comprehensive summary of the geology and hydrology of the NTS was edited and published by Eckel (1968).

There are two major hydrologic systems on the NTS (Figure 3). Groundwater in the northwestern part of the NTS or in the Pahute Mesa area has been reported (ERDA-1551, September 1977) to travel somewhere between 2 and 80 m per year to the south and southwest toward the Ash Meadows discharge area in the Amargosa Desert. It is estimated that the groundwater to the east of the NTS moves from north to south at a rate not less than 2 nor greater than 220 m per year. Carbon-14 analyses of this eastern groundwater indicate that the lower velocity is nearer the true value. At Mercury Valley, in the extreme southern part of the NTS, the groundwater flow direction shifts to the southwest toward the Ash Meadows discharge area in the southeastern Amargosa Valley.

The water levels below the NTS vary from depths of about 100 m beneath the surface at valleys in the southeastern part of the site to more than 600 m beneath the surface at highlands to the north. Although much of the valley fill is saturated, downward movement of water is extremely slow. The primary aquifer in these formations is the Paleozoic carbonates which underlie the more recent tuffs and alluviums.

## Land Use of NTS Environs

Figure 4 is a map of the off-NTS area showing general land use. A wide variety of uses, such as farming, mining, grazing, camping, fishing, and hunting, exist due to the variable terrain. For example, within a 300-km radius west of the NTS, elevations range from below sea level in Death Valley to 4420 m above MSL in the Sierra Nevada Range. Additionally, parts of two valleys of major agricultural importance (the Owens and San Joaquin) are included. The areas south of the NTS are more uniform since the Mojave Desert ecosystem (mid-latitude desert) comprises most of this portion of Nevada, California, and Arizona. The areas east of the NTS are primarily mid-latitude steppe with some of the older river valleys, such as the Virgin River Valley and Moapa Valley, supporting small-scale but intensive farming of a variety of crops by irrigation. Grazing is also common in this area, particularly to the northeast. The area north of the NTS is also mid-latitude steppe where the major agricultural-related activity is grazing of both cattle and sheep. Only areas of minor agricultural importance, primarily the growing of alfalfa hay, are found in this portion of the State within a distance of 300 km.

In the summer of 1974, a brief survey of home gardens around the NTS found that a majority of the residents grow or have access to locally grown fruits and vegetables. Approximately two dozen of the surveyed gardens within 30-80 km of the NTS boundary were selected for sampling. These gardens produce a variety of root, leaf, seed, and fruit crops (Andrews and Vandervort, 1978).

The only industrial enterprises within the immediate off-NTS area are 28 active mines, as shown in Figure 4, and several chemical processing plants located near Henderson, Nevada (about 23 km south of Las Vegas). The number of employees for these operations varies from one person at several small mines to several hundred workers for the chemical plants at Henderson. Most of the individual mining operations involve less than 10 workers per mine; however, a few operations employ up to 100-250 workers.

The major body of water close to the NTS is Lake Mead (100 km southeast) a man-made lake supplied by water from the Colorado River. Lake Mead supplies about 60 percent of the water used for domestic, recreational, and industrial purposes in the Las Vegas Valley and a portion of the water used by southern California. Smaller reservoirs and lakes located in the area are primarily for irrigation and for livestock. In California, the Owens River and Haiwee Reservoir feed into the Los Angeles Aqueduct and are the major sources of domestic water for the Los Angeles area.

As indicated by Figure 4, there are many places scattered in all directions from the NTS where such recreational activities as hunting, fishing, and camping are enjoyed by both local residents and tourists. In general, the camping and fishing sites to the northwest, north, and northeast of the NTS are utilized throughout the year except for the winter months. Camping and fishing at locations southeast, south, and southwest are utilized throughout the year with the most extensive activities occurring during all months except the hot summer months. All hunting is generally restricted to various times during the last 6 months of the year.

Dairy farming is not extensive within the 300-km-radius area under discussion. From a survey of milk cows during this report period, 8800 dairy cows, 419 family milk goats, and 464 family milk cows were located. The family cows and goats are found in all directions around the test site (Figure 5), whereas the dairy cows (Figure 6) are located southeast of the test site (Moapa River Valley, Nevada; Virgin River Valley, Nevada; and Las Vegas, Nevada), northeast (Lund area), and southwest (near Barstow, California).

Grazing of beef cattle and sheep is the most common use of the land in this area. Approximately 330,000 beef cattle and 267,000 sheep were produced within the 300-km radius surrounding the test site during this report period. Figures 7 and 8, respectively, show the distribution of the beef cattle and sheep by county.

## Population Distribution

The populated area of primary concern around the NTS which is sampled and monitored by surveillance networks is shown in Figure 9 as the area within a 300-km radius of the NTS Control Point (CP-1), except for the areas west of the Sierra Nevada Mountains and in the southern portion of San Bernardino County. Based upon the projections for the year 1976 by the U.S. Bureau of the Census and the 1977 projections for Washoe and Clark Counties by the University of Nevada (Reno), Figure 9 shows the current population of counties in Nevada and pertinent portions of the States of Arizona, California, and Utah. Las Vegas and vicinity is the only major population center within the inscribed area of Figure 9. With the assumption that the total populations of the counties bisected by the 300-km radius lie within the inscribed area, there is a population of about 528,800 people living within the area of primary concern, about 70 percent of which lives in the Las Vegas urbanized area. If the urbanized area is not considered in determining population density, there are about 0.6 people per $km^2$ (1.5 people per $mi^2$). For comparison, the United States (50 states, 1970 census) has a population density of 22 people per $km^2$, and the overall Nevada average from the 1976 projection is 2.3 people per $km^2$.

The off-site areas within about 80 km of the NTS are predominantly rural. Several small communities are located in the area, the largest being in the Pahrump Valley. This growing rural community, with an estimated population of about 3500, is located about 72 km south of the NTS. The Amargosa Farm area has a population of about 400 and is located about 50 km southwest of the center of the NTS. The Spring Meadows Farm area is a relatively new development consisting of approximately 10,000 $km^2$ (4000 $m^2$) with a population of about 130. This area is about 55 km south-south-west of the NTS. The largest town in the near off-site area is Beatty with a population of about 500; it is located about 65 km to the west of the site.

In the adjacent states, the Mojave Desert of California, which includes Death Valley National Monument, lies along the southwestern border of Nevada. The population within the Monument boundaries varies considerably from season to season with fewer than 200 permanent residents and tourists in the area during any given period in the summer months. However, during the winter as many as 15,000 tourists and campers can be in the area on any particular day during the major holiday periods. The largest town in this general area is Barstow, located 265 km south-southwest of the NTS, with a population of about 18,200. The Owens Valley, where numerous small towns are located, lies about 50 km west of Death Valley. The largest town in Owens Valley is Bishop, located 225 km west-northwest of the NTS, with a population of about 3800.

The extreme southwestern region of Utah is more developed than the adjacent part of Nevada. The largest town, Cedar City, with a population of 10,000, is located 280 km east-northeast of the NTS. The next largest community is St. George, located 220 km east of the NTS, with a population of 8500.

The extreme northwestern region of Arizona is mostly undeveloped range land with the exception of that portion in the Lake Mead Recreation Area.

Several small retirement communities are found along the Colorado River, primarily at Lake Mojave and Lake Havasu. The largest town in the area is Kingman, located 280 km southeast of the NTS, with a population of about 7500.

## OTHER TEST SITES

Table A-1 lists the names, dates, locations, yields, depths, and purposes of all underground nuclear tests conducted at locations other than the NTS. No off-NTS nuclear tests were conducted during this report period.

SUMMARY

During 1977, the monitoring of gamma radiation levels in the environs of the NTS was continued through the use of an off-site network of radiation dosimeters and gamma-rate recorders. Concentrations of radionuclides in pertinent environmental media were also continuously or periodically monitored by established air, milk, and water sampling networks. Before each underground nuclear detonation, mobile radiation monitors, equipped with radiation monitoring instruments and sampling equipment, were on standby in off-NTS locations to respond to any accidental release of airborne radioactivity. An airplane was airborne near the test area at detonation time to undertake tracking and sampling of any release which might occur.

All radioactivity from the underground nuclear tests was contained except for a total of about 36 curies (Ci) of radioactivity which was reported by DOE/NV as being released intermittently throughout the year and small undetermined amounts of radioxenon, tritium, and $^{85}$Kr which slowly seep to the surface from the underground test areas. The only off-NTS indication of this radioactivity was $^{133}$Xe in several air samples of the Noble Gas and Tritium Surveillance Network collected at Beatty, Diablo, Hiko, Las Vegas, and Tonopah during the period August 2 to September 28. The highest concentration of $^{133}$Xe detected ($1.4 \times 10^{-11}$ μCi/ml) was in a sample collected at Beatty. The estimated whole-body dose to a hypothetical receptor at this location was calculated as 2.5 microrem (μrem), which is 0.001 percent of the Radiation Protection Standard of 170 millirem (mrem) to a suitable sample of the exposed population. Based upon this dose and the population of Beatty, the estimated dose commitment[1] within a 80-km radius of the NTS Control Point was estimated to be 0.0013 man-rem. Due to the greater population density within the Las Vegas area, the highest dose commitment, 0.36 man-rem, was for this area, which is approximately 100 km from the NTS. This dose commitment is small compared to the 26,000 man-rem, which residents of Las Vegas and nearby communities received from natural background radiation.

All other measurements of radioactivity made by the Off-Site Radiological Safety Program were attributed to naturally occurring radioactivity or worldwide fallout and not related to underground nuclear test operations during this report period.


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[1]Product of estimated average dose equivalent and population.

Radioactivity from the atmospheric nuclear test by the People's Republic of China on September 17, 1977, at 0300 hours, EDT, was detected on filter samples of the Air Surveillance Network beginning on samples collected on September 21 and continuing throughout this report period. The tests resulted in increases of airborne radioactivity which were identified by the Air Surveillance Network as the radionuclides $^{95}Zr$, $^{99}Mo$, $^{103}Ru$, $^{131}I$, $^{132}Te$, $^{140}Ba$, $^{141}Ce$, $^{144}Ce$, and $^{147}Nd$.

The Long-Term Hydrological Monitoring Program used for the monitoring of radionuclide concentrations in surface and groundwaters which are down the hydrologic gradient from sites of past underground nuclear tests was continued for the NTS and eight other sites located elsewhere in Nevada, Alaska, Colorado, New Mexico, and Mississippi. Beginning this year, the EPA began the annual collection and analysis of water samples from Project Rio Blanco near Meeker, Colorado, and Projects Long Shot/Milrow/Cannikin, on Amchitka Island, Alaska, which were previously collected by the U.S. Geological Survey.

Higher than normal concentrations of radioactivity were observed in samples collected at wells known to be contaminated by the injection of radioactivity for tracer studies (Wells C and C-1 at the NTS and USGS Wells 4 and 8 near Malaga, New Mexico); however, no migration of the radioactivity was observed in samples collected from other wells nearby. Above background levels of $^{3}H$ radioactivity were also observed in water samples collected from Wells U3CN-5 and B at the NTS, from the Half Moon Creek Overflow (Project Dribble) near Baxterville, Mississippi, and from several locations at the Project Long Shot site on Amchitka Island, Alaska.

Three out of eleven water samples collected from Well U3CN-5 had $^{3}H$ concentrations of $2.0 \times 10^{-7}$ µCi/ml, $1.6 \times 10^{-7}$ µCi/ml, and $2.3 \times 10^{-7}$ µCi/ml; the concentration average of all samples was $<7.0 \times 10^{-8}$ µCi/ml. The six samples collected this year from Well B were consistently higher than other well samples with a concentration range of $1.5 \times 10^{-7}$ µCi/ml to $3.3 \times 10^{-7}$ µCi/ml. All samples from U3CN-5 Well B were <0.01 percent of the Concentration Guide ($3 \times 10^{-3}$ µCi/ml) for occupational exposures and <3 percent of the maximum contaminant level of the EPA Drinking Water Regulations for this nuclide. As the water from these wells is not used for human consumption, these concentrations were compared to the regulatory guides only as an aid in interpreting the significance of the concentrations. The annual sample collected from Half Moon Creek had a $^{3}H$ concentration of $1.8 \times 10^{-6}$ µCi/ml, (<0.06 percent of the Concentration Guide for $^{3}H$), which was again higher than other surface water samples, as samples have been from this location for the previous 3 years. Further exploratory surveys during this year identified sub-surface soil contaminated with $^{3}H$ from post-shot drill-back operations. An investigation to determine whether the contamination reached an acquifer used for drinking water is continuing. A report on the findings of these surveys will be reported separately at a later date.

At five locations near the Project Long Shot GZ, $^3H$ attributed to the Long Shot test and/or post-shot operations was found in water samples collected from shallow wells or surface waters. The range in concentrations was $1.8 \times 10^{-6}$ μCi/ml to $5.3 \times 10^{-6}$ μCi/ml, the highest being 0.2 percent of the Concentration Guide. The concentrations of $^3H$ at both locations, Project Dribble and Project Long Shot, were also <27 percent of the maximum contaminant level of the EPA Drinking Water Regulations for this nuclide. None of the sampled water sources are used for drinking purposes.

## MONITORING DATA COLLECTION, ANALYSIS, AND EVALUATION

The major portion of the Off-Site Radiological Safety Program for the NTS consisted of continuously operated dosimetry and air sampling networks and scheduled collections of milk and water samples at locations surrounding the NTS. Before each nuclear test, mobile monitoring personnel were positioned in the off-site areas most likely to be exposed to a possible release of radioactive material. These monitors, equipped with radiation survey instruments, gamma exposure-rate recorders, thermoluminescent dosimeters (TLD's), portable air samplers, and supplies for collecting environmental samples, were prepared to conduct a monitoring program directed from the NTS Control Point (CP-1) via two-way radio communications. In addition, for each event at the NTS, a U.S. Air Force aircraft with two Reynolds Electrical and Engineering Company monitoring personnel equipped with portable radiation survey instruments was airborne near surface ground zero to detect and track any radioactive effluent. One EMSL-LV cloud sampling and tracking aircraft was also available to obtain in-cloud samples, assess total cloud volume, and provide long-range tracking in the event of a release of airborne radioactivity.

During this report period, only underground nuclear detonations were conducted. All detonations were contained. However, during re-entry drilling operations, occasional low level releases of airborne radioactivity, primarily radioxenon, did occur. According to information provided by the Nevada Operations Office, DOE, the following quantities of radionuclides were released into the atmosphere during CY 1977:

TABLE 2. TOTAL AIRBORNE RADIONUCLIDE RELEASES AT THE NEVADA TEST SITE

| Radionuclide | | Quantity Released (Ci) |
|---|---|---|
| $^{3}H$ | | 6.880 |
| $^{133}Xe$ | | 28.286 |
| $^{133m}Xe$ | | 0.621 |
| $^{135}Xe$ | | 0.849 |
| $^{131}I$ | | 2.6 (pCi) |
| | Total | 36.636 |

Continuous low-level releases of $^3H$ and $^{85}Kr$ occur on the NTS. Tritium is released primarily from the Sedan crater and by evaporation from ponds formed by drainage of water from tunnel test areas in the Rainier Mesa. Krypton-85 slowly seeps to the surface from underground test areas. The quantities of radioactivity from seepage are not quantified, but are detected at on-site sampling locations and sometimes at off-NTS locations.

Contained within the following sections of this report are descriptions for each surveillance network and interpretations of the analytical results which are summarized (maximum, minimum, and arithmetic average concentrations) in tables. Where appropriate, the arithmetic averages in the tables are compared to the applicable DOE Concentration Guides (CG's) listed in Appendix B. Unless specifically stated otherwise, all concentration averages are arithmetic averages.

For "grab" type samples, radionuclide concentrations were extrapolated to the appropriate collection date. Concentrations determined over a period of time were extrapolated to the mid-point of the collection period. Concentration averages were calculated assuming that each concentration less than the minimum detectable concentration (MDC) was equal to the MDC, except for the airborne radionuclide concentration averages determined for the Air Surveillance Network. Due to the large number of airborne radionuclides that can be present below the MDC, those concentrations less than the MDC were assumed to be zero for the computation of concentration averages, and only those radionuclides detected above the MDC sometime during the year were averaged and reported.

All radiological analyses referred to within the text are briefly described in Table A-2 and listed with the minimum detectable concentrations (MDC's). To assure validity of the data, analytical personnel routinely calibrate equipment, split selected samples (except for the Air Surveillance Network) for replicate analyses, and analyze spiked samples prepared by the Quality Assurance Branch, EMSL-LV, on a bi-monthly, quarterly, semi-annual, and annual basis (EPA, in press). None of the quality assurance checks for the year identified problems which would affect the results reported here.

For the purpose of routinely assessing the sampling replication error plus analytical/counting errors associated with the collection and analysis of the different types of network samples, a replicate sampling program for all sample types was initiated at the end of CY 1975 and continued through 1977. A description of the procedures and results for 1976 was presented in last year's report (EMSL-LV, 1977). An evaluaion of this year's results will be reported at a later date. From the results of the program in 1976, the variances observed in all surveillance data were found to be greater than the sampling and analytical/counting errors except for the $^{85}Kr$ sampling and the monitoring of environmental gamma radiation with TLD's. Apparently the majority of the variation in $^{85}Kr$ concentrations observed in the past has been primarily due to the sampling and analytical/counting errors. As there are not sufficient TLD data for any given station in 1 year, a proper assessment of total variances in TLD results for a given station could not be made to compare to the precision error determination of this program.

## AIR SURVEILLANCE NETWORK

The Air Surveillance Network (ASN) was operated by the EMSL-LV to monitor environmental levels of radioactivity and to detect any airborne releases of radioactivity from NTS operations. The Network consisted of 48 active and 73 standby sampling stations located in 21 Western States (Figures 10 and 11). Samples of airborne particulates were collected continuously at each active station on 10-cm diameter, glass-fiber filters at a flow rate of about 400 $m^3$ of air per day. The filters, which are 99.9 percent efficient for particles $\leq 0.3$ μm in diameter, were collected three times per week, resulting in 48- or 72-hour samples from each active station. Activated charcoal cartridges directly behind the glass-fiber filters were used regularly for the collection of gaseous radioiodines at 21 stations near the NTS. Charcoal cartridges could have been added to all other stations and all standby stations could have been activated, if necessary, by a telephone request to station operators or by field personnel. All air samples (filters and cartridges) were mailed to the EMSL-LV for analysis. Special retrieval could have been arranged at selected locations in the event a release of radioactivity occurred.

During the year, the standby stations were activated quarterly to check the operation of the samplers and to maintain an understanding of Network procedures by station operators. In anticipation of airborne radioactivity from the atmospheric nuclear tests by the People's Republic of China on September 17 at 0300 hours EDT, 67 of the standby stations were activated with filters and charcoal cartridges during the period September 18 through October 19.

During the report period, no airborne radioactivity related to the underground nuclear testing program at the Nevada Test Site was detected on any sample from the ASN. However, radioactivity from the nuclear test by the People's Republic of China was detected on filters and charcoal cartridges. Appendix C summarizes the analytical results of those samples containing radioactivity from this test.

## NOBLE GAS AND TRITIUM SURVEILLANCE NETWORK

The Noble Gas and Tritium Surveillance Network, which was first established in March and April 1972, was operated to monitor the airborne levels of radiokrypton, radioxenon, and tritium ($^3H$) in the forms of tritiated hydrogen (HT), tritiated water (HTO), and tritiated methane ($CH_3T$). The Network consists of four on-NTS and seven off-NTS stations shown in Figure 12. Area 51, which appears to be off NTS, is considered to be on NTS as it is an access-controlled area with radiological safety support provided by NTS personnel.

The equipment used in this Network is composed of two separate systems, a compressor-type air sampler and a molecular sieve sampler. The compressor-type equipment continuously samples air over a 7-day period and stores it in two pressure tanks. The tanks together hold approximately 2 $m^3$ of air at atmospheric pressure. They are replaced weekly and returned to the EMSL-LV where the tank contents are separated and analyzed for $^{85}Kr$, radioxenons, and $CH_3T$ by gas chromatography and liquid-scintillation counting techniques (Table A-2). The molecular sieve equipment samples air through a filter to remove particulates and then through a series of molecular sieve columns. Approximately 5 $m^3$ of air are passed through each sampler over a 7-day sampling period. From the HTO absorbed on the first molecular sieve column, the concentration of $^3H$ in µCi/ml of recovered moisture and in µCi/ml of sampled air is determined by liquid-scintillation counting techniques. The $^3H$, passing through the first column as free hydrogen (HT), is oxidized and collected on the last molecular sieve column. From the concentration of $^3H$ for the moisture recovered from the last column, the $^3H$ (in µCi/ml of sampled air) as HT is determined.

Table A-3 summarizes the results of this Network by listing the maximum, minimum, and average concentrations for $^{85}Kr$, total Xe or $^{133}Xe$, $^3H$ as $CH_3T$, $^3H$ as HTO, and $^3H$ as HT. The annual average concentrations for each station were calculated over the time period sampled assuming that all values less than MDC were equal to the MDC. All concentrations of $^{85}Kr$, Xe or $^{133}Xe$, $^3H$ as $CH_3T$, $^3H$ as HTO, and $^3H$ as HT are expressed in the same unit, µCi/ml of air. Since the $^3H$ concentration in air may vary by factors of 15-20 while the concentration in µCi/ml of atmospheric water varies by factors up to about 7, the $^3H$ concentration in µCi/ml of atmospheric moisture is also given in the table as a more reliable indicator in cases when background concentrations of HTO are exceeded.

As shown by Table A-3, the average $^{85}Kr$ concentrations for the year were nearly the same for all stations, ranging from $1.9 \times 10^{-11}$ µCi/ml to $2.1 \times 10^{-11}$ µCi/ml, with an overall average of $1.96 \times 10^{-11}$ µCi/ml. As shown by the following table, the $^{85}Kr$ levels for all stations have been gradually increasing. Since this happened for all locations, the increase is probably a result of an increase in the ambient concentration worldwide, primarily as a result of nuclear reactor operations. Based upon the Network average concentrations over a 5-year period, this increase amounts to $3x10^{-13}$ to $1.5x10^{-12}$ μCi/ml/y.

TABLE 3. ANNUAL AVERAGE AIR CONCENTRATIONS OF $^{85}$KR, 1972-1977

| Location | Concentration, $10^{-11}$ μCi/ml | | | | | |
|---|---|---|---|---|---|---|
| | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 |
| Death Valley Jct., Calif. | 1.6 | 1.5 | 1.8 | 1.7 | 2.0 | 2.0 |
| Beatty, Nev. | 1.6 | 1.6 | 1.7 | 1.9 | 2.0 | 2.0 |
| Diablo, Nev. | 1.6 | 1.6 | 1.7 | 1.8 | 1.9 | 1.9 |
| Hiko, Nev. | 1.6 | 1.6 | 1.7 | 1.7 | 1.7 | 1.9 |
| Indian Springs, Nev. | - | - | - | 2.0 | 2.0 | 2.0 |
| Las Vegas, Nev. | 1.6 | 1.6 | 1.7 | 1.8 | 1.8 | 2.0 |
| Mercury, NTS, Nev. | 1.6 | 1.6 | 1.8 | 1.8 | 1.9 | 2.0 |
| Area 51, NTS, Nev. | 1.6 | 1.6 | 1.7 | 1.8 | 2.0 | 1.9 |
| BJY, NTS, Nev. | 1.7 | 1.8 | 1.9 | 1.9 | 2.0 | 2.1 |
| Area 12, NTS, Nev. | 1.6 | 1.6 | 1.8 | 1.8 | 2.0 | 1.9 |
| Tonopah, Nev. | 1.6 | 1.6 | 1.8 | 1.7 | 1.9 | 1.9 |
| Total Network | 1.62 | 1.61 | 1.76 | 1.81 | 1.93 | 1.96 |

The maximum concentrations of $^{85}$Zr for all stations ranged from $2.3x10^{-11}$ μCi/ml to $3.5x10^{-11}$ μCi/ml (Table A-3). From the expected geometric standard deviation resulting from the sampling and analytical/counting errors, as determined from the Replicate Sampling Program (EMSL-LV, 1977), the 99 percent upper confidence limits (UCL's) on the geometric mean concentrations of $^{85}$Kr would be $3.4x10^{-11}$ μCi/ml or $3.8x10^{-11}$ μCi/ml depending upon whether one is considering the location having the lowest geometric mean concentration ($1.89x10^{-11}$ μCi/ml at Diablo and Hiko) for the year or the location with the highest geometric mean concentration ($2.09x10^{-11}$ μCi/ml at BJY). Based upon the UCL's, all the Network stations had variations one would expect from the total errors of sample collection and analysis determined from the Replicate Sampling Program.

Xenon-133 was detected above its MDC of about $2x10^{-12}$ μCi/ml at the locations, periods, and concentrations shown in the following table.

TABLE 4. CONCENTRATIONS OF AIRBORNE $^{133}$XE DETECTED ON AND OFF NTS

| Location | Sampling Period | $^{133}$Xe Concentration ±2-Sigma Counting Error ($10^{-12}$ μCi/ml) |
|---|---|---|
| Beatty, Nev. | 08/02-09 | 12 ± 4.0 |
| | 09/20-27 | 14 ± 5.2 |
| Diablo, Nev. | 09/21-28 | 12 ± 4.3 |
| Hiko, Nev. | 09/21-28 | 11 ± 4.6 |
| Las Vegas, Nev. | 09/21-28 | 10 ± 8.2 |
| Mercury, NTS, Nev. | 08/08-15 | 7.1 ± 4.0 |
| BJY, NTS, Nev. | 10/25-31 | 100 ± 4.0 |
| | 11/14-21 | 30 ± 4.0 |
| Area 12, NTS, Nev. | 08/22-29 | 18 ± 7.5 |
| Tonopah, Nev. | 09/20-27 | 15 ± 7.8 |

As shown by the table, detectable concentrations occurred only in one or two samples at each location. The highest of these concentrations at an off-NTS location was $1.5 \times 10^{-11}$ μCi/ml at Tonopah, Nevada. If this level had persisted throughout the year, the result would have been 0.02 percent of the CG (Appendix B).

As in the past, concentrations of $^{3}$H as HTO in atmospheric moisture were generally at background levels at all off-NTS stations and at the on-NTS stations Mercury and Area 51 except for occasional increases in individual samples. The on-NTS stations of BJY and Area 12 continued to have concentrations consistently above background; the concentration averages for these stations for this year were about a factor of 5 greater than the average concentrations for all off-NTS stations. All of the off-NTS stations had concentrations of $^{3}$H as HTO in atmospheric moisture which were below the expected upper limit of background (approximately $1.0 \times 10^{-6}$ μCi/ml $H_2O$) used in the past.

The average concentrations of $^{3}$H as HT (Table A-3) at off-NTS Network stations were comparable to the averages for these locations last year. This year the averages ranged from $<6 \times 10^{-13}$ μCi/ml to $<2 \times 10^{-12}$ μCi/ml, whereas last year the averages ranged from $<6 \times 10^{-13}$ μCi/ml to $<3 \times 10^{-12}$ μCi/ml. From a review of the cumulative frequency distributions of the data for each station and for the whole Network, all concentrations appeared to be part of the environmental background.

Concentrations of $^{3}$H as $CH_3T$ were generally below the MDC at all locations as normally observed. Detectable concentrations did occur at Diablo, Hiko, Las Vegas, and Tonopah during the months of January, March, August, and December. The maximum concentrations for all locations ranged between $5.0 \times 10^{-12}$ μCi/ml to

$1.4x10^{-11}$ μCi/ml. The total of the average $^3H$ concentrations ($HTO+HT+CH_3T$) for the locations having the highest $CH_3T$ concentration ($1.4x10^{-11}$ μCi/ml at Indian Springs) was <0.009 percent of the CG for exposure to a suitable sample of the exposed population. Since the detectable concentrations occurred generally throughout the Network both on NTS and off NTS at the same level, the concentrations were not attributed to NTS operations.

## DOSIMETRY NETWORK

During 1977, the Dosimetry Network consisted of 78 locations surrounding the Nevada Test Site which were monitored continuously with thermoluminescent dosimeters (TLD's). The function of the Dosimetry Network is to measure the radiation dose, if any, due to releases of radioactivity from the NTS. To do this task accurately requires an accurate estimate of the environmental background radiation rate at each monitoring location so that any exposure in excess of background may be noted. The ability to measure the background rate, while both interesting and necessary, is of secondary importance to the measurement of radiation doses due to NTS activities.

As shown in Figure 13, all the stations are located within a 270-km radius of the center of the NTS and these include both inhabited and uninhabited locations. Each Dosimetry Network station was routinely equipped with three Harshaw Model 2271-G2 (TLD-200) dosimeters which were exchanged on a quarterly basis. Within the general area covered by the dosimetry stations, 25 cooperating off-site residents each wore a dosimeter which was exchanged at the same time as the station dosimeters. No radiation exposures due to the current nuclear testing program at the NTS were detected by the Dosimetry Network during 1977.

The Model 2271-G2 dosimeters consist of two small "chips" of dysprosium-activated calcium fluoride, designated TLD-200 by the manufacturer, mounted in a window of Teflon plastic attached to a small aluminum card. An energy compensation shield of 1.2-mm thick cadmium metal is placed over the chips, and the whole card is then sealed in an opaque plastic container. Three of these dosimeters are placed in a rugged plastic housing located 1 meter above the ground at each station location to standardize the exposure geometry and to prevent tampering or pilferage.

After appropriate corrections were made for background exposure accumulated during shipment between the laboratory and the monitoring location, the dosimeter readings for each station were averaged, and this average value for each station was compared to the values from the past year to determine if the new value was within the range of previous background values for that station. Any values significantly greater than previous values would have led to calculations of net exposure, while values significantly less than previously would have been examined to determine possible reading or handling errors. The results from each of the personnel dosimeters were compared to the background value of the nearest station to determine if a net exposure had occurred.

The smallest exposure in excess of background radiation which may be determined from these dosimeter readings depends primarily on variations in the natural background exposure rate at the particular station location. In the absence of other independent exposure rate measurements, it is necessary to compare present exposure rates with past data which have been accepted as representing the natural background. Typically, the smallest net exposure observable for a 90-day monitoring period would be 5-15 mR in excess of background, which ranges from 15-35 mR depending on location. The term "background," as used in this context, refers to naturally occurring radioactivity plus a contribution from residual man-made fission products.

Table A-4 lists the maximum, minimum, and average dose equivalent rate (mrem/day) measured at each station in the Network during 1977 due to penetrating gamma radiation. No allowance was made for the small additional dose due to the neutron component of the cosmic ray spectrum. No station exhibited an exposure in excess of background, which under present criteria is defined as the 99 percent confidence limit of the environmental background. It was noted in the 1976 report (EMSL-LV, 1977) that the station at Mammoth Mountain, California, may have shown a small net exposure. Additional data have continued to show the unusually large and cyclic variation at that location which is believed to be due to the heavy winter snow cover.

TABLE 5. DOSIMETRY NETWORK SUMMARY FOR THE YEARS 1971-1977

| Environmental Radiation Dose Rate (mrem/y) | | | |
|---|---|---|---|
| Year | Maximum | Minimum | Average |
| 1971 | 250 | 102 | 160 |
| 1972 | 200 | 84 | 144 |
| 1973 | 180 | 80 | 123 |
| 1974 | 160 | 62 | 114 |
| 1975 | 140 | 51 | 94 |
| 1976 | 140 | 51 | 94 |
| 1977 | 170 | 60 | 101 |

As shown in the above table, the average annual dose rate for the Dosimetry Network increased in 1977 over 1976. Part of this increase, approximately 3 mrem per year, was due to the addition of eight new stations in 1977, most of which exhibit dose rates above the average. The station with the highest dose rate was one of these: Stone Cabin Ranch, Nevada, with 170 mrem per year. Part of this increase may have resulted from biased data due to equipment problems. During the readout of the data for the second calendar quarter, severe mechanical problems were encountered in the automatic TLD reader, causing many invalid readings. This is believed to have resulted in a data set for that quarter which is noticeably dissimilar from the remaining three quarters. There has been insufficient time to analyze the effect of these problems, but preliminary indications are that the dose estimates for that quarter may have been inflated.

In order to assure the continuing validity of the data from the Dosimetry Network, dosimeters were submitted to the Third International Intercomparison of Environmental Dosimeters, conducted at the Oak Ridge National Laboratory in July and August 1977. For dosimeters given a controlled exposure in the laboratory, the calculated exposure was 91.7±7.3 mR; the mean exposure estimated by all participants was 86.2±12.0 mR; the average for the EMSL-LV dosimeters was 86.3±8.9 mR, essentially equal to the mean for all participants and about 6 percent below the calculated value. For dosimeters exposed under rather unusual field conditions, the calculated exposure was 34.9±2.4 mR; the mean exposure for all participants 31.5±6.5 mR; the average for the EMSL-LV dosimeters was 29.1±2.2 mR, 7 percent less than the mean value for all participants and 17 percent less than the calculated value. These results tend to indicate that the present calibration techniques used by EMSL-LV underestimate the exposure. Investigations are continuing into the source of this bias.

A network of 11 full-time and 19 standby stationary gamma exposure rate recorders (Figure 13) was also used at selected air sampling locations to document any changes in the ambient exposure rate. These units use a 2.5- by 30.5-cm constant-current ionization chamber (filled with methane) as the detector, operate on either 115V a.c. or a self-contained battery pack, and record on a paper strip chart. They have a range from 0.004 mR/h to 40 mR/h with an accuracy of about ±10 percent. The standby recorders were exercised at the same time as the standby air sampling stations, and were run continuously during the expected periods of fallout from the atmospheric nuclear tests by the People's Republic of China. No increase in exposure rates attributable to current NTS operations was detected by these recorders.

## MILK SURVEILLANCE NETWORK

Milk is only one of the sources of dietary intake of environmental radioactivity. However, it is a very convenient indicator of the general population's intake of biologically significant radionuclide contaminants. For this reason it is monitored on a routine basis. Few of the fission product radionuclides become incorporated into the milk due to the selective metabolism of the cow. However, those that are incorporated are very important from a radiological health standpoint and are a very sensitive measure of their concentrations in the environment. The six most common fission product radionuclides which can occur in milk are $^{3}H$, $^{89}Sr$, $^{90}Sr$, $^{131}I$, $^{137}Cs$, and $^{140}Ba$. A seventh radionuclide, $^{40}K$, also occurs in milk at a reasonably constant concentration of about $1.2 \times 10^{-6}$ µCi/ml. Since this is a naturally occurring radionuclide, it was not included in the analytical results summarized in this section.

The milk surveillance networks operated by the EMSL-LV were the routine Milk Surveillance Network (MSN) and the Standby Milk Surveillance Network (SMSN). The MSN, during 1977 (Figure 14), consisted of 23 different locations where 3.8-liter milk samples were collected to represent family cows, commerical pasteurized milk producers, Grade A raw milk intended for pasteurization, and Grade A raw milk for local consumption. In the event of a release of activity from the NTS, intensive sampling would have been conducted in the affected area within a 480-km radius of CP-1, NTS, to assess the radionuclide concentrations in milk, the radiation doses that could result from the ingestion of the milk, and the need for protective action. Samples are collected from milk suppliers and producers beyond 480 km within the SMSN.

During 1977, 85 milk samples were collected from the MSN on a quarterly collection schedule. During this report period, two changes were made in the Network. The Stanford Ranch at Trona, California, replaced the Riley Ranch in Olancha, California. Also, a family cow located in Alamo, Nevada, was added to the Network.

Each MSN milk sample was analyzed for gamma-emitters and $^{89,90}Sr$. Samples collected at six locations from the MSN were also analyzed for $^{3}H$. Table A-2 lists the general analytical procedures and detection limits for these analyses.

The SMSN consisted of about 140 Grade A milk processing plants in all States west of the Mississippi River. Managers of these facilities could be requested by telephone to collect raw milk samples representing milk sheds supplying milk to the plants. Since there were no releases of radioactivity from the NTS or other test locations, this network was not activated except to request one sample from most of the locations to check the readiness and reliability of the network. During the months of April and May, 116 milk samples were collected and analyzed by gamma spectrometry. Samples selected from all Western States were also analyzed for $^{3}H$ and $^{89,90}Sr$. During the months of September and October, an additional 69 milk samples were collected from the same SMSN stations in the States of Arizona, Arkansas, California, Colorado, Minnesota, and Nevada, due to concern for the fallout from the atmospheric nuclear test conducted by the People's Republic of China on September 17, 1977. These samples were analyzed only by gamma spectrometry.

The analytical results of milk samples collected from the MSN during 1977 are summarized in Table A-5, where the maximum, minimum, and average concentrations of the $^{137}Cs$, $^{131}I$, $^{89,90}Sr$, and $^{3}H$ in samples collected during the year are shown for each sampling location. As shown by the following table, the average radionuclide concentrations for the whole Network are comparable to those for the SMSN, if not slightly lower.

TABLE 6. SUMMARY OF RADIONUCLIDE CONCENTRATIONS FOR MILK SURVEILLANCE NETWORK AND STANDBY SURVEILLANCE NETWORK

| Network | Radionculide | No. of Samples | Concentration ($10^{-9}$ μCi/ml) $C_{Max}$ | $C_{Min}$ | $C_{Avg}$ |
|---|---|---|---|---|---|
| MSN | $^{140}Ba$ | 21 | <20 | <3 | <6 |
| | $^{137}Cs$ | 85 | <13 | <3 | <6 |
| | $^{131}I$ | 85 | 140 | <4 | <10 |
| | $^{89}Sr$ | 84 | 4.0 | <0.6 | <2 |
| | $^{90}Sr$ | 64 | 2.5 | <0.5 | <2 |
| | $^{3}H$ | 20 | <400 | <300 | <10 |
| SMSN | $^{140}Ba$ | 116 | 22 | <2 | <8 |
| | $^{137}Cs$ | 116 | 8.2 | <2 | <5 |
| | $^{131}I$ | 69 | 100 | <5 | <14 |
| | $^{89}Sr$ | 21 | <5 | <2 | <4 |
| | $^{90}Sr$ | 21 | 7.1 | <0.7 | <3 |
| | $^{3}H$ | 21 | 450 | <300 | <400 |

The concentrations of $^{137}Cs$, $^{131}I$, $^{89}Sr$, $^{90}Sr$, and $^{3}H$ for the MSN shown in Table 6 were for all samples collected during the entire year. The $^{137}Cs$, $^{89}Sr$, $^{90}Sr$, and $^{3}H$ results for the SMSN are for samples collected during April and May 1977, during the annual Network activation. The $^{131}I$ levels for the SMSN are for samples collected during September and October 1977. The only $^{131}I$ results for the MSN were for samples collected in October during the fourth quarter routine collection. As similar levels of $^{131}I$ were observed in the samples from the SMSN, all $^{131}I$ concentrations were attributed to the Chinese test of September 17, 1977.

LONG-TERM HYDROLOGICAL MONITORING PROGRAM

During this reporting period, EMSL-LV personnel continued the collection and analysis of water samples from wells, springs, and spring-fed surface water sources which are down the hydrologic gradient of the groundwater at the NTS and at off-NTS sites of underground nuclear detonations to monitor for any migration of test-related radionuclides through the movement of groundwater. The water samples were collected from wellheads or spring discharge points wherever possible. Prior to each sampling at a wellhead, water was pumped from the aquifer to assure the collection of representative samples. If pumps were not available, an electrical-mechanical water sampler capable of collecting 3-liter samples at depths to 1800 m was used.

Nevada Test Site

For the NTS, attempts were made to sample 10 locations monthly and 20 locations semi-annually (Figures 15 and 16). Additionally, samples were collected annually from 12 locations. Not all stations could be sampled with the desired frequency because of inclement weather conditions and inoperative pumps.

During the year, sampling at Test Well B was changed from semi-annual to monthly collection, sampling at Watertown No. 3 was terminated, Shoshone Spring was changed from semi-annual collection to annual, and the Union Carbide Well at Tempiute was added to the annual collection.

For each sampled location, samples of raw water, filtered water, and filtered and acidified water were collected. The raw water samples were analyzed for $^{3}H$. Portions of the filtered and acidified samples were given radiochemical analyses by the criteria summarized in Table A-6. Table A-2 summarizes the analytical techniques used. Each filter was also analyzed by gamma spectrometry.

Tables A-7, A-8, and A-9 list the analytical results for all samples collected and analyzed during this reporting period and compare them to the CG's (Appendix B). As indicated by Table A-6, the analyses for $^{89,90}Sr$, $^{226}Ra$, $^{234}U$, $^{235}U$ $^{238}U$, $^{238}Pu$, and $^{239}Pu$, which were normally done at least once during the year on a sample from each location, were not made unless the levels of gross alpha and gross beta radioactivity in any sample showed an unexpected increase. As no increases were observed in the gross alpha and gross beta radioactivity during the year, no additional analyses were required. The ranges in radioactivity were $<2\times10^{-9}$ µCi/ml to $1.9\times10^{-8}$ µCi/ml and $<3\times10^{-8}$ µCi/ml to $2.0\times10^{-8}$ µCi/ml, respectively.

As in the past, $^{3}H$ was detected in NTS Wells C (Table A-7) and C-1 (Table A-8) due to tracer experiments conducted prior to the commencement of this surveillance program. All $^{3}H$ concentrations were below 0.01 percent of the Concentration Guide for an occupationally exposed person.

As observed last year, those locations from which samples were collected having $^{3}H$ concentrations greater than normal were Well U3CN-5 and Well B (Table A-7) located on NTS. Well U3CN-5 had three out of eleven samples during the year which had $^{3}H$ concentrations of $2.0x10^{-7}$ µCi/ml, $1.6x10^{-7}$ µCi/ml, and $2.3x10^{-7}$ µCi/ml; all other concentrations ranged from $<8x10^{-9}$ µCi/ml to $2.5x10^{-8}$ µCi/ml. The six samples from Well B consistently had $^{3}H$ concentrations higher than normal, ranging from $1.5x10^{-7}$ µCi/ml to $3.3x10^{-7}$ µCi/ml. No explanation for the levels is available. All $^{3}H$ concentrations were below 0.01 percent of the Concentration Guide for an occupationally exposed person. All $^{3}H$ concentrations were also <3 percent of the maximum contaminant level of the EPA Drinking Water Regulations for this nuclide (Appendix B).

## Other Test Sites

The annual collection and radiological analysis of water samples were continued for this program at all off-NTS sites of underground nuclear detonations. The project sites at which samples were collected are Project Gnome near Carlsbad, New Mexico; Project Faultless in Central Nevada; Project Shoal near Fallon, Nevada; Project Gasbuggy in Rio Arriba County, New Mexico; Project Rulison near Rifle, Colorado; Project Dribble at Tatum Dome, Mississippi; Project Rio Blanco near Meeker, Colorado; and Projects Long Shot/Milrow/Cannikin on Amchitka Island, Alaska. The latter four sites, which were previously sampled by the U.S. Geological Survey, were sampled by the EPA for the first time in 1977. Figures 17 through 28 identify the sampling locations, and Table A-1 lists additional information on the location of each site and tests performed at these locations.

All samples were analyzed in accordance with the same criteria (Table A-6) as for samples collected on and around the NTS. Samples were collected for the first time at the Project Rio Blanco site and Projects Long Shot/Milrow/Cannikin sites, and therefore were analyzed for $^{89,90}Sr$, $^{226}Ra$, $^{234,235,238}U$, and $^{238,239}Pu$. The results of all analyses are listed or summarized in Table A-10 and compared to the appropriate CG's (Appendix B) except for Project Rio Blanco. As the special analyses ($^{89,90}Sr$, $^{226}Ra$, $^{234,235,238}U$, and $^{238,239}Pu$) for samples from this location were not initiated until the latter part of the year, the analyses were not completed in time for this report.

The ranges in concentrations of gross alpha radioactivity, gross beta radioactivity, and $^{3}H$ in samples collected from all project sites were $<8x10^{-10}$ µCi/ml to $<2x10^{-9}$ µCi/ml, $<4x10^{-9}$

$\mu$Ci/ml to $4.7\times10^{-8}$ $\mu$Ci/ml, and $<7\times10^{-9}$ $\mu$Ci/ml to $5.3\times10^{-6}$ $\mu$Ci/ml, respectively. The observed radioactivity concentrations were similar to those observed in the past. No analytical results of samples collected previously at Project Rio Blanco were available; however, the concentrations of gross alpha radioactivity, gross beta radioactivity, and $^{3}H$ in this year's samples were comparable to those observed in the samples collected at the Project Rulison site near Rifle, Colorado. The gross alpha and gross beta radioactivity concentration in samples collected at the Projects Long Shot/Milrow/Cannikin sites were comparable to those observed in samples from other sites and in samples collected in August 1973, May 1974, and August 1974 by the U.S. Geological Survey (Ballance, 1974; Thordarson and Ballance, 1976) and in samples collected in August 1976 by University of Washington (Nelson and Seymour, 1977). The $^{3}H$ concentrations in several samples collected at the Project Long Shot site were higher than normal, i.e., $5.3\times10^{-6}$ $\mu$Ci/ml at Well GZ No. 1, $1.8\times10^{-6}$ $\mu$Ci/ml at Well GZ No. 2, $2.0\times10^{-6}$ $\mu$Ci/ml at Mud Pit No. 1, $2.5\times10^{-6}$ $\mu$Ci/ml at Mud Pit No. 2, and $3.4\times10^{-6}$ $\mu$Ci/ml at Mud Pit No. 3. The highest of these concentrations, $5.3\times10^{-6}$ $\mu$Ci/ml, was 0.2 percent of the of the CG for $^{3}H$. As these samples were collected near the Long Shot GZ, the higher than normal levels of $^{3}H$ were attributed to the Long Shot test. The U.S. Geological Survey (Ballance, 1974; Thordarson and Ballance, 1976) also reported $^{3}H$ concentrations of this magnitude (concentration range of $1.3\times10^{-6}$ $\mu$Ci/ml to $1.3\times10^{-4}$ $\mu$Ci/ml) in surface water and well samples collected at three locations near the Project Long Shot GZ. The University of Washington (Nelson and Seymour, 1977) reported $^{3}H$ concentrations as high as $1.13\times10^{-5}$ $\mu$Ci/ml in surface waters near the GZ.

One surface water sample from Half Moon Creek Overflow, near Baxterville, Mississippi, had a $^{3}H$ concentration ($1.8\times10^{-6}$ $\mu$Ci/ml) higher than concentrations observed in other surface water samples collected near the Project Dribble site. The $^{3}H$ concentrations at this location have been consistently high ($2.4\times10^{-6}$ $\mu$Ci/ml in 1976, $2.2\times10^{-6}$ $\mu$Ci/ml in 1975, $5.1\times10^{-6}$ $\mu$Ci/ml in 1974) over the previous 3 years. Further exploratory surveys during this year identified sub-surface $^{3}H$ soil contamination left from post-shot drill-back operations as the source of the $^{3}H$. A report on the findings of these surveys will be reported separately at a later date.

As reported in previous annual reports, concentrations of radioactivity above background were observed in samples collected from USGS Wells 4 and 8 near Malaga, New Mexico (Table A-10). These wells, which are fenced, posted, and locked to prevent their use by unauthorized personnel, were contaminated by the injection of high concentrations of $^{3}H$, $^{90}Sr$, and $^{137}Cs$ (USGS Well No. 8 only) for a tracer study.

Several samples collected from the Projects Long Shot/Milrow/Cannikin sites had concentrations of $^{90}Sr$ and $^{238}Pu$ that were above the MDC's for these radionuclides. The locations and results for these samples are as follows:

TABLE 7. DETECTABLE CONCENTRATIONS OF $^{90}$SR AND $^{238}$PU IN WATER SAMPLES

| Location | Radio-nuclide | Concentration ±3-Sigma Counting Error ($10^{-9}$ μCi/ml) |
|---|---|---|
| Project Cannikin | | |
| South End of Cannikin Lake | $^{90}$Sr | 1.8 ± 0.80 |
| | $^{238}$Pu | 0.041 ± 0.045* |
| North End of Cannikin Lake | $^{90}$Sr | 2.2 ± 3.3* |
| Well HTH-3 | $^{90}$Sr | 1.7 ± 0.77 |
| | $^{238}$Pu | 0.040 ± 0.039* |
| Ice Box Lake | $^{90}$Sr | 1.6 ± 0.93 |
| | $^{238}$Pu | 0.029 ± 0.033* |
| White Alice Creek | $^{90}$Sr | 2.3 ± 0.98 |
| | $^{238}$Pu | 0.042 ± 0.024 |
| Pit South of Cannikin GZ | $^{90}$Sr | 2.3 ± 0.90 |
| | $^{238}$Pu | 0.043 ± 0.036 |
| Project Milrow | | |
| Heart Lake | $^{90}$Sr | 2.0 ± 0.92 |
| | $^{238}$Pu | 0.046 ± 0.035 |
| Rifle Range Creek | $^{90}$Sr | 1.5 ± 0.77 |
| | $^{238}$Pu | 0.034 ± 0.027 |
| Project Long Shot | | |
| Reed Pond | $^{90}$Sr | 2.1 ± 1.0 |
| Well GZ No. 1 | $^{90}$Sr | 1.5 ± 0.77 |
| | $^{238}$Pu | 0.042 ± 0.039* |
| Well WL-1 | $^{238}$Pu | 0.042 ± 0.051* |
| Mud Pit No. 1 | $^{238}$Pu | 0.030 ± 0.041* |

(continued)

TABLE 7. (continued)

| Location | Radio-nuclide | Concentration ±3-Sigma Counting Error ($10^{-9}$ µCi/ml) |
|---|---|---|
| Mud Pit No. 3 | $^{238}Pu$ | 0.032 ± 0.038* |
| Amchitka Background Sample | | |
| Jones Lake | $^{90}Sr$ | 0.70 ± 0.67 |
| | $^{238}Pu$ | 0.042 ± 0.032 |

Several of these concentrations annotated with an asterisk (*) were less than or sufficiently close to the three-sigma counting error whereby they were considered to be the result of statistical error and not necessarily a true indication of the presence of these radionuclides. Those concentrations which were greater than the three-sigma counting error were for samples from surface waters and shallow wells which could possibly have been affected by atmospheric fallout.

## WHOLE-BODY COUNTING

Twenty families consisting of 60 residents from 13 locations near the NTS were examined twice during the year to determine their body burdens of radioactivity and to watch for any physiological changes that could be attributable to the effects of acute or chronic exposure to radiation or radioactivity. When possible, all members of a family were included in the examinations. The home locations of these individuals were Pahrump, Lund, Beatty, Caliente, Pioche, Nyala, Round Mountain, Ely, Tempiute, Goldfield, Lathrop Wells, Tonopah, and Spring Meadow Farms, Nevada.

Each examination consisted of a measurement of the body burden of radioactivity with the whole-body counting facility described previously (NERC-LV, 1974), a complete hematological examination, and a thyroid profile. A urine sample was also collected from each individual for $^{3}H$ analysis, and a composite of urine samples from each family was analyzed for $^{238}Pu$ and $^{239}Pu$.

From the results of the whole-body counting, the fission product $^{137}Cs$ was detected above the detection limit in 94 out of 117 measurements. The maximum, minimum, and average body burdens for this radionuclide were $3.9 \times 10^{-8}$, $5.0 \times 10^{-9}$, and $1.4 \times 10^{-8}$ µCi/g body weight, respectively, which were similar to last year's concentrations (maximum of $2.8 \times 10^{-8}$ µCi/g; minimum of $5.0 \times 10^{-9}$; and average of $1.2x10^{-8}$ μCi/g body weight).

In regard to the hematological examinations and thyroid profiles, no abnormal results were observed which could be attributed to past or present NTS testing operations.

From the analytical results for urine samples, $^{238}Pu$ concentrations slightly above the detection limit were observed in four composite samples, which had a maximum concentration and two-sigma counting error of $1.0x10^{-10}$±$0.56x10^{-10}$ μCi/ml, a minimum of $2.2x10^{-11}$ ± $2.2x10^{-11}$ μCi/ml, and an average of $5.5x10^{-11}$ μCi/ml. Plutonium-239 was reported in only one composite sample. Its concentration was $2.9x10^{-11}$±$1.8x10^{-11}$ μCi/ml. The concentrations of $^{3}H$ observed in urine samples (average of $7.0x10^{-7}$ with a range of $2.0x10^{-7}$ to $2.0x10^{-6}$ μCi/ml) were within the range of background concentrations normally observed in surface waters or atmospheric moisture.

## DOSE ASSESSMENT

The only radionuclide ascribed to NTS operations detected off-NTS was $^{133}Xe$ at Beatty, Diablo, Hiko, Las Vegas, and Tonopah, Nevada, where the $^{133}Xe$ concentrations in air occurred during the months of August and September. The highest whole-body dose calculated for these locations was at Beatty, Nevada, where the dose equivalent was estimated to be

$$\frac{(7\ \text{days})(1.2\times10^{-11}\ \mu\text{Ci/ml}+1.4\times10^{-11}\ \mu\text{Ci/ml})(500\ \text{mrem/year})}{(10^{-7}\ \mu\text{Ci/ml})(365\ \text{days/year})} = 2.5\ \mu\text{rem}$$

which is 0.001 percent of the Radiation Protection Standard of 170 mrem (Appendix B). The estimated doses for all locations are shown in Table 8 with the estimated dose commitment (product of estimated average dose equivalent and population).

TABLE 8. ESTIMATED DOSE COMMITMENT FROM $^{133}$XE CONCENTRATIONS

| Location | Population | Estimated Dose Equivalent (μrem) | Dose Commitment (man-rem) | Dose Commitment Within 80 km (man-rem) |
|---|---|---|---|---|
| Beatty, Nev. | 500 | 2.5 | 0.0013 | 0.0013 |
| Diablo, Nev. | 6 | 1.2 | 0.0000072 | 0.0 |
| Hiko, Nev. | 60 | 1.1 | 0.000066 | 0.0 |
| Las Vegas, Nev. | 370,500* | 0.96 | 0.36 | 0.0 |
| Tonopah, Nev. | 2,000 | 1.4 | 0.0028 | 0.0 |
| Total | | | 0.36 | 0.0013 |

*Population is for Las Vegas and nearby communities within Clark County.

Due to the greater population density within the Las Vegas area, the highest dose commitment (0.36 man-rem) was for this area, which is approximately 100 km from the NTS. This dose commitment is small compared to the 26,000 man-rem, which residents of Las Vegas and nearby communities received from natural background radiation during this reporting period.

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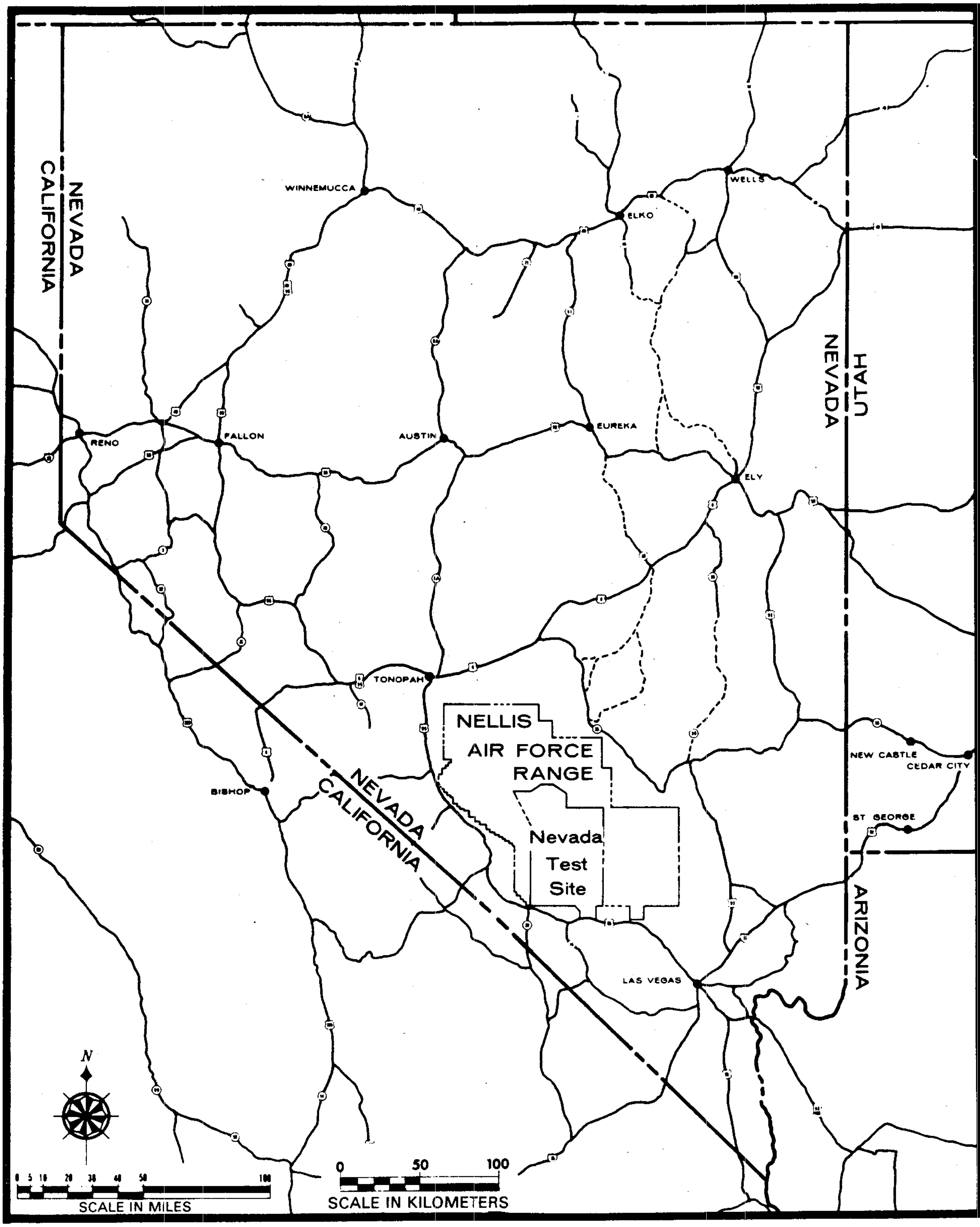


Figure 1. Nevada Test Site Location

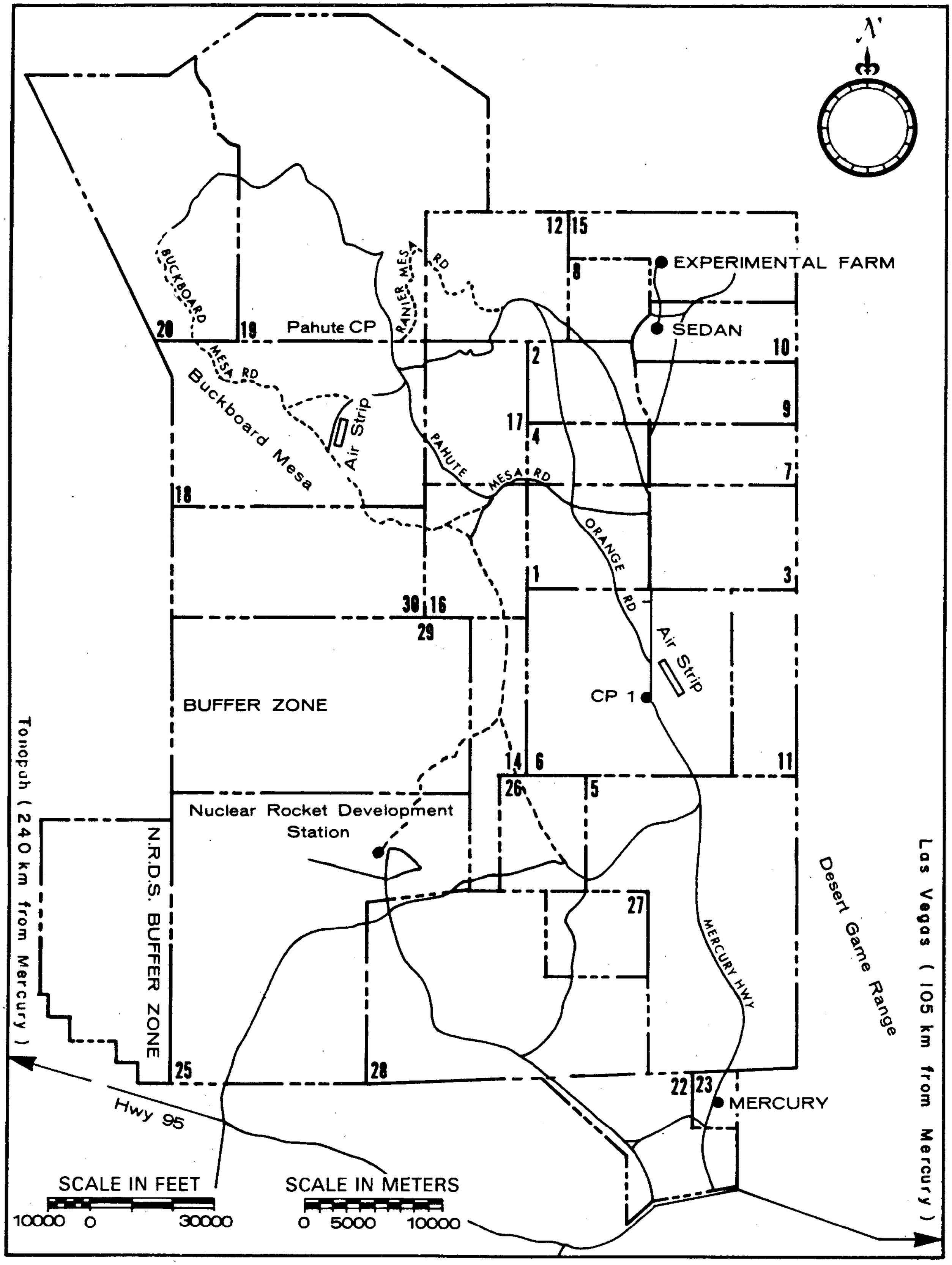


Figure 2. Nevada Test Site Road and Facility Map

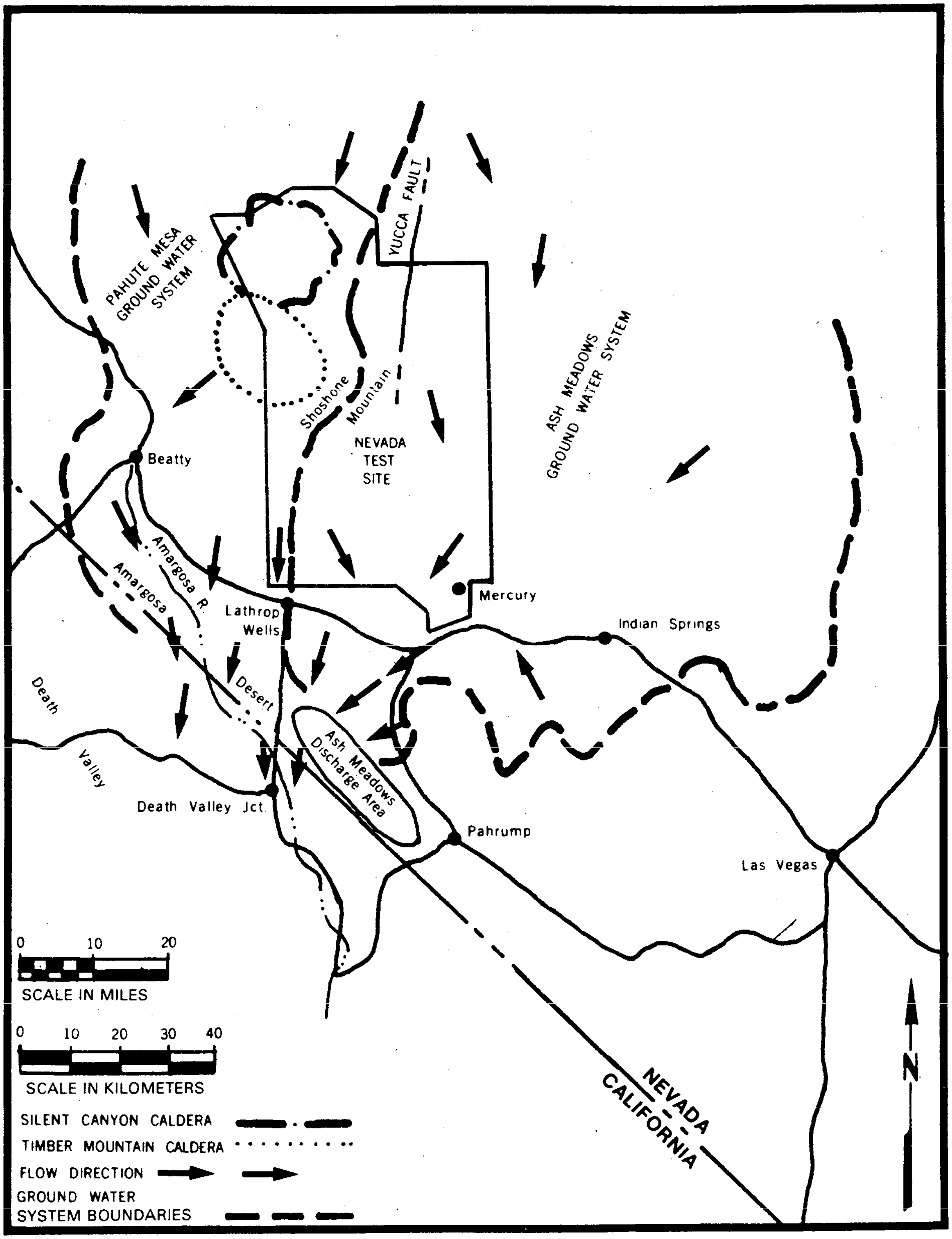


Figure 3. Groundwater Flow Systems - Nevada Test Site

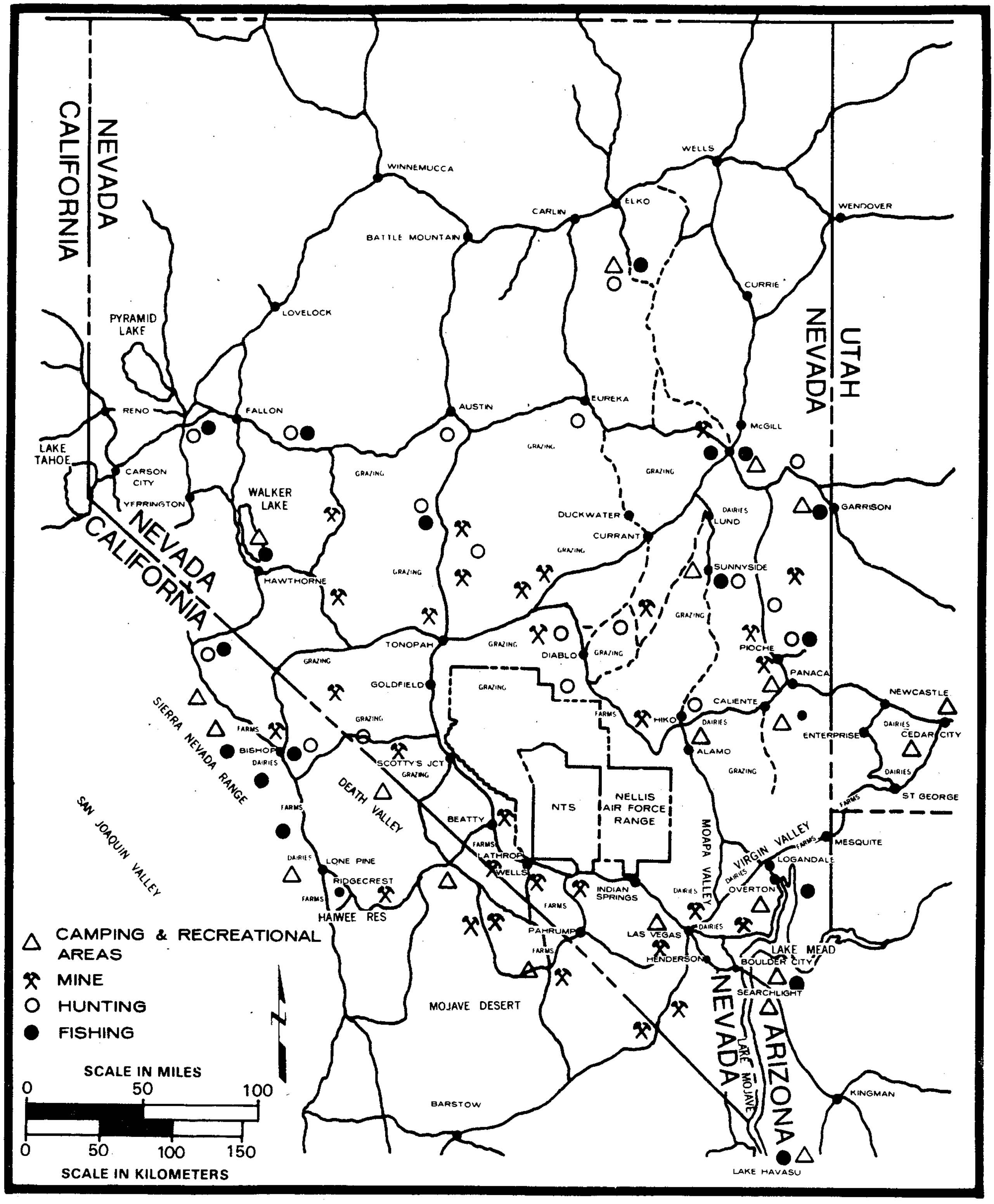


Figure 4. General Land Use, Nevada Test Site Vicinity

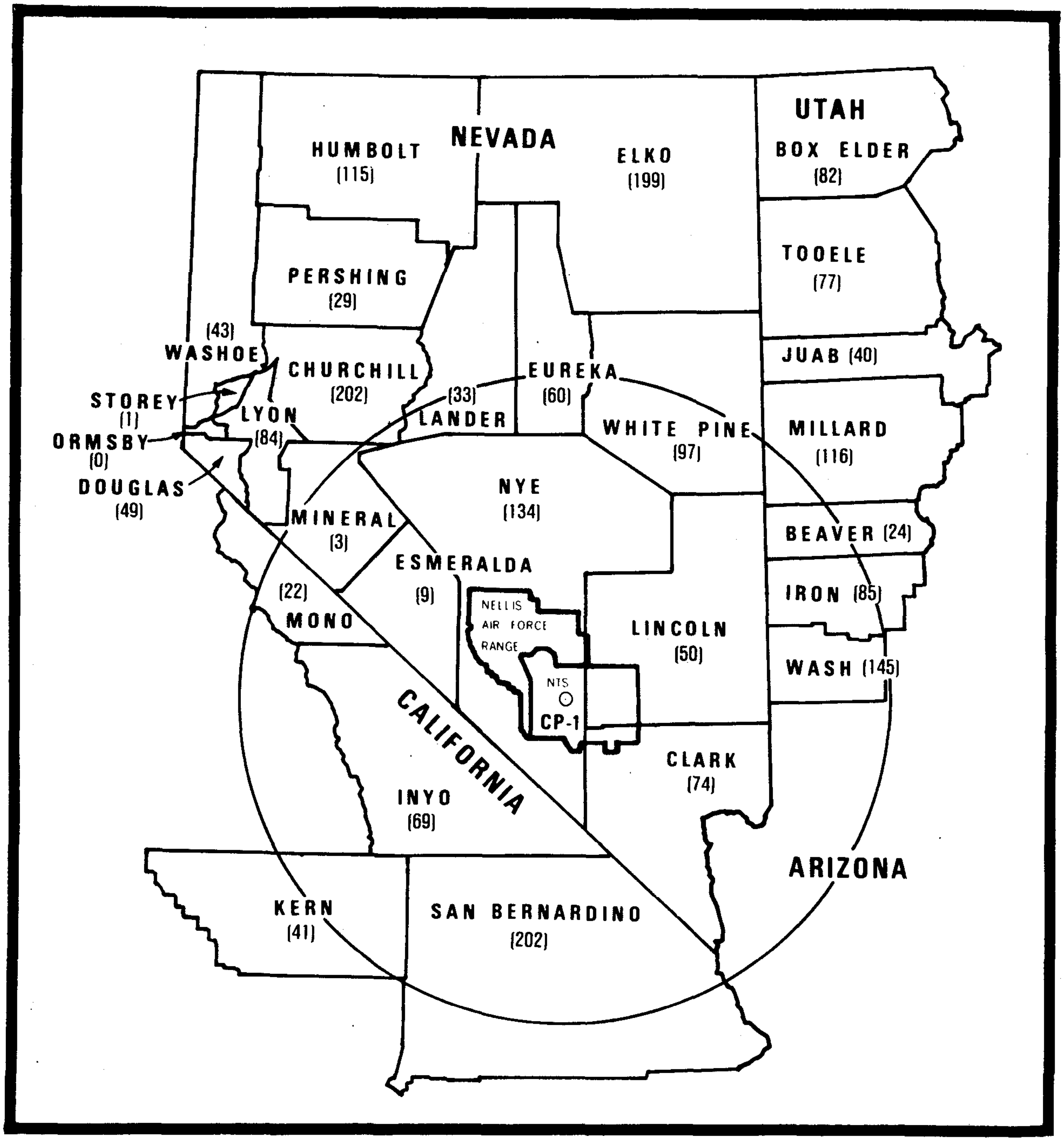


Figure 5. Location and Number of Family Milk Cows and Goats

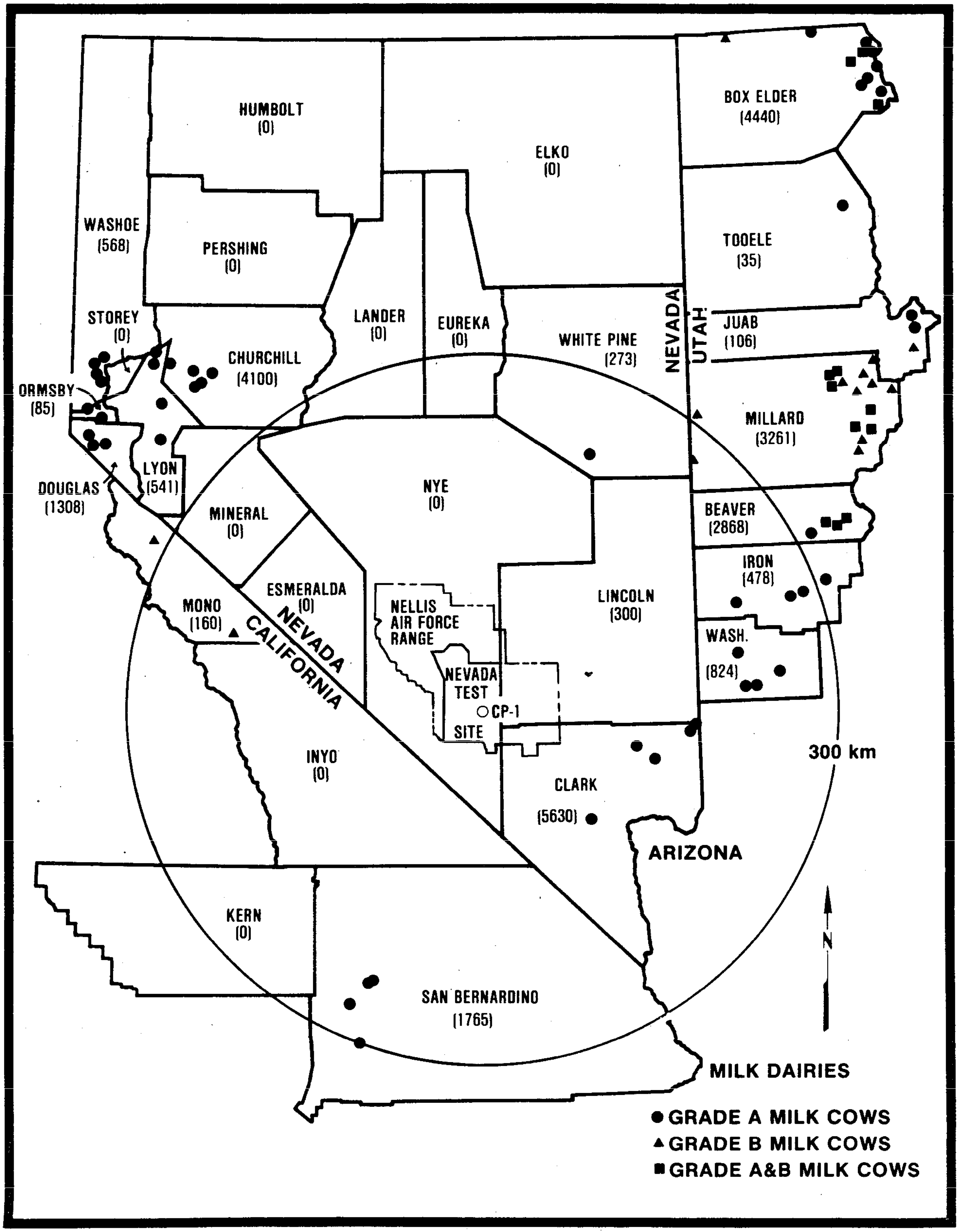


Figure 6. Location and Number of Dairy Cows

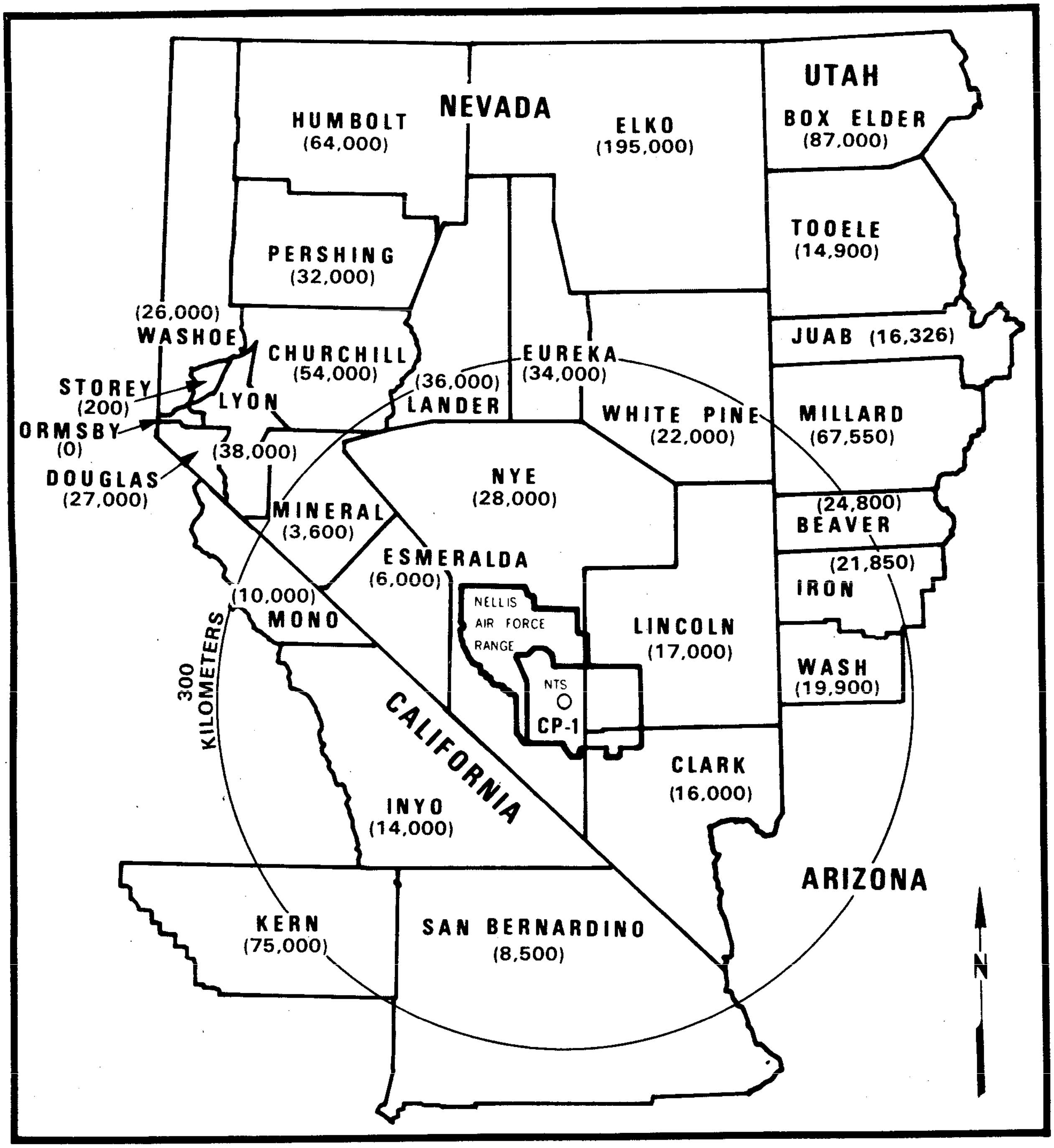


Figure 7. Distribution of Beef Cattle by County

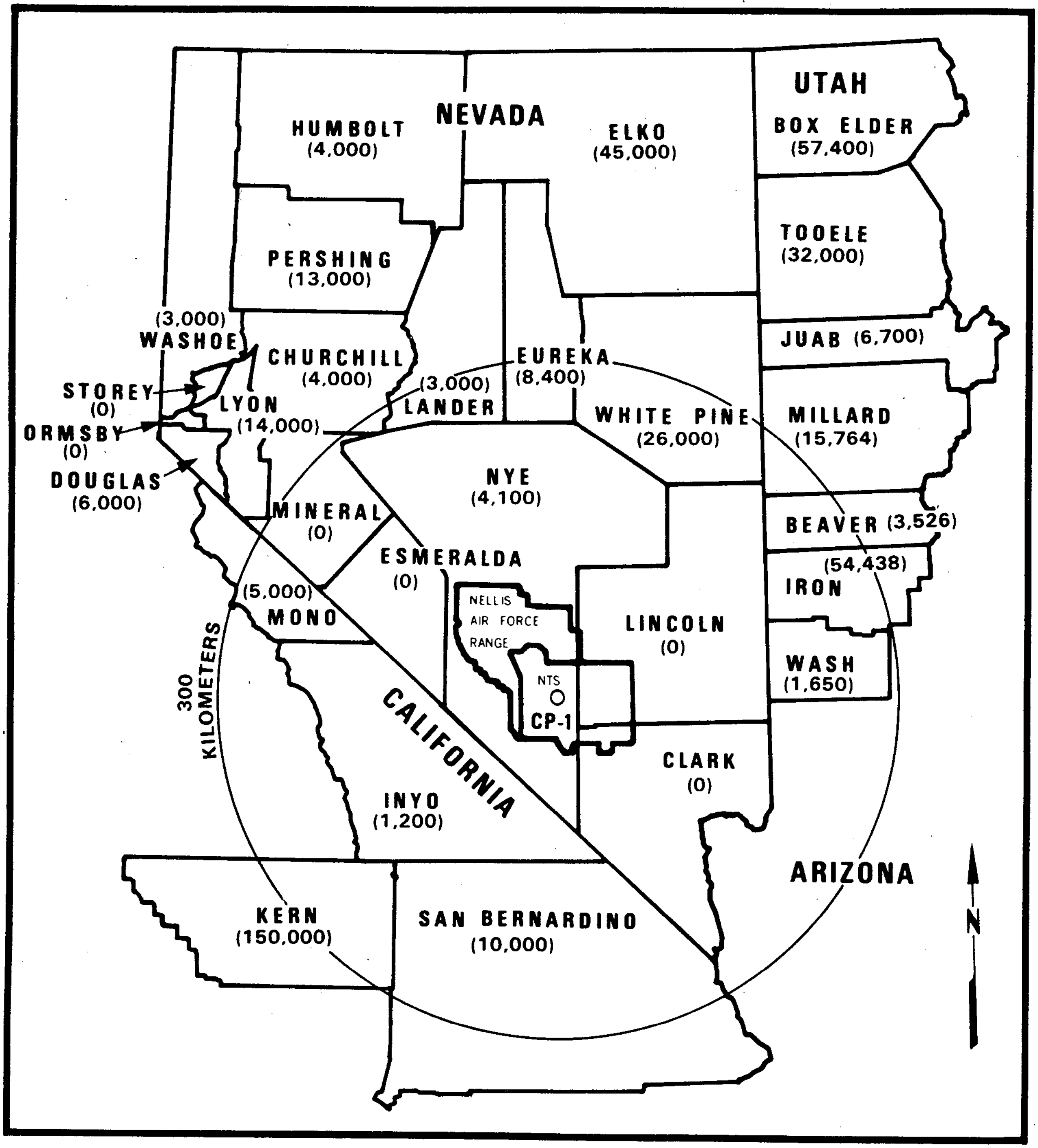


Figure 8. Distribution of Sheep by County

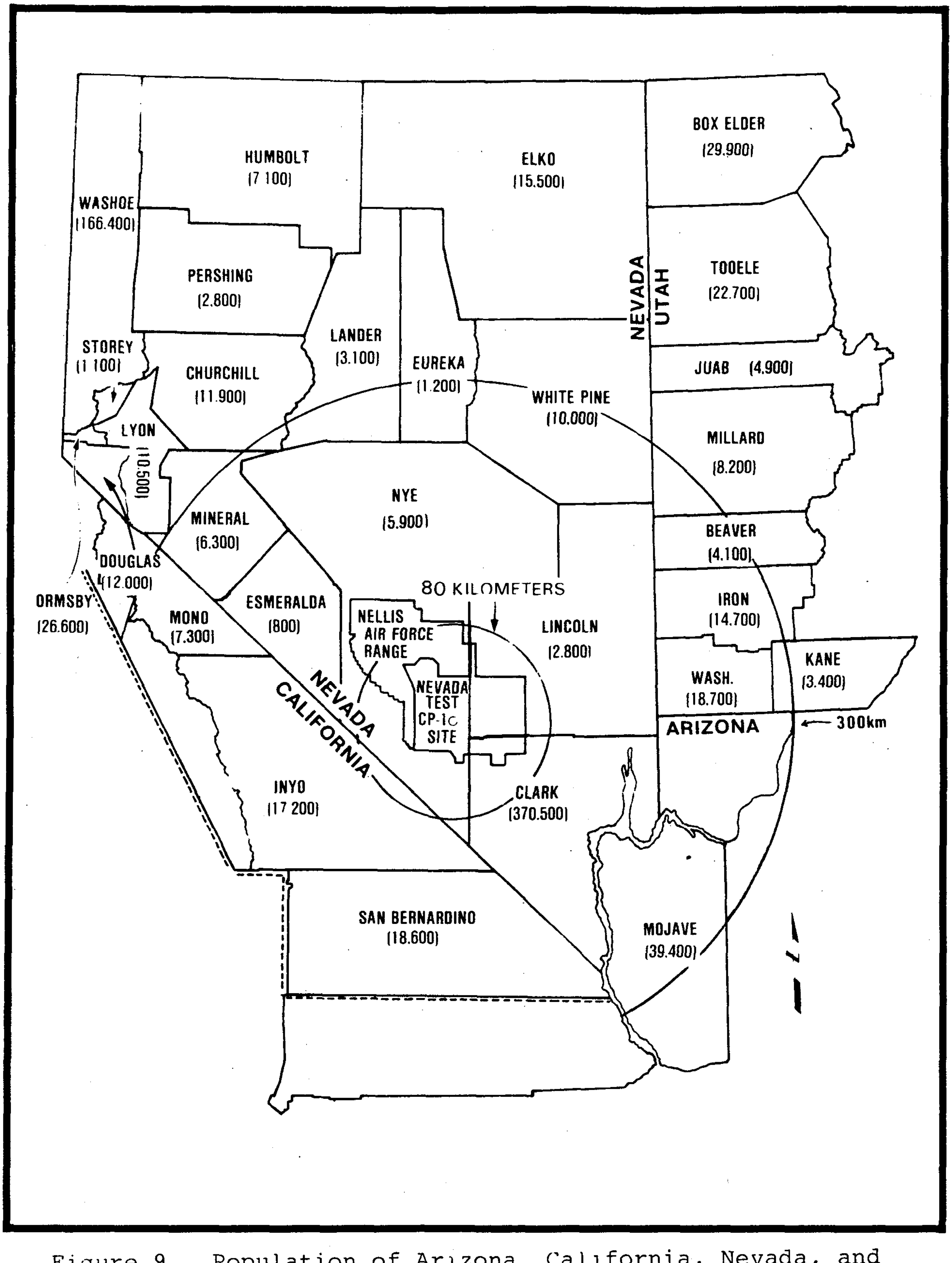


Figure 9. Population of Arizona, California, Nevada, and Utah Counties Near the Nevada Test Site

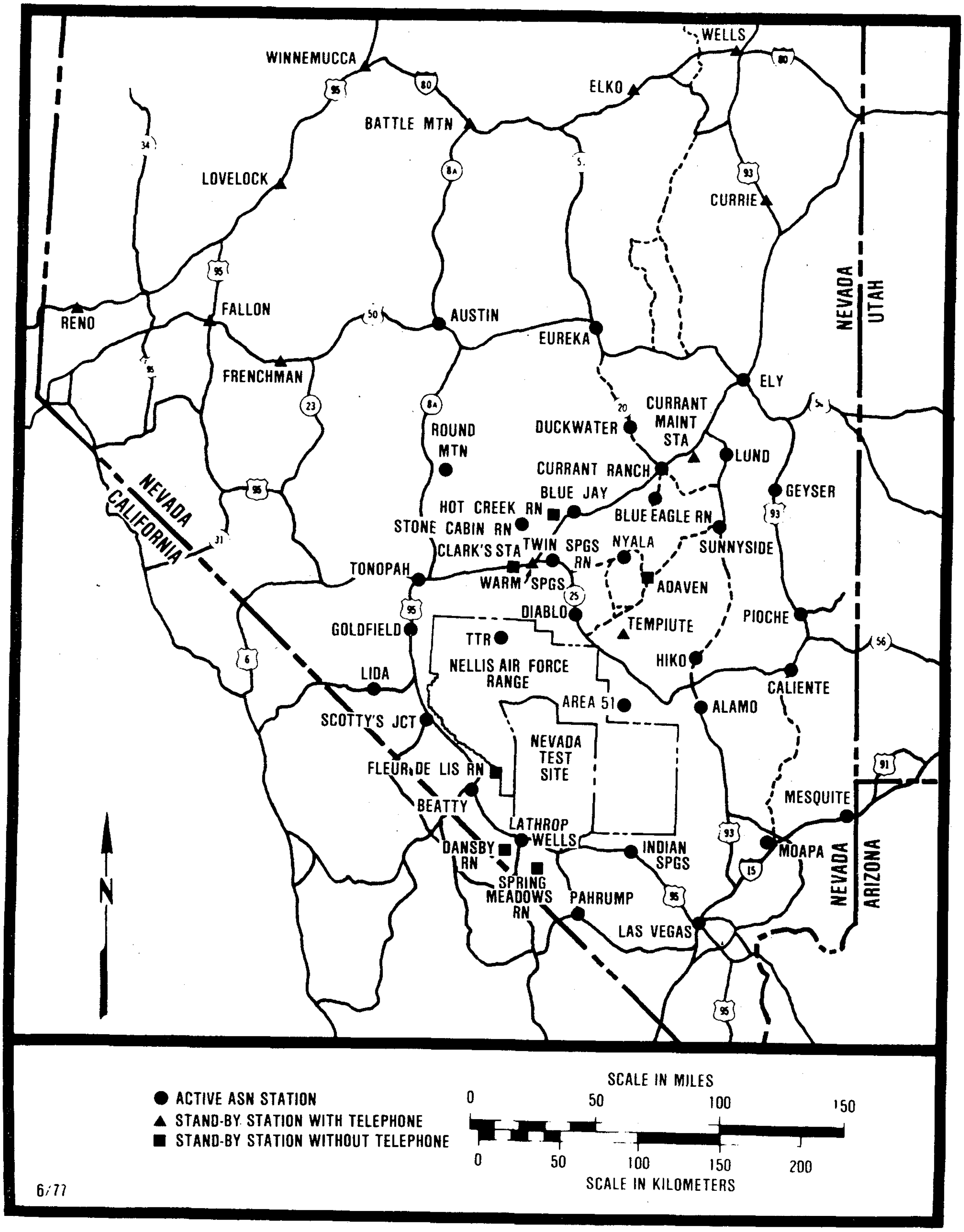


Figure 10. Air Surveillance Network - Nevada

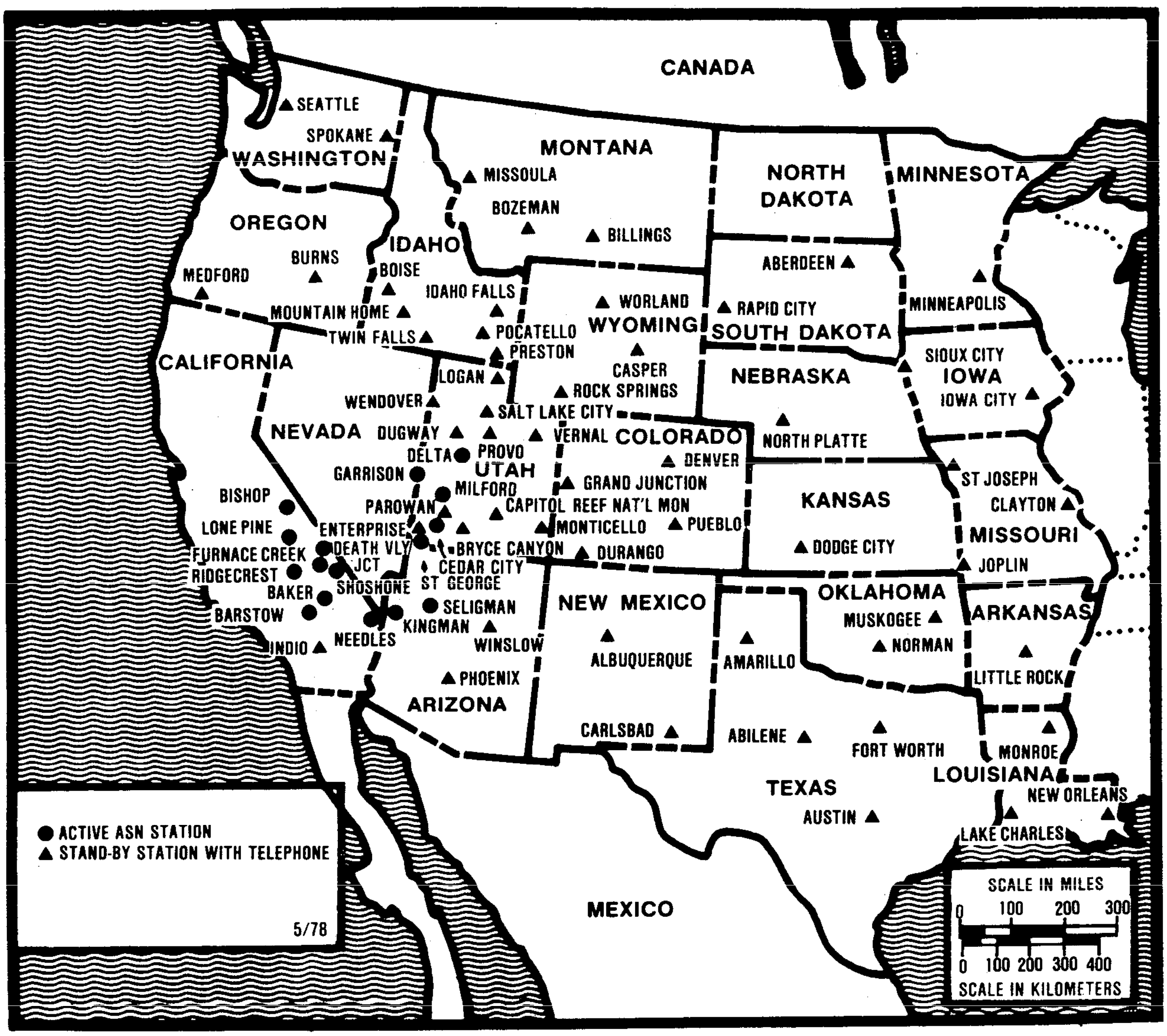


Figure 11. Air Surveillance Network - Outside Nevada

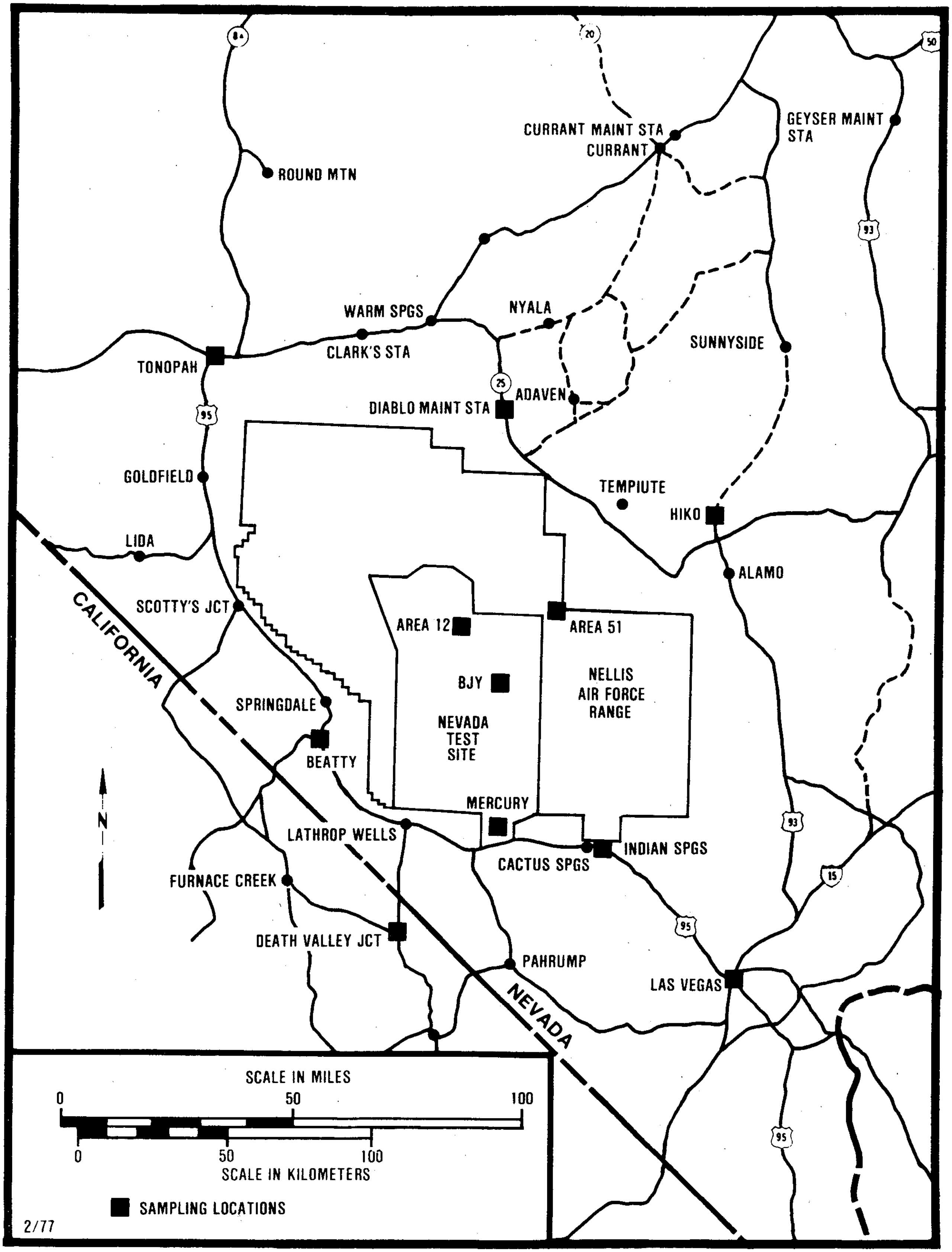


Figure 12. Noble Gas and Tritium Surveillance Network

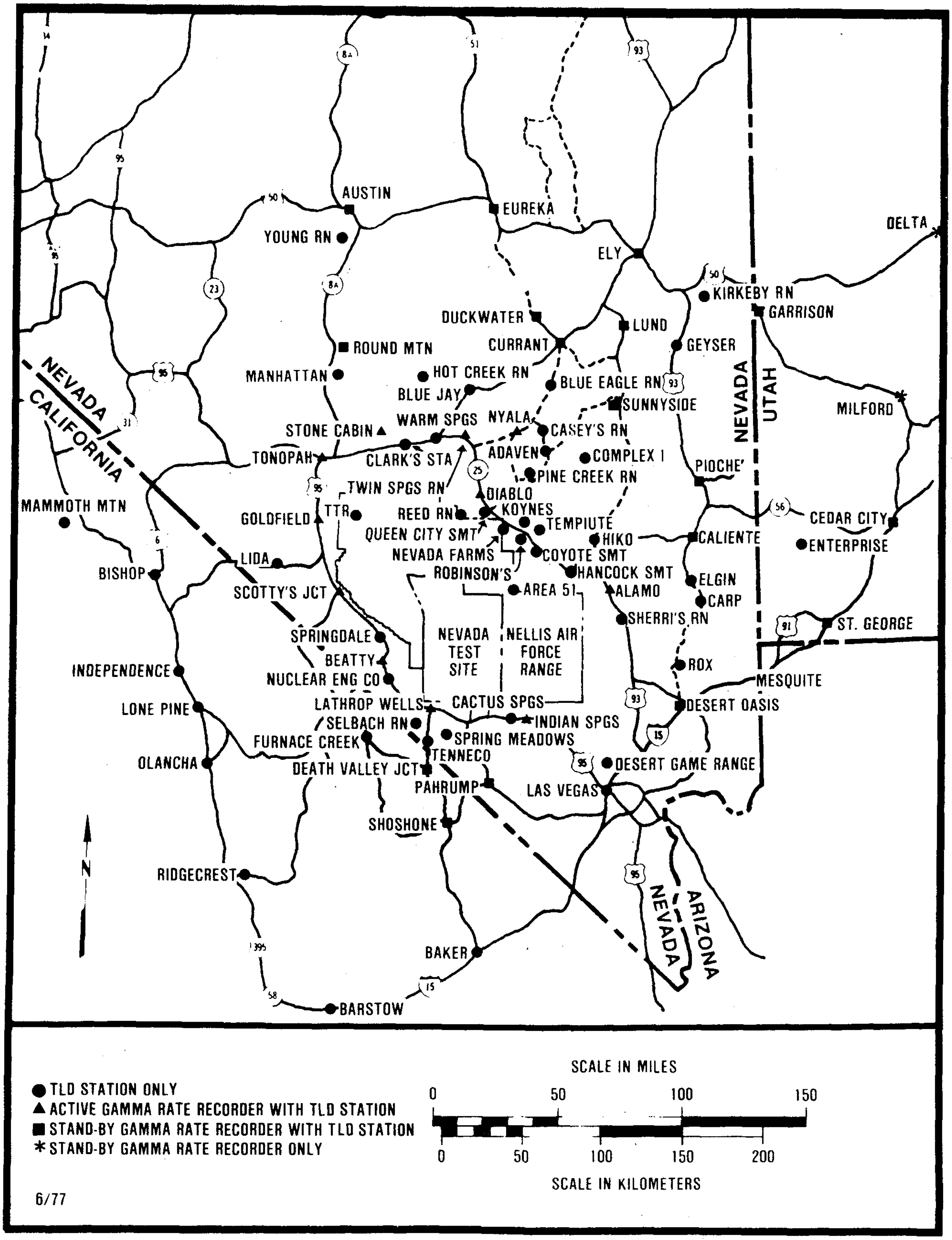


Figure 13. Dosimetry Network

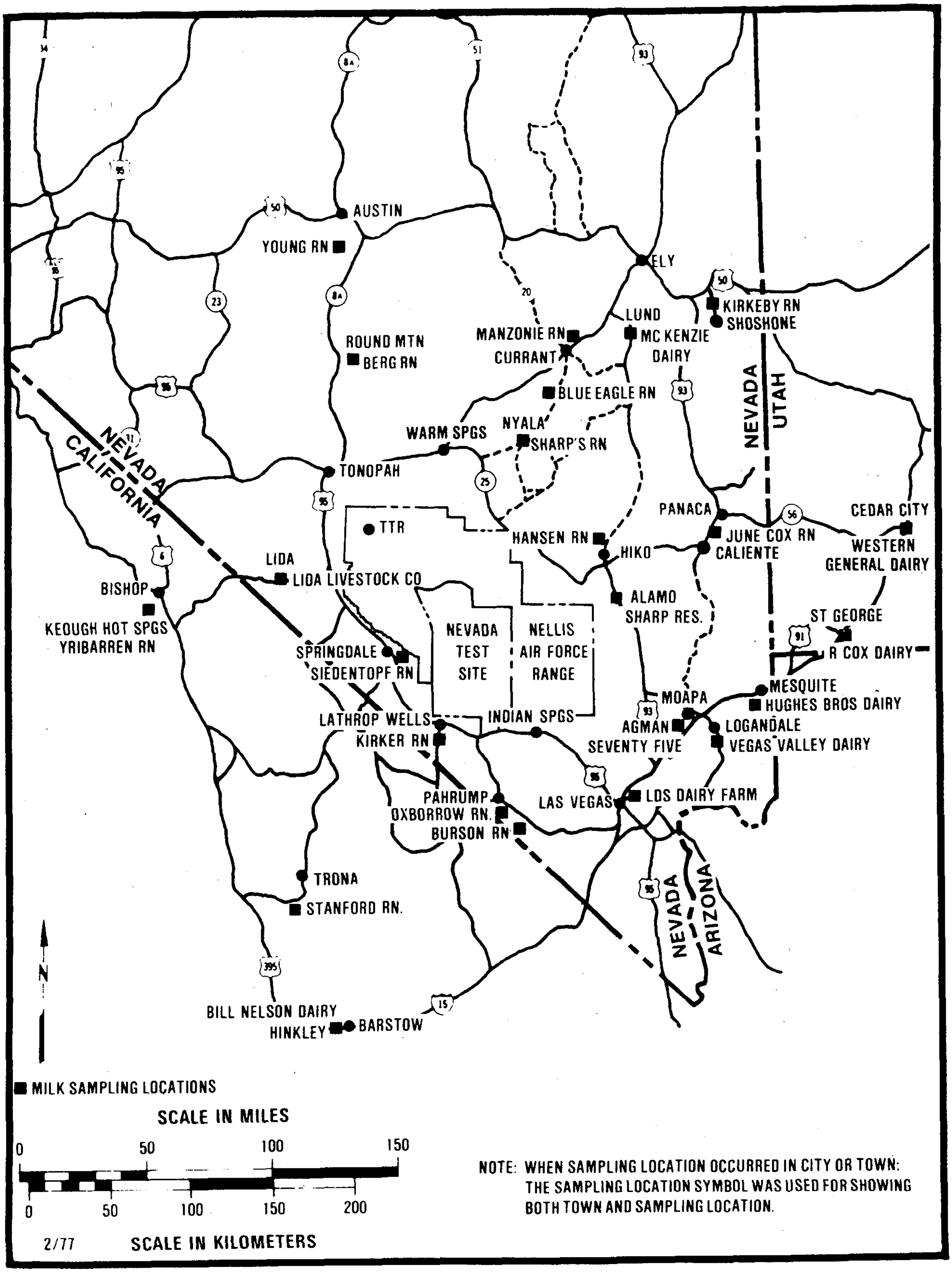


Figure 14. Milk Surveillance Network

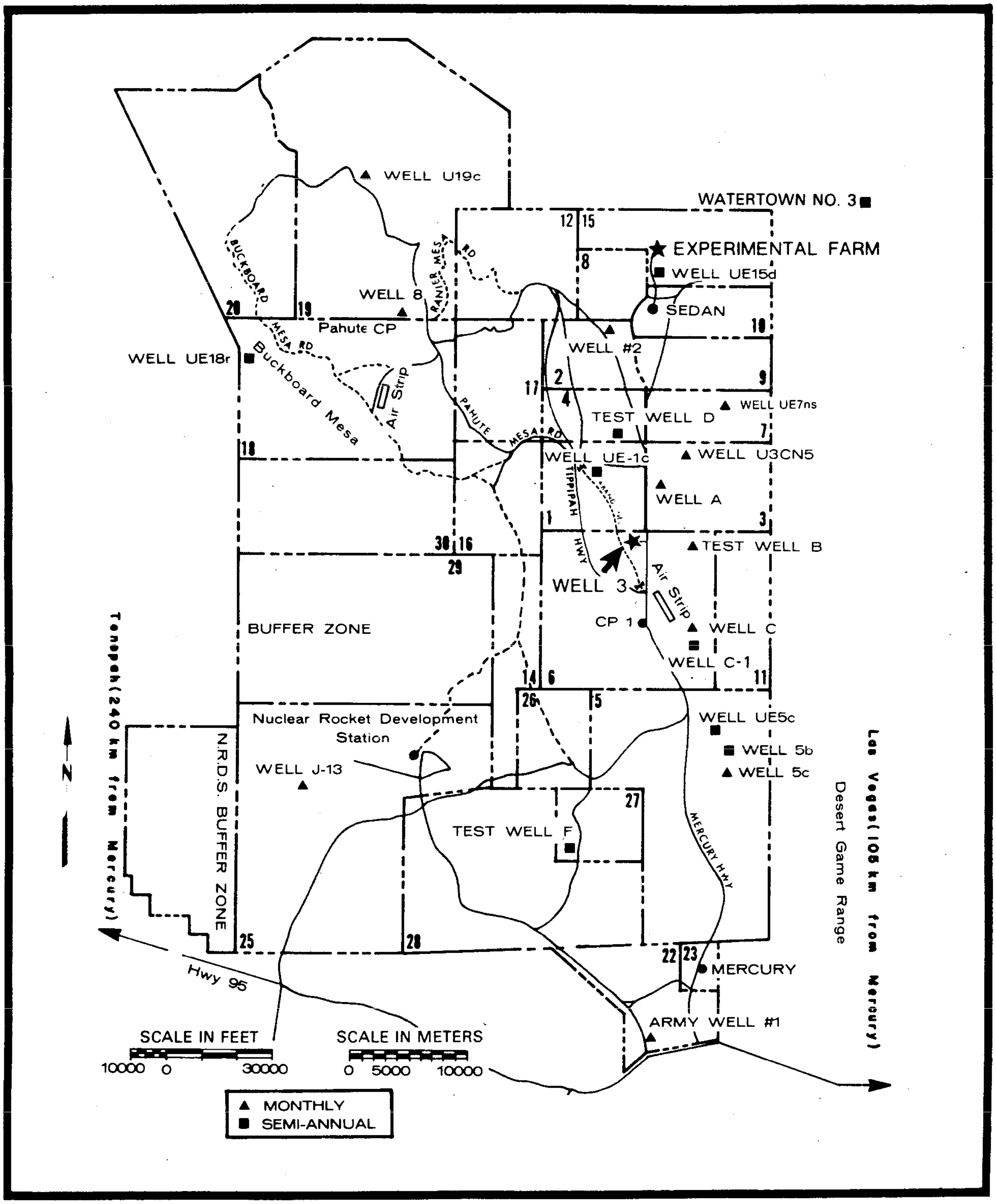


Figure 15. On-Site Long-Term Hydrological Monitoring Program, Nevada Test Site

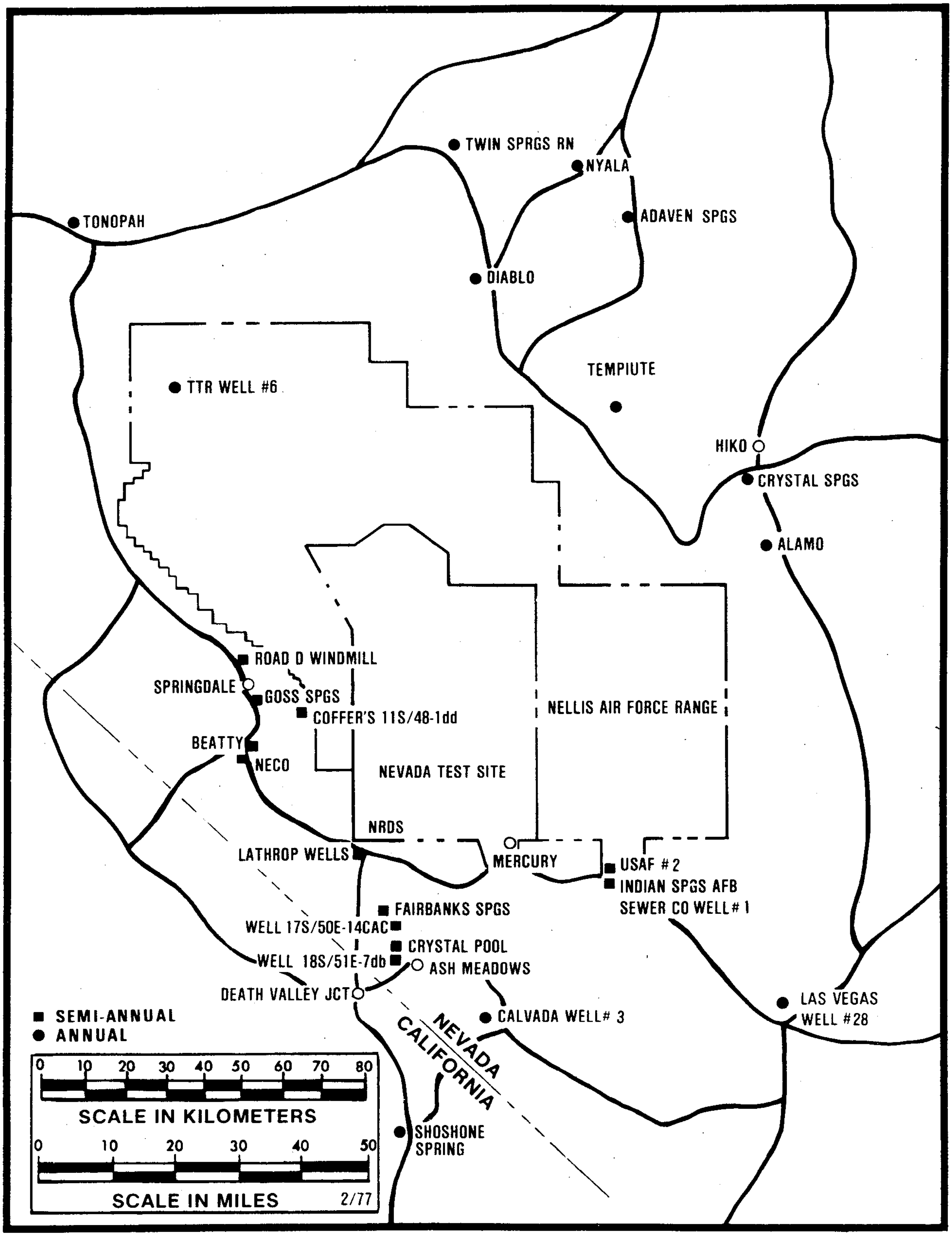


Figure 16. Off-Site Long-Term Hydrological Monitoring Program, Nevada Test Site

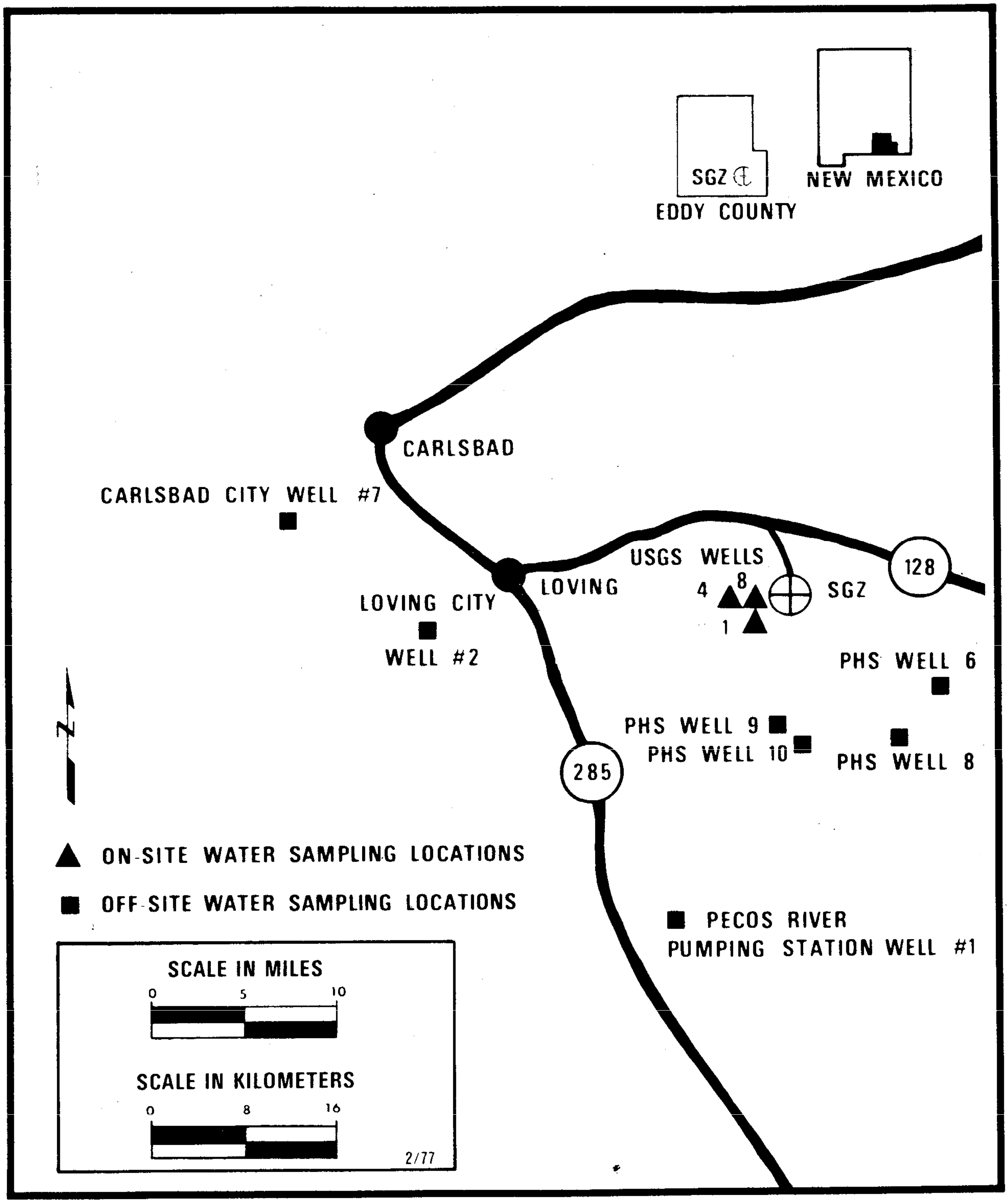


Figure 17. Long-Term Hydrological Monitoring Program, Carlsbad, New Mexico, Project Gnome/Coach

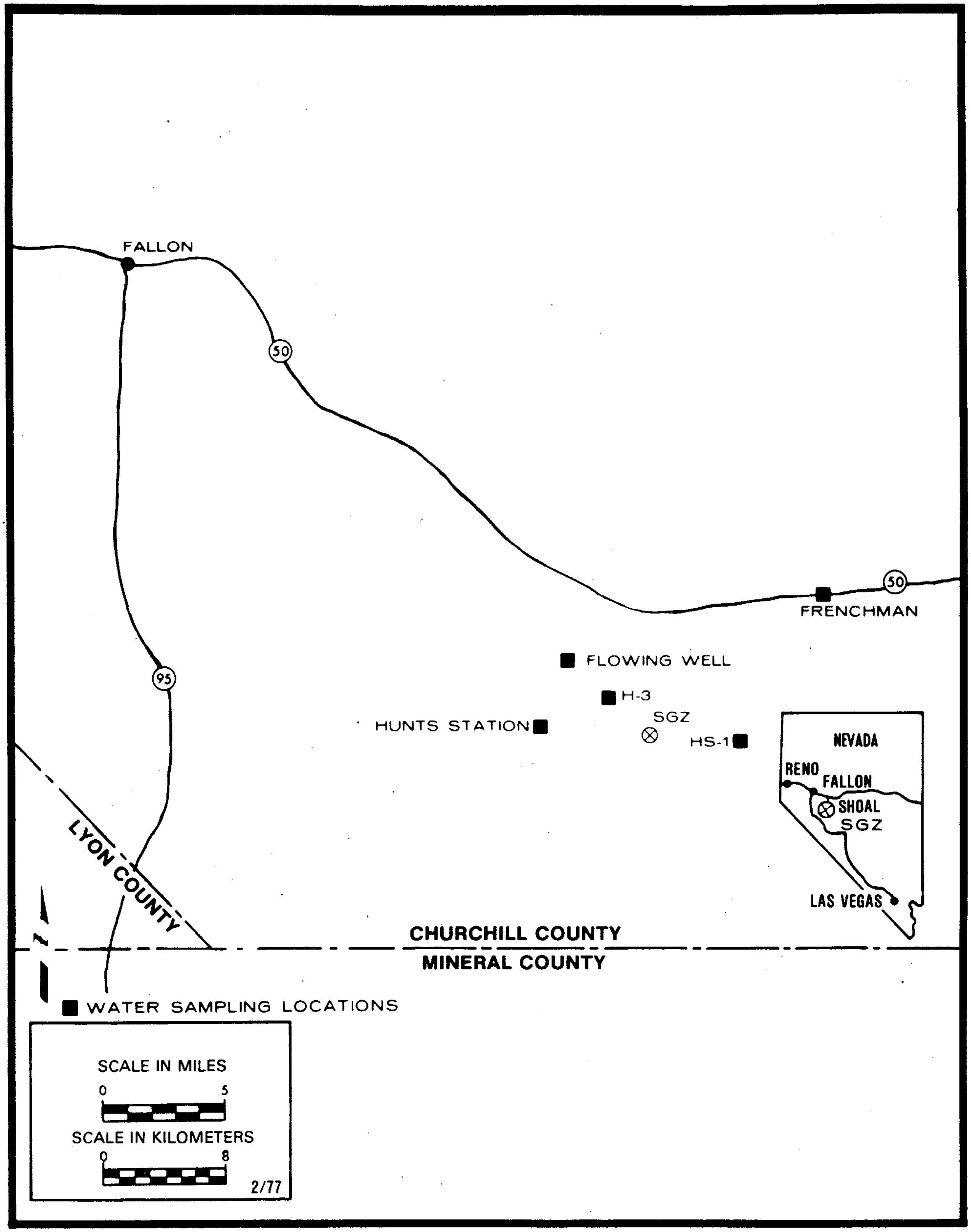


Figure 18. Long-Term Hydrological Monitoring Program, Fallon, Nevada, Project Shoal

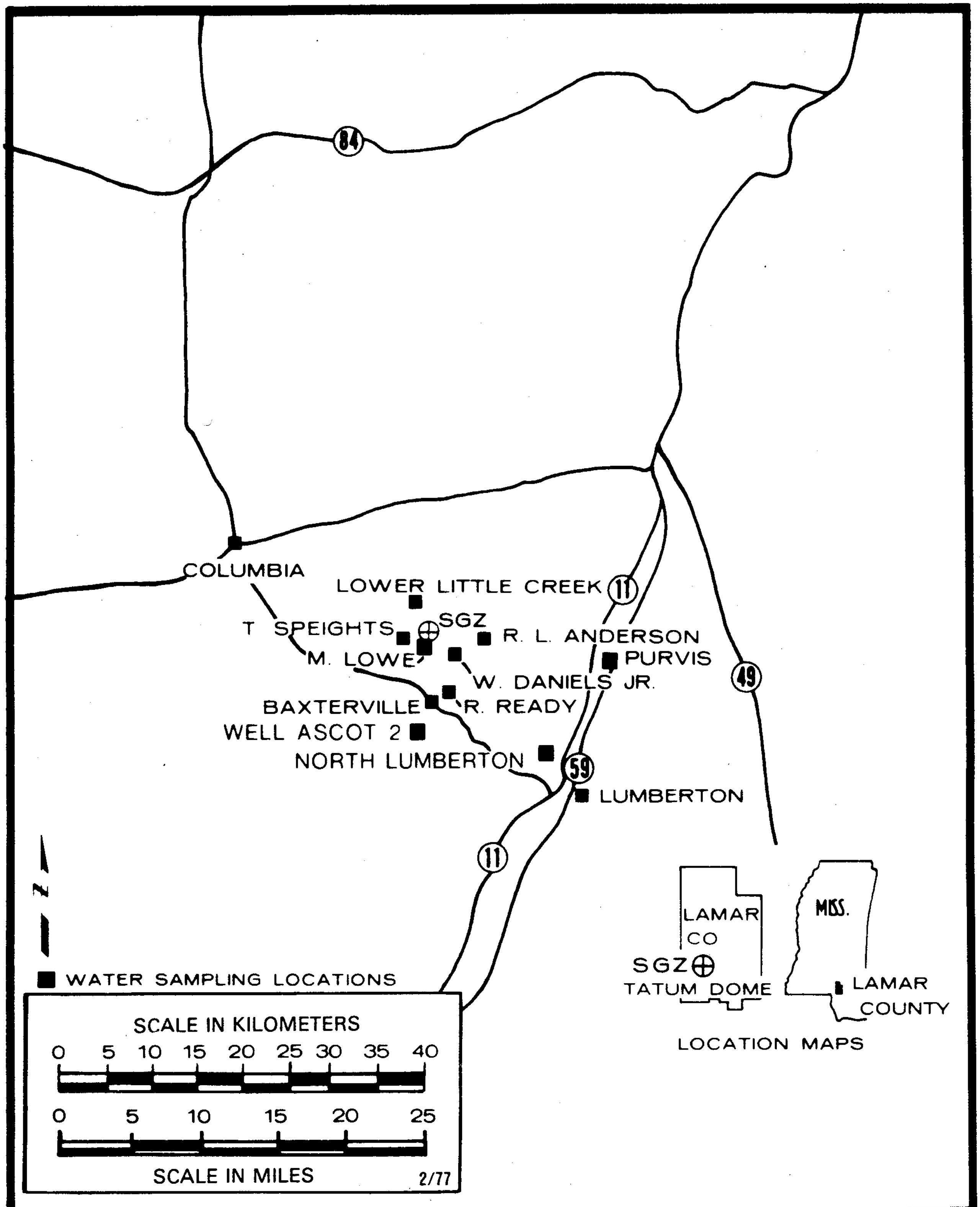


Figure 19. Long-Term Hydrological Monitoring Program, Project Dribble/Miracle Play (vicinity of Tatum Salt Dome, Mississippi)

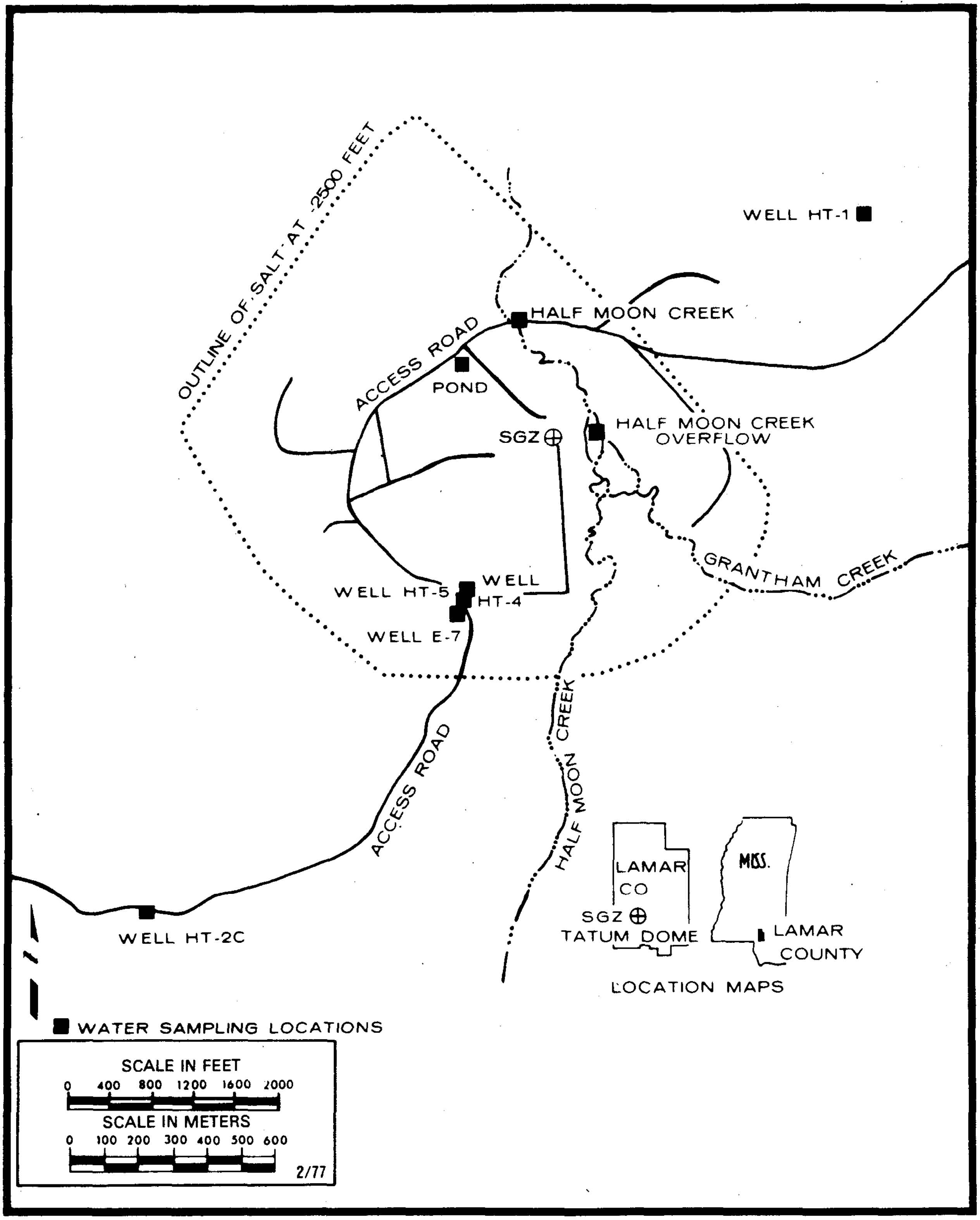


Figure 20. Long-Term Hydrological Monitoring Program, Project Dribble/Miracle Play (Tatum Salt Dome, Mississippi)

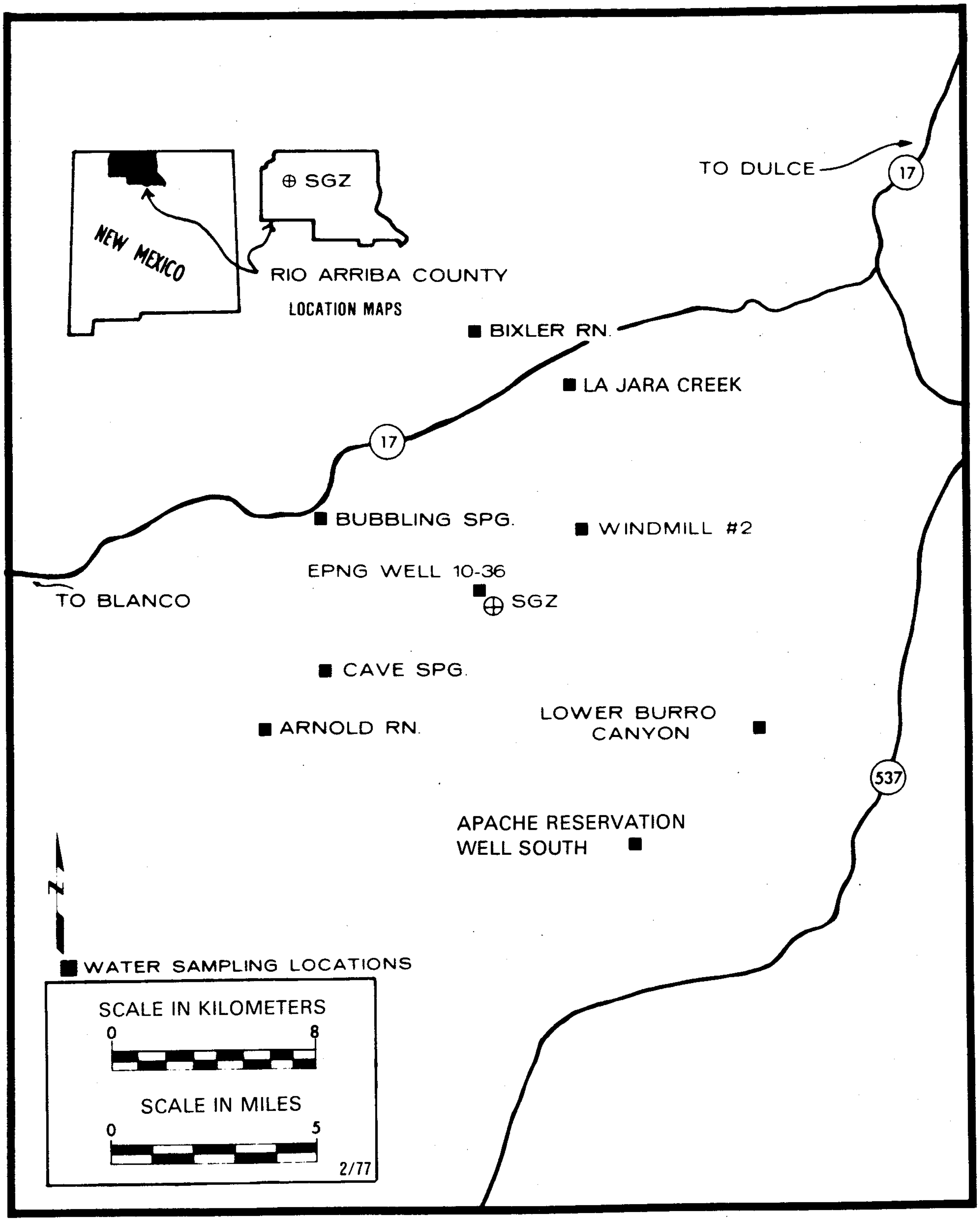


Figure 21. Long-Term Hydrological Monitoring Program, Rio Arriba County, New Mexico, Project Gasbuggy

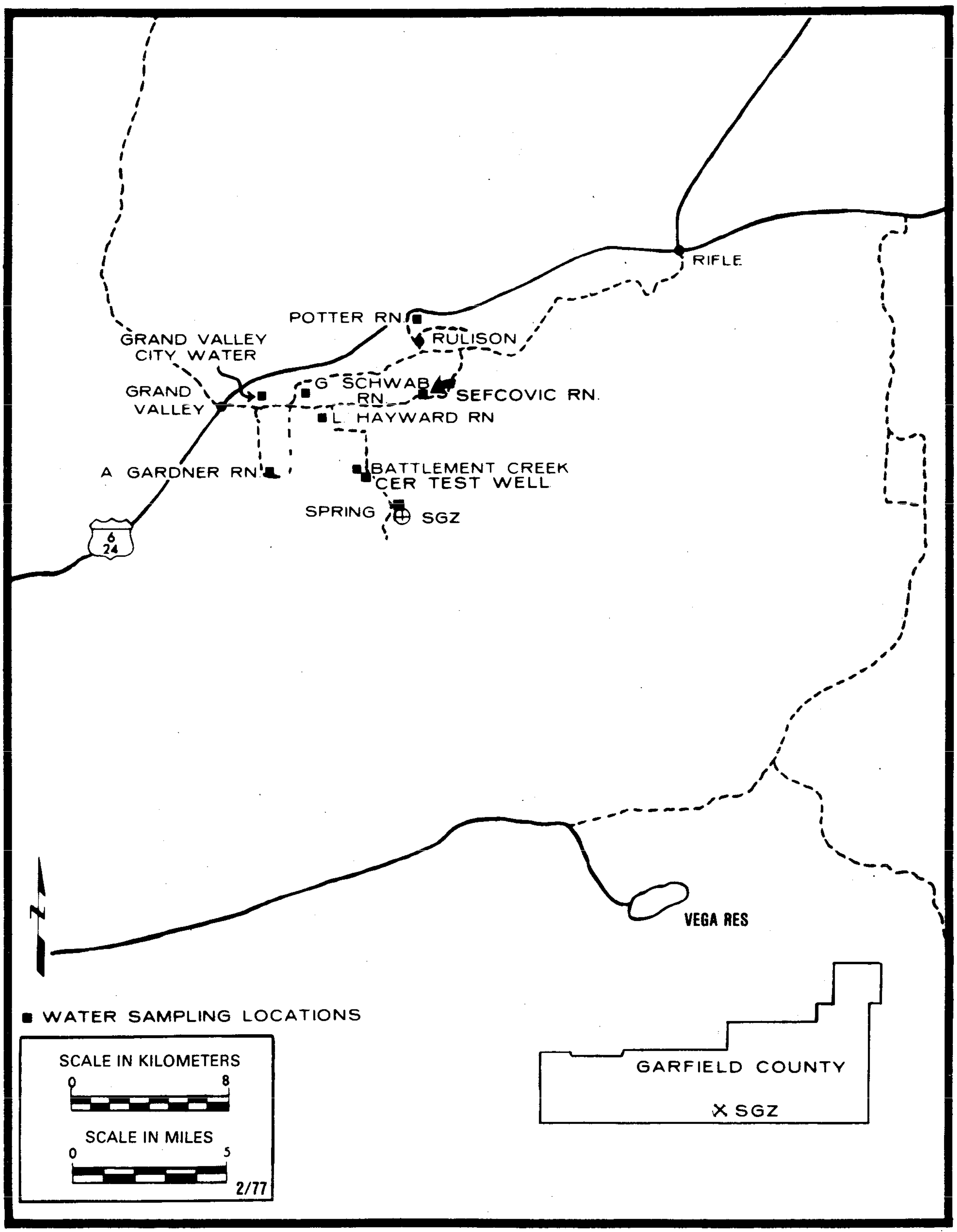


Figure 22. Long-Term Hydrological Monitoring Program, Rulison, Colorado, Project Rulison

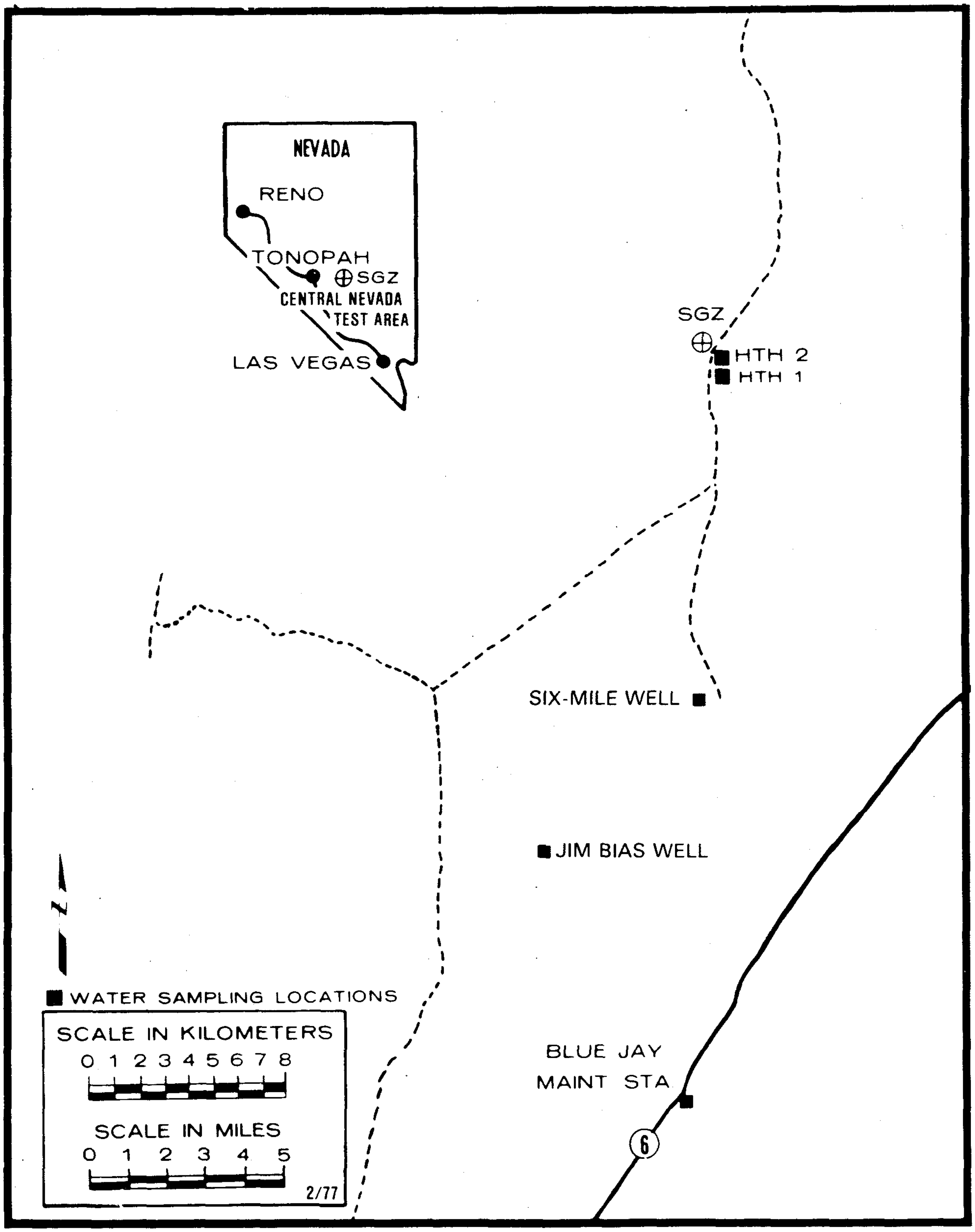


Figure 23. Long-Term Hydrological Monitoring Program, Central Nevada Test Area, Faultless Event

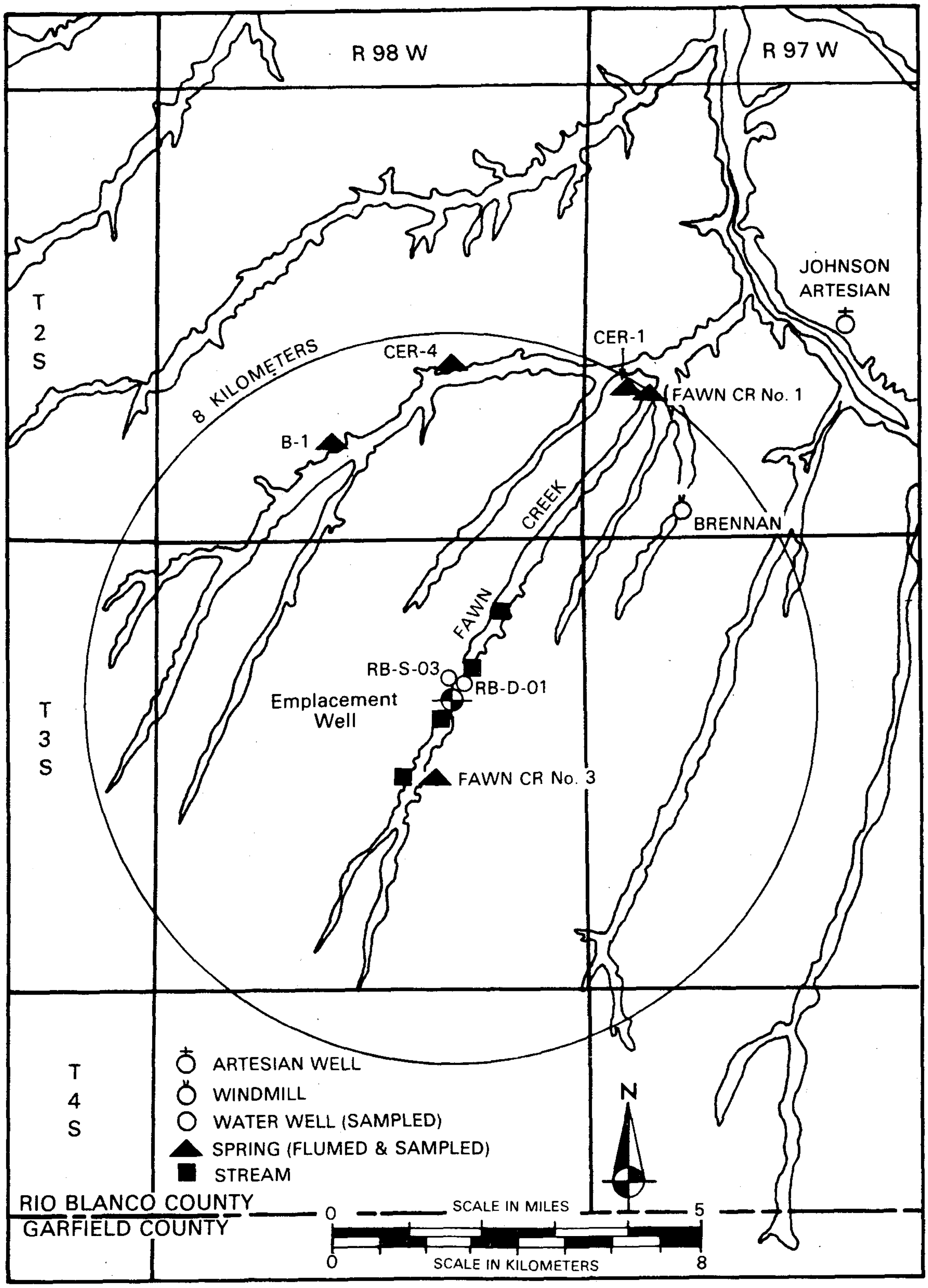


Figure 24. Long-Term Hydrological Monitoring Program, Project Rio Blanco, Rio Blanco County, Colorado

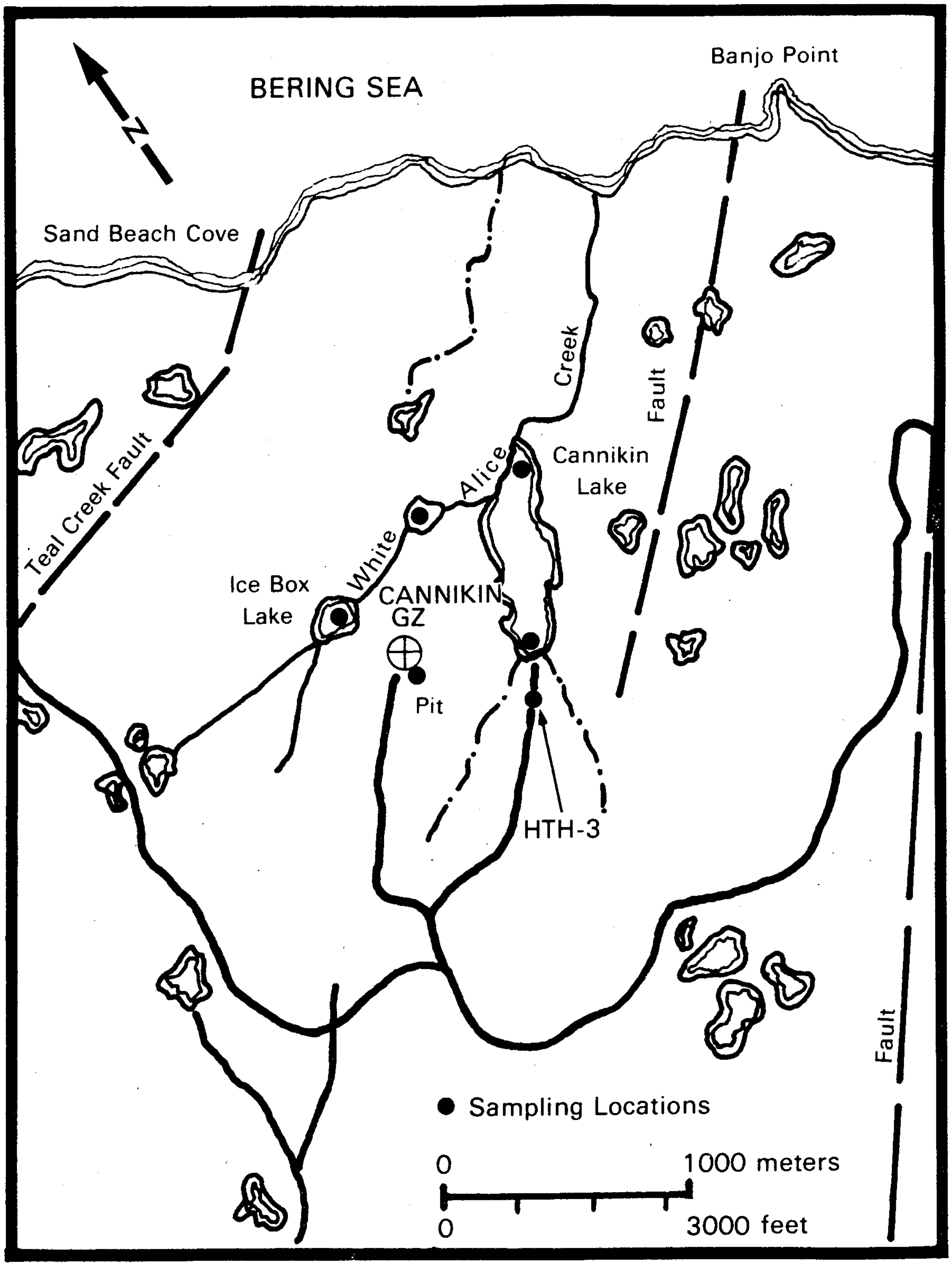


Figure 25. Long-Term Hydrological Monitoring Program, Project Cannikin, Amchitka Island, Alaska

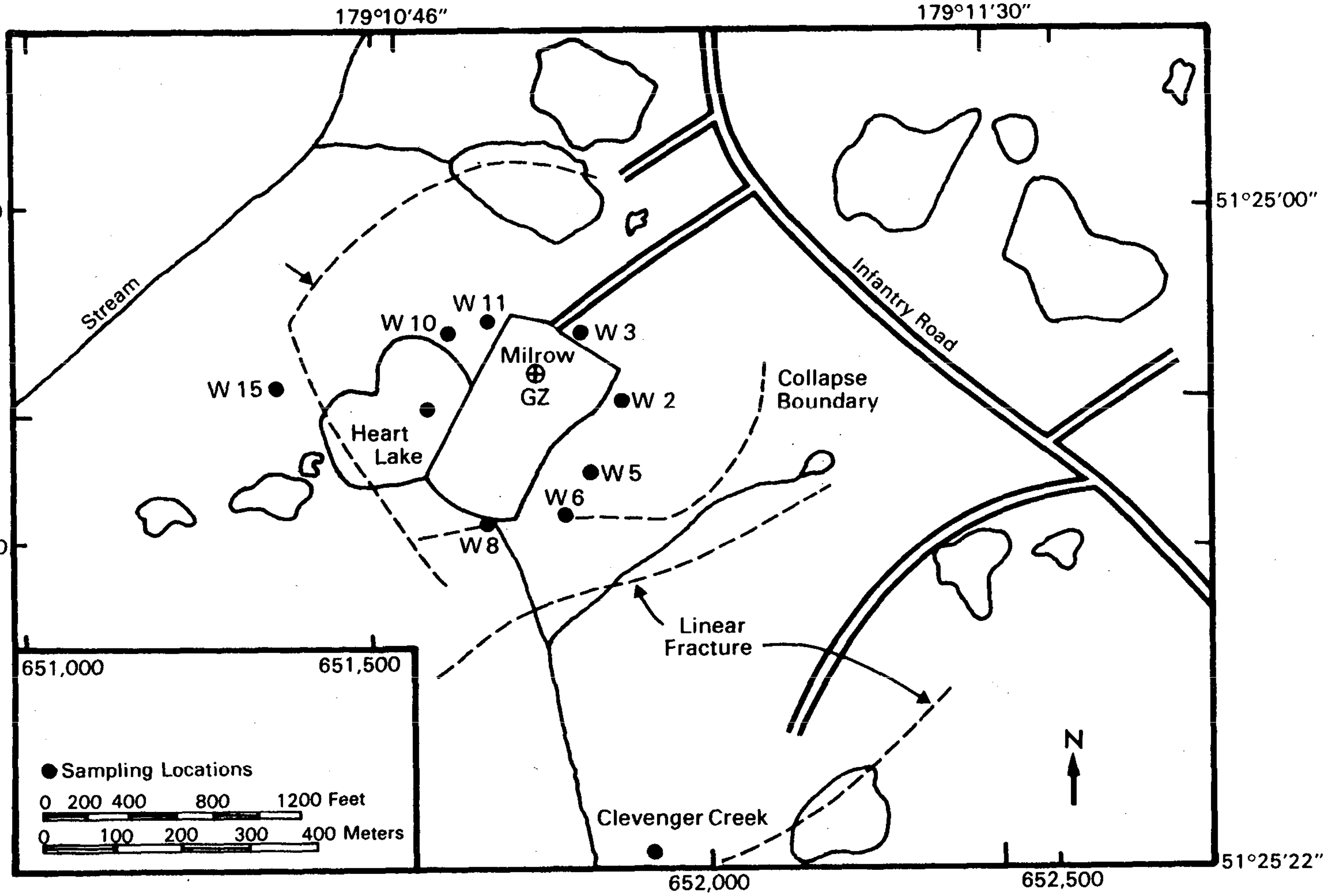


Figure 26. Long-Term Hydrological Monitoring Program, Project Milrow, Amchitka Island, Alaska

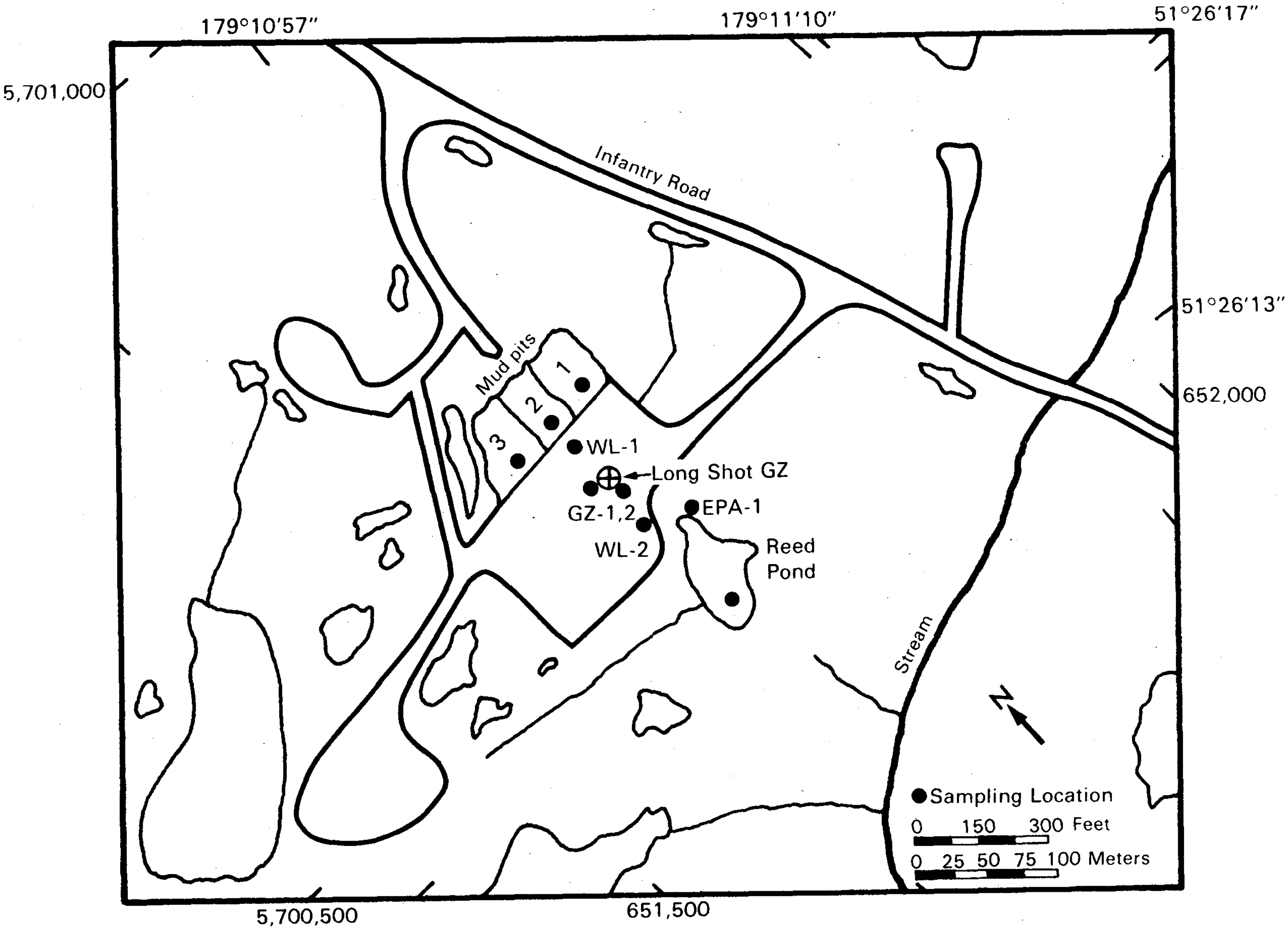


Figure 27. Long-Term Hydrological Monitoring Program, Project Long Shot, Amchitka Island, Alaska

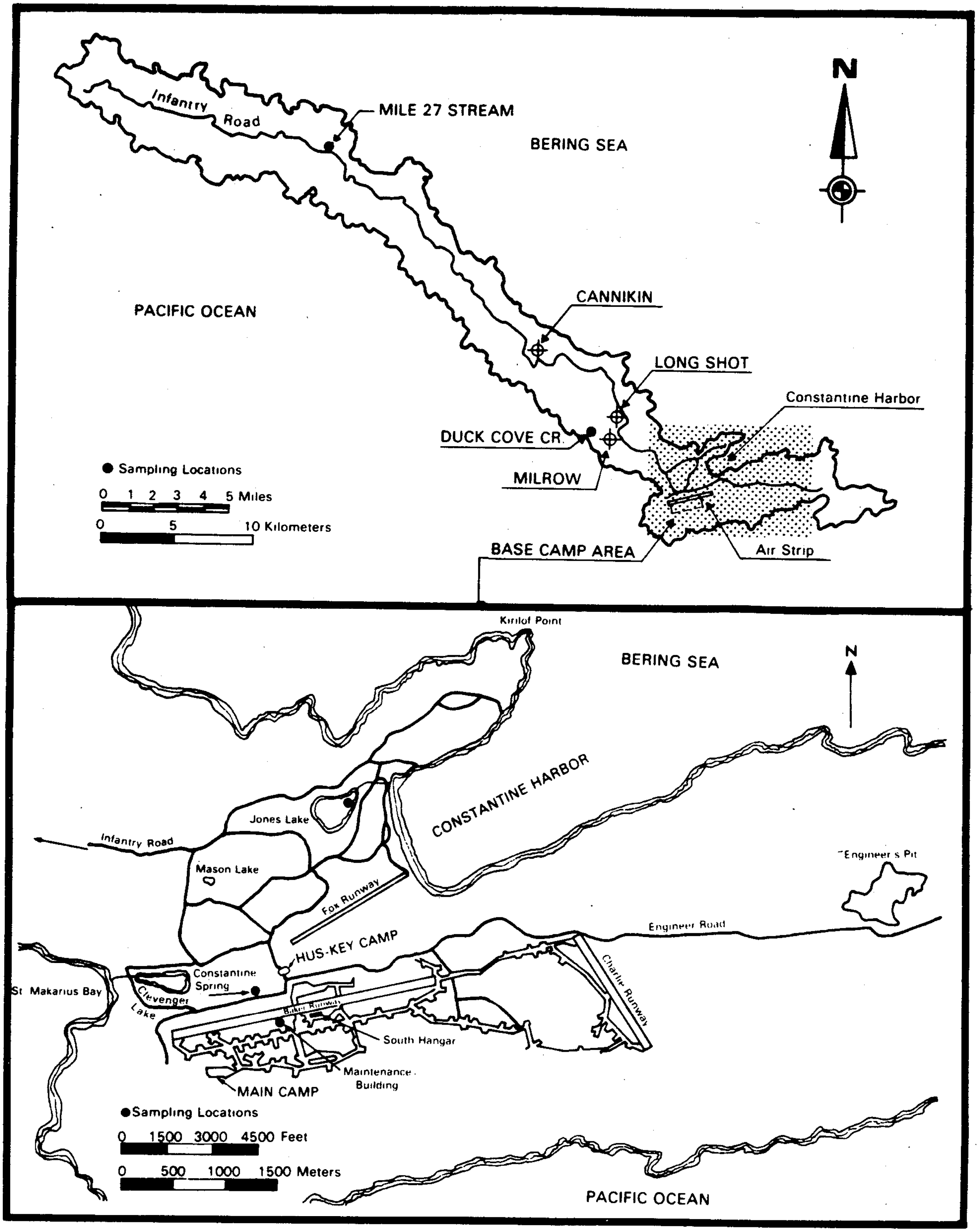


Figure 28. Long-Term Hydrological Monitoring Program Background Sampling, Amchitka Island, Alaska

# APPENDIX A. TABLES

## Table A-1. Underground Testing Conducted Off the Nevada Test Site

| Name of Test, Operation or Project | Date | Location | Yield[4] (kt) | Depth m (ft) | Purpose of the Event[4 5] |
|---|---|---|---|---|---|
| Project Gnome/ Coach[1] | 12/10/61 | 48 km (30 mi) SE of Carlsbad, N. Mex. | 3.1[6] | 360 (1184) | Multi-purpose experiment. |
| Project Shoal[2] | 10/26/63 | 45 km (28 mi) SE of Fallon, Nev. | 12 | 366 (1200) | Nuclear test detection research experiment. |
| Project Dribble[2] (Salmon Event) | 10/22/64 | 34 km (21 mi) SW of Hattiesburg, Miss. | 5.3 | 823 (2700) | Nuclear test detection research experiment. |
| Operation Long Shot[2] | 10/29/65 | Amchitka Island, Alaska | 80 | 716 (2350) | DOD nuclear test detection experiment. |
| Project Dribble[2] (Sterling Event) | 12/03/66 | 34 km (21 mi) SW of Hattiesburg, Miss. | 0.38 | 823 (2700) | Nuclear test detection research experiment. |
| Project Gasbuggy[1] | 12/10/67 | 88 km (55 mi) E of Farmington, N. Mex. | 29 | 1292 (4240) | Joint Government-Industry gas stimulation experiment. |
| Faultless Event[3] | 01/19/68 | Central Nevada Test Area 96 km (60 mi) E of Tonopah, Nev. | 200-1000 | 914 (3000) | Calibration test. |
| Project Miracle Play (Diode Tube)[2] | 02/02/69 | 34 km (21 mi) SW of Hattiesburg, Miss. | Non-nuclear explosion | 823 (2700) | Detonated in Salmon/Sterling cavity. Seismic studies. |
| Project Rulison[1] | 09/10/69 | 19 km (12 mi) SW of Rifle, Colo. | 40 | 2568 (8425) | Gas stimulation experiment. |
| Operation Milrow[3] | 10/02/69 | Amchitka Island, Alaska | 1000 | 1219 (4000) | Calibration test. |
| Project Miracle Play (Humid Water)[2] | 04/19/70 | 34 km (21 mi) SW of Hattiesburg, Miss. | Non-nuclear explosion | 823 (2700) | Detonated in Salmon/Sterling cavity. Seismic studies. |
| Operation Cannikin[3] | 11/06/71 | Amchitka Island, Alaska | <5000 | 1829 (6000) | Test of warhead for Spartan missile. |
| Project Rio Blanco[1] | 05/17/73 | 48 km (30 mi) SW of Meeker, Colo. | 3x30 | 1780 to 2040 (5840 to 6690) | Gas stimulation experiment. |

## Table A-1. (continued)

(1) Plowshare Events

(2) Vela Uniform Events

(3) Weapons Tests

(4) Information from "Revised Nuclear Test Statistics," dated September 20, 1974, and "Announced United States Nuclear Test Statistics," dated June 30, 1976, distributed by David G. Jackson, Director, Office of Public Affairs, Energy Research & Administration, Nevada Operations Office, Las Vegas, Nevada.

(5) News release AL-62-50, AEC Albuquerque Operations Office, Albuquerque, New Mexico. December 1, 1961.

(6) "The Effects of Nuclear Weapons," Rev. Ed. 1964.

## Table A-2. Summary of Analytical Procedures

| Type of Analysis | Analytical Equipment | Counting Period (Min) | Analytical Procedures | Sample Size (Liter) | Approximate Detection Limit[2] |
|---|---|---|---|---|---|
| Gamma Spectroscopy[1] | Gamma spectrometer with 10-cm-thick by 10-cm-diameter NaI (Tl-activated) crystal calibrated at 10 keV per channel (0-2 MeV range). | 100 min for milk, water, Long-Term Hydro. suspended solids; 10 min. for air charcoal cartridges and air filters. | Radionuclide concentrations quantitated from gamma spectrometer data by computer using a least squares technique | 3.5 for routine milk and water samples; 800-1200 $m^3$ for air filter samples; 7.3 liter for Long-Term Hydro. Water suspended solids. | For routine milk and water generally, $5x10^{-9}$ μCi/ml for most common fallout radionuclides in a simple spectrum. For air filters, $2x10^{-14}$ μCi/ml. For Long-Term Hydro. suspended solids, $3.0x10^{-9}$ μCi/ml. |
| $^{89-90}Sr$[3] | Low-background thin-window, gas-flow proportional counter with a 5.7-cm diameter window (80 μg/$cm^2$). | 50 | Chemical separation by ion exchange. Separated sample counted successively; activity calculated by simultaneous equations. | 1.0 | $^{89}Sr = 2x10^{-9}$ μCi/ml<br>$^{90}Sr = 1x10^{-9}$ μCi/ml. |
| $^3H$[3] | Automatic liquid scintillation counter with output printer. | 200 | Sample prepared by distillation. | 0.005 | $2x10^{-7}$ μCi/ml |
| $^3H$ Enrichment (Long-Term Hydrological Samples)[3] | Automatic scintillation counter with output printer. | 200 | Sample concentrated by electrolysis followed by distillation. | 0.25 | $6x10^{-9}$ μCi/ml |
| $^{238}$ $^{239}Pu$<br>$^{234}$ $^{235}$<br>$^{238}U$[3] | Alpha spectrometer with 450 $mm^2$, 300-μm depletion depth, silicon surface barrier detectors operated in vacuum chambers. | 1000 - 1400 | Sample is digested with acid, separated by ion exchange, electroplated on stainless steel planchet and counted by alpha spectrometer. | 1 | $^{238}Pu = 4x10^{-11}$ μCi/ml<br>$^{239}Pu$, $^{234}U$, $^{235}U$<br>$^{238}U = 2x10^{-11}$ μCi/ml |
| $^{226}Ra$[3] | Single channel analyzer coupled to P.M. tube detector. | 30 | Precipitated with Ba, converted to chloride. Stored for 30 days for $^{222}Rn$ $^{226}Ra$ to equilibrate. Radon gas pumped into scintillation cell for alpha scintillation counting. | 1.5 | $1x10^{-10}$ μCi/ml |

## Table A-2. (continued)

| Type of Analysis | Analytical Equipment | Counting Period (Min) | Analytical Procedures | Sample Size (Liter) | Approximate Detection Limit[2] |
|---|---|---|---|---|---|
| Gross alpha Gross beta in liquid samples[3] | Low-background thin-window, gas-flow proportional counter with a 5.7-cm-diameter window (80 μg/cm²). | 50 | Sample evaporated; residue weighed and counted; corrected for self-attenuation. | 0.2 | $\alpha = 3x10^{-9}$ μCi/ml<br>$\beta = 2x10^{-9}$ μCi/ml |
| Gross beta on air filters[1] | Low-level end window, gas flow proportional counter with a 12.7-cm-diameter window (100 mg/cm²). | 20 | Filters counted at 7 and 14 days after collection; two counts can be used to extrapolate concentration to mid-collection time assuming $T^{-1.2}$ decay or using experimentally derived decay. | 10-cm diameter glass fiber filter; sample collected from 800-1200m³. | $2x10^{-15}$ μCi/ml |
| $^{85}Kr$<br>Xe<br>$CH_3T$[3] | Automatic liquid scintillation counter with output printer. | 200 | Physical separation by gas chromatography; dissolved in toluene "cocktail" for counting. | 400-1000 | $^{85}Kr = 2x10^{-12}$ μCi/ml<br>$Xe = 2x10^{-12}$ μCi/ml<br>$CH_3T = 2x10^{-12}$ μCi/ml |

(1)Lem, P. N., and Snelling, R. N. "Southwestern Radiological Health Laboratory Data Analysis and Procedures Manual," SWRHL-21. Southwestern Radiological Health Laboratory, U.S. Environmental Protection Agency, Las Vegas, NV. March 1971

(2)The detection limit for all samples is defined as that radioactivity which equals the 2-sigma counting error.

(3)Johns, F. B. "Handbook of Radiochemical Analytical Methods," EPA 680/4-75-001. U.S. Environmental Protection Agency, NERC-LV, Las Vegas, NV. February 1975.

## Table A-3. 1977 Summary of Analytical Results for the Noble Gas and Tritium Surveillance Network

| Sampling Location | No. Days Sampled | Radio-nuclide | Units | Radioactivity Concentrations C Max | C Min | C Avg | % of Conc. Guide* |
|---|---|---|---|---|---|---|---|
| Death Valley Jct., Calif. | 335.7 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 25 | 14 | 20 | 0.02 |
| | 349.6 | Total Xe | $10^{-12}\mu Ci/ml$ air | 15 | < 4 | < 6 | <0.01 |
| | 315.5 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 0.6 | < 0.3 | < 0.4 | - |
| | 342.7 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | 10 | < 2 | < 3 | |
| | 315.5 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | < 5 | 0.5 | < 2 | <0.01 |
| | 308.5 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 2.3 | < 0.2 | < 0.7 | |
| Beatty, Nev. | 337.6 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 26 | 15 | 20 | 0.02 |
| | 337.6 | $^{133}Xe$ | $10^{-12}\mu Ci/ml$ air | 14 | < 4 | < 6 | <0.01 |
| | 324.7 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 0.6 | < 0.3 | < 0.4 | - |
| | 337.6 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | 12 | < 2 | < 3 | |
| | 324.7 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | < 4 | 0.2 | < 2 | <0.01 |
| | 324.7 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 1.2 | < 0.1 | < 0.6 | |
| Diablo, Nev. | 350.4 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 29 | 12 | 19 | 0.02 |
| | 350.4 | $^{133}Xe$ | $10^{-12}\mu Ci/ml$ air | 12 | < 4 | < 5 | <0.01 |
| | 325.4 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 0.8 | < 0.3 | < 0.4 | - |
| | 343.4 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | 5 | < 2 | < 3 | |
| | 325.4 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | < 5 | < 0.5 | < 2 | <0.01 |
| | 325.4 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 1.9 | 0.4 | < 0.7 | |
| Hiko, Nev. | 358.6 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 23 | 13 | 19 | 0.02 |
| | 364.5 | $^{133}Xe$ | $10^{-12}\mu Ci/ml$ air | 11 | < 4 | < 5 | <0.01 |
| | 329.3 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 0.4 | < 0.3 | < 0.3 | - |
| | 364.4 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | < 2 | < 2 | < 2 | |
| | 329.3 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ ai4 | < 5 | 0.7 | < 2 | <0.01 |
| | 329.3 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 26 | < 0.3 | < 2 | |
| Indian Springs, Nev. | 350.2 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 30 | 14 | 20 | 0.02 |
| | 350.2 | Total Xe | $10^{-12}\mu Ci/ml$ air | < 6 | < 4 | < 5 | <0.01 |
| | 316.5 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 0.8 | < 0.3 | < 0.4 | - |
| | 350.2 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | 14 | < 2 | < 3 | |
| | 316.5 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | 3.6 | < 0.5 | < 2 | <0.01 |
| | 316.5 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 3.2 | < 0.2 | < 0.9 | |

Table A-3. (continued)

| Sampling Location | No. Days Sampled | Radio-nuclide | Units | Radioactivity Concentrations C Max | C Min | C Avg | % of Conc. Guide* |
|---|---|---|---|---|---|---|---|
| Las Vegas, Nev. | 345.2 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 23 | 15 | 20 | 0.02 |
| | 352.2 | $^{133}Xe$ | $10^{-12}\mu Ci/ml$ air | 10 | < 4 | < 5 | <0.01 |
| | 303.1 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 0.7 | < 0.3 | < 0.4 | - |
| | 352.2 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | < 6 | < 2 | < 3 | |
| | 303.1 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | 4.5 | < 0.3 | < 2 | <0.01 |
| | 303.1 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 2.2 | < 0.3 | < 0.7 | |
| NTS, Nev. Mercury | 345.6 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 24 | 13 | 20 | <0.01 |
| | 358.5 | $^{133}Xe$ | $10^{-12}\mu Ci/ml$ air | 7.1 | < 2 | < 5 | <0.01 |
| | 323.6 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 4.4 | < 0.3 | < 0.5 | - |
| | 358.6 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | 9 | < 2 | < 3 | |
| | 323.6 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | 7.6 | < 0.3 | < 2 | <0.01 |
| | 323.6 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 4.5 | < 0.3 | < 0.8 | |
| NTS, Nev. Area 51# | 343.4 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 28 | 14 | 19 | <0.01 |
| | 364.5 | Total Xe | $10^{-12}\mu Ci/ml$ air | < 6 | < 2 | < 5 | <0.01 |
| | 323.7 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 10 | < 0.3 | < 0.6 | - |
| | 344.5 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | 7 | < 2 | < 3 | |
| | 323.7 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | 45 | < 0.4 | < 3 | <0.01 |
| | 316.7 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 6.5 | 0.2 | < 0.7 | |
| NTS, Nev. BJY | 306.4 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 35 | 13 | 21 | <0.01 |
| | 336.6 | $^{133}Xe$ | $10^{-12}\mu Ci/ml$ air | 100 | < 2 | < 7 | <0.01 |
| | 323.2 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 7.1 | < 0.3 | < 2 | - |
| | 330.5 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | 6 | < 2 | < 3 | |
| | 323.2 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | 35 | < 2 | <11 | <0.01 |
| | 317.3 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 7.7 | < 0.5 | < 2 | |
| NTS, Nev. Area 12 | 337.7 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 25 | 12 | 19 | <0.01 |
| | 351.6 | $^{133}Xe$ | $10^{-12}\mu Ci/ml$ air | 18 | < 4 | < 5 | <0.01 |
| | 343.7 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 14 | < 0.3 | < 2 | - |
| | 351.6 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | 6 | < 2 | < 3 | |
| | 343.7 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | 50 | < 2 | <10 | <0.01 |
| | 350.7 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 12 | < 0.2 | < 2 | |

Table A-3. (continued)

| Sampling Location | No. Days Sampled | Radio-nuclide | Units | Radioactivity Concentrations C Max | C Min | C Avg | % of Conc. Guide* |
|---|---|---|---|---|---|---|---|
| Tonopah, Nev. | 357.8 | $^{85}Kr$ | $10^{-12}\mu Ci/ml$ air | 23 | 14 | 19 | 0.02 |
| | 364.5 | $^{133}Xe$ | $10^{-12}\mu Ci/ml$ air | 15 | < 4 | < 5 | <0.01 |
| | 336.7 | $^{3}H$ as HTO | $10^{-6}\mu Ci/ml$ $H_2O$ | 0.5 | < 0.3 | < 0.4 | - |
| | 356.6 | $^{3}H$ as $CH_3T$ | $10^{-12}\mu Ci/ml$ air | < 7 | < 2 | < 3 | <0.01 |
| | 336.7 | $^{3}H$ as HTO | $10^{-12}\mu Ci/ml$ air | < 5 | < 0.7 | < 2 | |
| | 329.7 | $^{3}H$ as HT | $10^{-12}\mu Ci/ml$ air | 1.8 | < 0.4 | < 0.8 | |

* Concentration Guides used for NTS stations are those applicable to exposures to radiation workers. Those used for off-NTS stations are for exposure to a suitable sample of the population in an uncontrolled area. See Appendix B for Concentration Guides.

# Also known as Groom Lake.

Table A-4. 1977 Summary of Radiation Doses for the Dosimetry Network

| Station Location | Measurement Period | Dose Equivalent Rate (mrem/d) Max. | Min. | Avg. | Annual Adjusted Dose Equivalent (mrem/y) |
|---|---|---|---|---|---|
| Adaven, Nev. | 1/10/77 - 1/10/78 | 0.40 | 0.38 | 0.39 | 140 |
| Alamo, Nev. | 1/04/77 - 1/09/78 | 0.33 | 0.25 | 0.28 | 100 |
| Area 51-NTS, Nev. | 1/10/77 - 1/09/78 | 0.21 | 0.18 | 0.19 | 72 |
| Austin, Nev. | 1/12/77 - 1/11/78 | 0.44 | 0.38 | 0.42 | 150 |
| Baker, Calif. | 1/10/77 - 1/09/78 | 0.24 | 0.23 | 0.23 | 84 |
| Barstow, Calif. | 1/10/77 - 1/09/78 | 0.27 | 0.25 | 0.26 | 96 |
| Beatty, Nev. | 1/04/77 - 1/31/78 | 0.32 | 0.28 | 0.28 | 120 |
| Bishop, Calif. | 1/11/77 - 1/10/78 | 0.31 | 0.26 | 0.27 | 100 |
| Blue Eagle Ranch, Nev. | 1/13/77 - 1/11/78 | 0.23 | 0.17 | 0.18 | 67 |
| Blue Jay, Nev. | 1/13/77 - 1/10/78 | 0.39 | 0.32 | 0.35 | 120 |
| Cactus Springs, Nev. | 1/03/77 - 1/16/78 | 0.19 | 0.16 | 0.17 | 64 |
| Caliente, Nev. | 1/06/77 - 1/10/78 | 0.39 | 0.34 | 0.37 | 140 |
| Carp, Nev. | 1/05/77 - 1/10/78 | 0.34 | 0.27 | 0.30 | 110 |
| Casey's Ranch, Nev. | 1/10/77 - 1/11/78 | 0.22 | 0.19 | 0.20 | 75 |
| Cedar City, Utah | 1/11/77 - 2/01/78 | 0.25 | 0.21 | 0.22 | 87 |
| Clark Station, Nev. | 1/13/77 - 1/10/78 | 0.33 | 0.30 | 0.32 | 120 |
| Complex I, Nev. | 1/10/77 - 1/10/78 | 0.32 | 0.29 | 0.30 | 110 |
| Coyote Summit, Nev. | 1/10/77 - 1/09/78 | 0.34 | 0.31 | 0.33 | 120 |
| Currant, Nev. | 1/12/77 - 1/11/78 | 0.29 | 0.25 | 0.28 | 98 |
| Death Valley Jct., Calif. | 1/13/77 - 1/12/78 | 0.23 | 0.20 | 0.21 | 79 |
| Desert Game Range, Nev. | 1/03/77 - 1/16/78 | 0.21 | 0.16 | 0.17 | 64 |
| Desert Oasis, Nev. | 1/10/77 - 1/31/78 | 0.21 | 0.18 | 0.18 | 72 |

Table A-4. (continued)

| Station Location | Measurement Period | Dose Equivalent Rate (mrem/d) Max. | Min. | Avg. | Annual Adjusted Dose Equivalent (mrem/y) |
|---|---|---|---|---|---|
| Diablo Maint. Sta., Nev. | 1/10/77 - 1/12/78 | 0.36 | 0.34 | 0.35 | 130 |
| Duckwater, Nev. | 1/12/77 - 1/11/78 | 0.32 | 0.29 | 0.30 | 110 |
| Elgin, Nev. | 1/05/77 - 1/10/78 | 0.36 | 0.33 | 0.35 | 130 |
| Ely, Nev. | 1/13/77 - 1/11/78 | 0.29 | 0.21 | 0.23 | 84 |
| Enterprise, Utah | 1/11/77 - 2/01/78 | 0.31 | 0.28 | 0.30 | 110 |
| Eureka, Nev. | 1/12/77 - 1/11/78 | 0.39 | 0.30 | 0.33 | 120 |
| Furnace Creek, Calif. | 1/13/77 - 1/12/78 | 0.19 | 0.16 | 0.17 | 65 |
| Garrison, Utah | 1/11/77 - 1/09/78 | 0.26 | 0.20 | 0.21 | 78 |
| Geyser Maint. Sta., Nev. | 1/11/77 - 1/09/78 | 0.35 | 0.28 | 0.30 | 110 |
| Goldfield, Nev. | 1/10/77 - 1/09/78 | 0.29 | 0.26 | 0.27 | 97 |
| Hancock Summit, Nev. | 1/10/77 - 1/09/78 | 0.47 | 0.38 | 0.42 | 150 |
| Hiko, Nev. | 1/04/77 - 1/09/78 | 0.24 | 0.20 | 0.21 | 81 |
| Hot Creek Ranch, Nev. | 1/13/77 - 1/10/78 | 0.26 | 0.25 | 0.25 | 91 |
| Independence, Calif. | 1/11/77 - 1/10/78 | 0.29 | 0.27 | 0.28 | 100 |
| Indian Springs, Nev. | 1/03/77 - 1/16/78 | 0.21 | 0.18 | 0.18 | 69 |
| Kirkeby Ranch, Nev. | 1/11/77 - 1/09/78 | 0.26 | 0.20 | 0.22 | 81 |
| Koynes, Nev. | 1/10/77 - 1/12/78 | 0.28 | 0.24 | 0.26 | 95 |
| Las Vegas (Airport), Nev. | 1/03/77 - 2/06/78 | 0.19 | 0.14 | 0.16 | 64 |
| Las Vegas (Placak), Nev. | 1/05/77 - 2/06/78 | 0.22 | 0.14 | 0.17 | 60 |
| Las Vegas (USDI), Nev. | 1/03/77 - 2/06/78 | 0.17 | 0.15 | 0.17 | 67 |
| Lathrop Wells, Nev. | 1/04/77 - 1/16/78 | 0.26 | 0.26 | 0.26 | 98 |
| Lida, Nev. | 1/10/77 - 1/09/78 | 0.30 | 0.28 | 0.28 | 100 |

Table A-4. (continued)

| Station Location | Measurement Period | Dose Equivalent Rate (mrem/d) Max. | Min. | Avg. | Annual Adjusted Dose Equiv-alent (mrem/y) |
|---|---|---|---|---|---|
| Lone Pine, Calif. | 1/11/77 - 1/10/78 | 0.31 | 0.25 | 0.27 | 99 |
| Lund, Nev. | 1/10/77 - 1/10/78 | 0.29 | 0.21 | 0.24 | 87 |
| Mammoth Mtn., Calif. | 1/12/77 - 1/11/78 | 0.39 | 0.28 | 0.31 | 110 |
| Manhattan, Nev. | 1/11/77 - 1/10/78 | 0.36 | 0.33 | 0.35 | 130 |
| Mesquite, Nev. | 1/10/77 - 1/31/78 | 0.20 | 0.18 | 0.18 | 71 |
| Nevada Farms, Nev. | 1/10/77 - 1/12/78 | 0.35 | 0.30 | 0.33 | 120 |
| Nuclear Eng. Co., Nev. | 1/05/77 - 1/31/78 | 0.40 | 0.32 | 0.35 | 140 |
| Nyala, Nev. | 1/10/77 - 1/11/78 | 0.27 | 0.20 | 0.24 | 87 |
| Olancha, Calif. | 1/11/77 - 1/10/78 | 0.26 | 0.24 | 0.25 | 91 |
| Pahrump, Nev. | 1/06/77 - 1/17/78 | 0.21 | 0.18 | 0.18 | 70 |
| Pine Creek Ranch, Nev. | 1/10/77 - 1/10/78 | 0.37 | 0.33 | 0.36 | 130 |
| Pioche, Nev. | 1/05/77 - 1/11/78 | 0.28 | 0.22 | 0.24 | 88 |
| Queen City Summit, Nev. | 1/10/77 - 1/09/78 | 0.44 | 0.33 | 0.39 | 140 |
| Reed Ranch, Nev. | 1/10/77 - 1/09/78 | 0.34 | 0.31 | 0.32 | 120 |
| Ridgecrest, Calif. | 1/11/77 - 1/10/78 | 0.26 | 0.22 | 0.24 | 84 |
| Robinson's Tr. Park, Nev. | 1/10/77 - 1/12/78 | 0.36 | 0.32 | 0.34 | 130 |
| Round Mountain, Nev. | 1/11/77 - 1/10/78 | 0.34 | 0.30 | 0.32 | 120 |
| Rox, Nev. | 1/10/77 - 1/31/78 | 0.26 | 0.23 | 0.24 | 92 |
| Scotty's Junction, Nev. | 1/10/77 - 1/09/78 | 0.35 | 0.29 | 0.31 | 110 |
| Selbach Ranch, Nev. | 1/05/77 - 1/31/78 | 0.32 | 0.28 | 0.30 | 120 |
| Sherri's Bar, Nev. | 1/04/77 - 1/09/78 | 0.23 | 0.21 | 0.22 | 81 |
| Shoshone, Calif. | 1/13/77 - 1/12/78 | 0.33 | 0.27 | 0.30 | 110 |

Table A-4. (continued)

| Station Location | Measurement Period | Dose Equivalent Rate (mrem/d) Max. | Min. | Avg. | Annual Adjusted Dose Equivalent (mrem/y) |
|---|---|---|---|---|---|
| Springdale, Nev. | 1/04/77 - 2/01/78 | 0.35 | 0.31 | 0.32 | 130 |
| Spring Meadows, Nev. | 1/04/77 - 1/17/78 | 0.18 | 0.17 | 0.17 | 69 |
| St. George, Utah | 1/12/77 - 2/02/78 | 0.22 | 0.18 | 0.20 | 76 |
| Stone Cabin Ranch, Nev. | 1/13/77 - 1/11/78 | 0.50 | 0.45 | 0.47 | 170 |
| Sunnyside, Nev. | 1/10/77 - 1/10/78 | 0.23 | 0.18 | 0.20 | 72 |
| Tempiute, Nev. | 1/10/77 - 1/12/78 | 0.31 | 0.27 | 0.30 | 110 |
| Tenneco, Nev. | 1/04/77 - 1/17/78 | 0.30 | 0.29 | 0.29 | 110 |
| Tonopah, Nev. | 1/10/77 - 1/09/78 | 0.31 | 0.29 | 0.30 | 110 |
| Tonopah Test Range, Nev. | 1/11/77 - 1/10/78 | 0.28 | 0.26 | 0.27 | 100 |
| Twin Springs Ranch, Nev. | 1/10/77 - 1/12/78 | 0.32 | 0.29 | 0.30 | 110 |
| Warm Springs, Nev. | 1/13/77 - 1/11/78 | 0.32 | 0.30 | 0.31 | 120 |
| Young's Ranch, Nev. | 1/11/77 - 1/10/78 | 0.27 | 0.25 | 0.26 | 95 |

Table A-5. 1977 Summary of Analytical Results for the Milk Surveillance Network

| Sampling Location | Sample Type[1] | No. of Samples | Radio-nuclide | Radioactivity Conc. ($10^{-9}$ µCi/ml) C Max | C Min | C Avg |
|---|---|---|---|---|---|---|
| Hinkley, Calif. Bill Nelson Dairy | 12 | 4 | $^{137}Cs$ | <8 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <2 | <0.6 | <2 |
| | | 4 | $^{90}Sr$ | 2.5 | <0.7 | <2 |
| Keough Hot Spgs., Calif. Yribarren Ranch | 13 | 4 | $^{137}Cs$ | 7.6 | <4 | <6 |
| | | 4 | $^{89}Sr$ | 4 | <1 | <3 |
| | | 4 | $^{90}Sr$ | 3.1 | 1.8 | 2.3 |
| Trona, Calif. Stanford Ranch | 13 | 3 | $^{137}Cs$ | <7 | <4 | <5 |
| | | 3 | $^{89}Sr$ | <2 | <2 | <2 |
| | | 3 | $^{90}Sr$ | 2.5 | <0.7 | <2 |
| Alamo, Nev. A. J. Sharp[2] | 14 | 1 | $^{137}Cs$ | <6 | <6 | <6 |
| | | 1 | $^{89}Sr$ | <3 | <3 | <3 |
| | | 1 | $^{90}Sr$ | <0.9 | <0.9 | <0.9 |
| Austin, Nev. Young's Ranch | 13 | 4 | $^{137}Cs$ | <12 | <4 | <6 |
| | | 4 | $^{89}Sr$ | 4.1 | <1 | <3 |
| | | 4 | $^{90}Sr$ | 2.8 | 1.2 | 2.1 |
| | | 4 | $^{3}H$ | 550 | <300 | <400 |
| Caliente, Nev. June Cox Ranch | 13 | 4 | $^{137}Cs$ | <6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <3 | <0.6 | <2 |
| | | 4 | $^{90}Sr$ | <1 | <0.6 | <0.8 |

Table A-5. (continued)

| Sampling Location | Sample Type[1] | No. of Samples | Radio-nuclide | Radioactivity Conc. ($10^{-9}$ μCi/ml) C Max | C Min | C Avg |
|---|---|---|---|---|---|---|
| Currant, Nev. Blue Eagle Ranch | 13 | 4 | $^{137}Cs$ | 6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <2.6 | <0.9 | <2 |
| | | 4 | $^{90}Sr$ | 2.3 | 0.9 | <2 |
| Currant, Nev. Manzonie Ranch | 13 | 2 | $^{137}Cs$ | <5 | <4 | <4 |
| | | 2 | $^{89}Sr$ | <1 | <1 | <1 |
| | | 2 | $^{90}Sr$ | 1.2 | 1 | 1 |
| Hiko, Nev. Darrel Hansen Ranch | 13 | 4 | $^{137}Cs$ | <6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <3 | <2 | <2 |
| | | 4 | $^{90}Sr$ | 1.7 | <0.7 | <1 |
| | | 4 | $^{3}H$ | <300 | <300 | <300 |
| Las Vegas, Nev. LDS Dairy Farm | 12 | 4 | $^{137}Cs$ | <6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <2 | <0.9 | <2 |
| | | 4 | $^{90}Sr$ | 2.3 | <0.7 | <2 |
| | | 4 | $^{3}H$ | <400 | <300 | <300 |
| Lathrop Wells, Nev. Kirker Ranch | 13 | 4 | $^{137}Cs$ | <5 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <3 | <2 | <3 |
| | | 4 | $^{90}Sr$ | 1.1 | <0.7 | <2 |
| Lida, Nev. Lida Livestock Co. | 13 | 4 | $^{137}Cs$ | <5 | <3 | <4 |
| | | 4 | $^{89}Sr$ | <3 | <0.7 | <2 |
| | | 4 | $^{90}Sr$ | 2.5 | <1 | <2 |

Table A-5. (continued)

| Sampling Location | Sample Type[1] | No. of Samples | Radio-nuclide | Radioactivity Conc. ($10^{-9}$ μCi/ml) C Max | C Min | C Avg |
|---|---|---|---|---|---|---|
| Logandale, Nev. Vegas Valley Dairy | 12 | 4 | $^{137}Cs$ | <6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <3 | <1 | <2 |
| | | 4 | $^{90}Sr$ | 2.4 | 0.7 | <2 |
| Lund, Nev. McKenzie Dairy | 12 | 4 | $^{137}Cs$ | <12 | <4 | <6 |
| | | 3 | $^{89}Sr$ | <3 | <1 | <2 |
| | | 3 | $^{90}Sr$ | 2 | <0.8 | <2 |
| | | 4 | $^{3}H$ | <400 | <300 | <300 |
| Mesquite, Nev. Hughes Bros. Dairy | 12 | 4 | $^{137}Cs$ | <6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <3 | <0.7 | <2 |
| | | 4 | $^{90}Sr$ | <0.9 | <0.5 | <0.7 |
| | | 4 | $^{3}H$ | <400 | <300 | <300 |
| Moapa, Nev. Agman Seventy-Five, Inc. | 12 | 4 | $^{137}Cs$ | <10 | <4 | <6 |
| | | 4 | $^{89}Sr$ | <3 | <1 | <2 |
| | | 4 | $^{90}Sr$ | 2.8 | <0.8 | <2 |
| Nyala, Nev. Sharp's Ranch | 13 | 4 | $^{137}Cs$ | <5 | <4 | <4 |
| | | 4 | $^{89}Sr$ | <4 | <1 | <2 |
| | | 4 | $^{90}Sr$ | <2 | <0.7 | <0.9 |
| | | 4 | $^{3}H$ | <400 | <300 | <300 |

Table A-5. (continued)

| Sampling Location | Sample Type[1] | No. of Samples | Radio-nuclide | Radioactivity Conc. ($10^{-9}$ μCi/ml) $C_{Max}$ | $C_{Min}$ | $C_{Avg}$ |
|---|---|---|---|---|---|---|
| Pahrump, Nev. Burson Ranch[3] | 13 | 3 | $^{137}Cs$ | <4 | <4 | <4 |
| | | 3 | $^{89}Sr$ | <2 | <0.6 | <2 |
| | | 3 | $^{90}Sr$ | <0.7 | <0.7 | <0.7 |
| Pahrump, Nev. Oxborrow Ranch | 13 | 1 | $^{137}$ | <6 | <6 | <6 |
| | | 1 | $^{89}Sr$ | <2 | <2 | <2 |
| | | 1 | $^{90}Sr$ | 1.3 | 1.3 | 1.3 |
| Round Mountain, Nev. Berg Ranch | 13 | 2 | $^{137}Cs$ | <13 | <5 | <9 |
| | | 2 | $^{89}Sr$ | <2 | <2 | <2 |
| | | 2 | $^{90}Sr$ | 1.6 | 1.4 | 1.5 |
| Shoshone, Nev. Kirkeby Ranch | 13 | 4 | $^{137}Cs$ | <6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <3 | <1 | <2 |
| | | 4 | $^{90}Sr$ | 2.2 | <1 | <2 |
| Springdale, Nev. Boiling Pot Ranch | 13 | 4 | $^{137}Cs$ | <6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <2 | <1 | <2 |
| | | 4 | $^{90}Sr$ | 1.2 | <0.7 | <0.9 |
| Cedar City, Utah Western General Dairy | 12 | 4 | $^{137}Cs$ | <5 | <4 | <4 |
| | | 4 | $^{89}Sr$ | <3 | <0.7 | <3 |
| | | 4 | $^{90}Sr$ | 2.1 | <1 | <2 |

Table A-5. (continued)

| Sampling Location | Sample Type[1] | No. of Samples | Radio-nuclide | Radioactivity Conc. ($10^{-9}$ µCi/ml) $C_{Max}$ | $C_{Min}$ | $C_{Avg}$ |
|---|---|---|---|---|---|---|
| St. George, Utah R. Cox Dairy | 12 | 4 | $^{137}Cs$ | <6 | <4 | <5 |
| | | 4 | $^{89}Sr$ | <2 | <0.9 | <2 |
| | | 4 | $^{90}Sr$ | 1.1 | <0.7 | <0.8 |

(1) 12 = Raw Milk from Grade A Producer(s)
13 = Raw Milk from family cow(s)
14 = Other than Grade A Producer (Raw)

(2) A. J. Sharp replaced Alamo Dairy.

(3) Burson Ranch replaced by Oxborrow Ranch, Pahrump, Nev.

Table A-6. Analytical Criteria for Long-Term Hydrological Monitoring Program Samples

| | |
|---|---|
| Gross alpha | All samples |
| Gross beta | All samples |
| Gamma scan | All samples |
| $^{3}H$ [1] | All samples |
| $^{89,90}Sr$ | Only samples collected at locations for the first time during CY77. |
| $^{226}Ra$ | Only samples collected at locations for the first time during CY77 if gross alpha exceeded $3 \times 10^{-9}$ $\mu Ci/ml$. |
| U | Only samples collected at locations for the first time during CY77. |
| $^{238,239}Pu$ | Only samples collected at locations for the first time during CY77. |

(1) All samples were first analyzed by the more rapid conventional technique (MDC of about $2 \times 10^{-7}$ $\mu Ci/ml$). Those samples having tritium concentrations <MDC were then analyzed by the enrichment technique (MDC of about $6 \times 10^{-9}$ $\mu Ci/ml$).

Table A-7. 1977 Summary of Analytical Results for the NTS Monthly Long-Term Hydrological Monitoring Program

| Sampling Location | (1) No. Samples Collected | No. Samples Analyzed | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) Max | Min | Avg | % of Conc. Guide(2) |
|---|---|---|---|---|---|---|---|
| NTS Well 8 | 11 | 11 | Gross α | <3 | <2 | <3 | <7 |
| | | 11 | Gross β | <4 | <4 | <4 | <20 |
| | | 11 | $^3H$ | <10 | <7 | <9 | <0.01 |
| NTS Well U3CN-5 | 11 | 11 | Gross α | 9.7 | <3 | <5 | <20 |
| | | 11 | Gross β | 20 | <4 | <20 | <40 |
| | | 11 | $^3H$ | 230 | <8 | <70 | <0.01 |
| NTS Well A | 11 | 11 | Gross α | 7.5 | <3 | <6 | <20 |
| | | 11 | Gross β | 7.5 | <4 | <5 | <20 |
| | | 11 | $^3H$ | <9 | <7 | <8 | <0.01 |
| NTS Well C | 11 | 11 | Gross α | 15 | <4 | <9 | <30 |
| | | 11 | Gross β | 20 | 7.0 | 11 | 40 |
| | | 11 | $^3H$ | 150 | 33 | 58 | <0.01 |
| NTS Well 5c | 11 | 11 | Gross α | 8.5 | 3.6 | <6 | <20 |
| | | 11 | Gross β | 15 | <3 | <5 | <20 |
| | | 11 | $^3H$ | 13 | <7 | <9 | <0.01 |
| NTS Army Well No. 1 | 11 | 11 | Gross α | 6.1 | <3 | <4 | <20 |
| | | 11 | Gross β | <4 | <3 | <4 | <20 |
| | | 11 | $^3H$ | 9.5 | <7 | <9 | <0.01 |
| NTS Well 2 | 11 | 11 | Gross α | 4.4 | <3 | <3 | <10 |
| | | 11 | Gross β | 5.5 | <4 | <4 | <20 |
| | | 11 | $^3H$ | <10 | <7 | <8 | <0.01 |
| NTS Test Well B | 6 | 6 | Gross α | 5.5 | <3 | <3 | <10 |
| | | 6 | Gross β | 6.3 | <4 | <4 | <20 |
| | | 6 | $^3H$ | 330 | 150 | 230 | <0.01 |
| NTS Well J-13 | 10 | 10 | Gross α | 8.5 | <3 | <4 | <20 |
| | | 10 | Gross β | <4 | <3 | <4 | <200 |
| | | 10 | $^3H$ | <10 | <7 | <8 | <0.01 |

Table A-7. (continued)

| Sampling Location | [1]No. Samples Collected | No. Samples Analyzed | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) Max | Min | Avg | % of Conc. Guide[2] |
|---|---|---|---|---|---|---|---|
| NTS | 5 | 5 | Gross α | 4.9 | <2 | <4 | <20 |
| Well U19c | | 5 | Gross β | 8.1 | <4 | <5 | <20 |
| | | 5 | $^{3}H$ | 48 | <7 | <20 | <0.01 |

[1]Samples could not be collected every month due to weather conditions or inoperative pumps.

[2]Concentration Guides for drinking water at on-NTS locations are the same as those for off-NTS locations. See Appendix B for Concentration Guides.

Table A-8. 1977 Analytical Results for the NTS Semi-Annual Long-Term Hydrological Monitoring Program

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}\mu Ci/ml$) | % of Conc. Guide |
|---|---|---|---|---|---|---|
| NTS Well UE15d | 1/04 | | 23 | Gross α | 19 | 63 |
| | | | | Gross β | <3 | <10 |
| | | | | $^{3}H$ | 44 | <0.01 |
| NTS Well UE15d | 6/08 | | 23 | Gross α | 10 | 33 |
| | | | | Gross β | 14 | 47 |
| | | | | $^{3}H$ | <9 | <0.01 |
| NTS Test Well D | 1/25 | 571 | 23 | Gross α | <3 | <10 |
| | | | | Gross β | <4 | <20 |
| | | | | $^{3}H$ | 31 | <0.01 |
| NTS Test Well D | 6/09 | 571 | 23 | Gross α | <3 | <10 |
| | | | | Gross β | <4 | <20 |
| | | | | $^{3}H$ | 17 | <0.01 |
| NTS Well UE1c | 1/27 | 500 | 23 | Gross α | <3 | <10 |
| | | | | Gross β | 8.5 | 28 |
| | | | | $^{3}H$ | <7 | <0.01 |
| NTS Well UE1c | 6/09 | 500 | 23 | Gross α | 8.6 | 29 |
| | | | | Gross β | 9.7 | 32 |
| | | | | $^{3}H$ | <8 | <0.01 |
| NTS Well C-1 | 1/04 | | 23 | Gross α | 4.0 | 13 |
| | | | | Gross β | 12 | 40 |
| | | | | $^{3}H$ | 22 | <0.01 |
| NTS Well C-1 | 6/13 | | 23 | Gross α | 6.5 | 22 |
| | | | | Gross β | 11 | 37 |
| | | | | $^{3}H$ | 20 | <0.01 |
| NTS Well UE5C | 2/02 | | 23 | Gross α | 8.9 | 30 |
| | | | | Gross β | <4 | <20 |
| | | | | $^{3}H$ | <9 | <0.01 |

Table A-8. (continued)

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}\mu Ci/ml$) | % of Conc. Guide |
|---|---|---|---|---|---|---|
| NTS Well UE5C | 6/13 | | 23 | Gross α | 5.1 | 17 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <8 | <0.01 |
| NTS Well UE18r | 1/26 | 507 | 23 | Gross α | <3 | <10 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | 8.2 | <0.01 |
| NTS Well UE18r | 6/08 | 507 | 23 | Gross α | 3.7 | 12 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <9 | <0.01 |
| NTS Well 5B | 2/02 | | 23 | Gross α | 4.0 | 13 |
| | | | | Gross β | 6.4 | 21 |
| | | | | $^3H$ | <9 | <0.01 |
| NTS Well 5B | 6/13 | | 23 | Gross α | 5.5 | 18 |
| | | | | Gross β | 8.5 | 28 |
| | | | | $^3H$ | <9 | <0.01 |
| NTS Test Well F | 1/24 | 1006 | 23 | Gross α | <3 | <10 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | 7.3 | <0.01 |
| NTS Test Well F | 6/06 | 1006 | 23 | Gross α | 7.2 | 24 |
| | | | | Gross β | 8.6 | 29 |
| | | | | $^3H$ | <9 | <0.01 |
| Ash Meadows, Nev. Crystal Pool | 1/18 | | 27 | Gross α | 9.1 | 30 |
| | | | | Gross β | 11 | 37 |
| | | | | $^3H$ | <8 | <0.01 |
| Ash Meadows, Nev. Crystal Pool | 6/15 | | 27 | Gross α | 12 | 40 |
| | | | | Gross β | 15 | 50 |
| | | | | $^3H$ | <10 | <0.01 |

Table A-8. (continued)

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}\mu Ci/ml$) | % of Conc. Guide |
|---|---|---|---|---|---|---|
| Ash Meadows, Nev. Well 18S/51E-7DB | 1/18 | | 23 | Gross α | <4 | <20 |
| | | | | Gross β | 4.9 | 16 |
| | | | | $^3H$ | <8 | <0.01 |
| Ash Meadows, Nev. Well 18S/51E-7DB | 6/15 | | 23 | Gross α | 5.8 | 19 |
| | | | | Gross β | 16 | 53 |
| | | | | $^3H$ | <20 | <0.01 |
| Ash Meadows, Nev. Well 17S/50E-14CAC | 1/18 | | 23 | Gross α | <3 | <10 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <9 | <0.01 |
| Ash Meadows, Nev. Well 17S/50E-14CAC | 6/15 | | 23 | Gross α | 6.7 | 22 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <10 | <0.01 |
| Ash Meadows, Nev. Fairbanks Springs | 1/18 | | 27 | Gross α | 8.1 | 27 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <8 | <0.01 |
| Ash Meadows, Nev. Fairbanks Springs | 6/15 | | 27 | Gross α | <3 | <10 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <8 | <0.01 |
| Beatty, Nev. City Supply | 1/20 | | 23 | Gross α | 15 | 50 |
| | | | | Gross β | <3 | <10 |
| | | | | $^3H$ | <8 | <0.01 |
| Beatty, Nev. City Supply | 6/16 | | 23 | Gross α | 15 | 50 |
| | | | | Gross β | 10 | 33 |
| | | | | $^3H$ | 20 | <0.01 |
| Beatty, Nev. Nuclear Engineering Co. | 1/20 | | 23 | Gross α | 12 | 40 |
| | | | | Gross β | <3 | <10 |
| | | | | $^3H$ | <8 | <0.01 |

Table A-8. (continued)

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}\mu Ci/ml$) | % of Conc. Guide |
|---|---|---|---|---|---|---|
| Beatty, Nev. Nuclear Engineering Co. | 6/14 | | 23 | Gross α | 8.4 | 28 |
| | | | | Gross β | 7.8 | 26 |
| | | | | $^3H$ | <9 | <0.01 |
| Beatty, Nev. Coffers Well | 6/15 | | 23 | Gross α | 3.7 | 12 |
| | | | | Gross β | 13 | 43 |
| | | | | $^3H$ | <9 | <0.01 |
| Indian Springs, Nev. USAF No. 2 | 1/17 | | 23 | Gross α | 7.8 | 26 |
| | | | | Gross β | <3 | <10 |
| | | | | $^3H$ | 17 | <0.01 |
| Indian Springs, Nev. USAF No. 2 | 6/14 | | 23 | Gross α | <4 | <20 |
| | | | | Gross β | 5.3 | 18 |
| | | | | $^3H$ | <8 | <0.01 |
| Indian Springs, Nev. Sewer Co. Inc. Well No. 1 | 1/17 | | 23 | Gross α | 12 | 40 |
| | | | | Gross β | <3 | <10 |
| | | | | $^3H$ | <8 | <0.01 |
| Indian Springs, Nev. Sewer Co. Inc. Well No. 1 | 6/14 | | 23 | Gross α | 4.0 | 13 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <7 | <0.01 |
| Lathrop Wells, Nev. City Supply | 1/18 | | 23 | Gross α | <3 | <10 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <9 | <0.01 |
| Lathrop Wells, Nev. City Supply | 6/14 | | 23 | Gross α | <3 | <10 |
| | | | | Gross β | <4 | <20 |
| | | | | $^3H$ | <10 | <0.01 |
| Springdale, Nev. Goss Springs | 1/20 | | 27 | Gross α | 11 | 37 |
| | | | | Gross β | <3 | <10 |
| | | | | $^3H$ | <9 | <0.01 |

Table A-8. (continued)

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}\mu Ci/ml$) | % of Conc. Guide |
|---|---|---|---|---|---|---|
| Springdale, Nev. Goss Springs | 6/14 | | 27 | Gross α | <4 | <20 |
| | | | | Gross β | 5.2 | 17 |
| | | | | $^3H$ | <8 | <0.01 |
| Springdale, Nev. Goss Springs | 8/11 | | 27 | $^3H$ | <9 | <0.01 |
| Springdale, Nev. Road D Windmill | 2/02 | | 23 | Gross α | 5.1 | 17 |
| | | | | Gross β | 4.3 | 14 |
| | | | | $^3H$ | <9 | <0.01 |
| Springdale, Nev. Road D Windmill | 6/14 | | 23 | Gross α | <4 | <20 |
| | | | | Gross β | 4.4 | 15 |
| | | | | $^3H$ | 11 | <0.01 |

(1) If depth not shown, water was collected at surface

(2) 23 - Well
27 - Spring

Table A-9. 1977 Analytical Results for the
NTS Annual Long-Term Hydrological Monitoring Program

| Sampling Location | Date | Sample Type(1) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide(2) |
|---|---|---|---|---|---|
| Shoshone, Calif. Shoshone Spring | 6/23 | 27 | Gross α | <5 | <20 |
| | | | Gross β | 13 | 43 |
| | | | $^3$H | <7 | <0.01 |
| Hiko, Nev. Crystal Springs | 6/21 | 27 | Gross α | 6.5 | 22 |
| | | | Gross β | 19 | 63 |
| | | | $^3$H | <20 | <0.01 |
| Alamo, Nev. City Supply | 6/21 | 23 | Gross α | 5.5 | 18 |
| | | | Gross β | 20 | 67 |
| | | | $^3$H | <8 | <0.01 |
| Warm Springs, Nev. Twin Springs Ranch | 6/22 | 27 | Gross α | 4.8 | 16 |
| | | | Gross β | 20 | 67 |
| | | | $^3$H | <7 | <0.01 |
| Diablo, Nev. Highway Maint. Station | 6/21 | 23 | Gross α | <3 | <10 |
| | | | Gross β | 17 | 57 |
| | | | $^3$H | <7 | <0.01 |
| Nyala, Nev. Sharp Ranch | 6/22 | 23 | Gross α | <3 | <10 |
| | | | Gross β | 9.2 | 31 |
| | | | $^3$H | <10 | <0.01 |
| Adaven, Nev. Adaven Spring | 6/22 | 27 | Gross α | 5.9 | 20 |
| | | | Gross β | <4 | <20 |
| | | | $^3$H | 110 | <0.01 |
| Pahrump, Nev. Calvada Well 3 | 6/23 | 23 | Gross α | 7.4 | 25 |
| | | | Gross β | <4 | <20 |
| | | | $^3$H | <9 | <0.01 |
| Tonopah, Nev. City Supply | 6/22 | 23 | Gross α | 2.9 | 10 |
| | | | Gross β | 17 | 57 |
| | | | $^3$H | <7 | <0.01 |

Table A-9. (continued)

| Sampling Location | Date | Sample Type[1] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[2] |
|---|---|---|---|---|---|
| Clark Station, Nev. Tonopah Test Range Well 6 | 6/22 | 23 | Gross α | <3 | <10 |
| | | | Gross β | 17 | 57 |
| | | | $^{3}H$ | <7 | <0.01 |
| Las Vegas, Nev. Water District Well No. 28 | 6/23 | 23 | Gross α | 2.7 | 9.0 |
| | | | Gross β | <4 | <20 |
| | | | $^{3}H$ | <8 | <0.01 |
| Tempiute, Nev. Union Carbide Well | 6/21 | 23 | Gross α | <3 | <10 |
| | | | Gross β | 13 | 43 |
| | | | $^{3}H$ | 36 | <0.01 |

(1) 23 - Well
27 - Spring
(2) See Appendix B for Concentration Guides.

Table A-10. 1977 Analytical Results for the Off-NTS Long-Term Hydrological Monitoring Program

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide(3) |
|---|---|---|---|---|---|---|
| | | | PROJECT GNOME | | | |
| Malaga, N. Mex. USGS Well No. 1 | 4/28 | 161 | 23 | Gross α | <20 | - |
| | | | | Gross β | <20 | - |
| | | | | $^{3}H$ | <7 | <0.01 |
| | | | | $^{89}Sr$ | <4 | <2 |
| | | | | $^{90}Sr$ | 0.84 | 0.03 |
| Malaga, N. Mex. USGS Well No. 4 | 4/28 | 148 | 23 | Gross α | 15 | - |
| | | | | Gross β | 18,000 | - |
| | | | | $^{3}H$ | 830,000 | 28 |
| | | | | $^{89}Sr$ | <110 | <0.4 |
| | | | | $^{90}Sr$ | 10,000 | 3,300 |
| Malaga, N. Mex. USGS Well No. 8 | 4/28 | 144 | 23 | Gross α | <8 | - |
| | | | | Gross β | 23,000 | - |
| | | | | $^{3}H$ | 750,000 | 25 |
| | | | | $^{89}Sr$ | <110 | <0.4 |
| | | | | $^{90}Sr$ | 12,000 | 4,000 |
| | | | | $^{137}Cs$ | 87 | 0.44 |
| Malaga, N. Mex. PHS Well No. 6 | 4/27 | | 23 | Gross α | <3 | - |
| | | | | Gross β | 8.8 | - |
| | | | | $^{3}H$ | 110 | <0.01 |
| Malaga, N. Mex. PHS Well No. 8 | 4/27 | | 23 | Gross α | <7 | - |
| | | | | Gross β | <5 | - |
| | | | | $^{3}H$ | 10 | <0.01 |
| Malaga, N. Mex. PHS Well No. 9 | 4/27 | | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | <8 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide(3) |
|---|---|---|---|---|---|---|
| Malaga, N. Mex. PHS Well No. 10 | 4/27 | | 23 | Gross α | <10 | - |
| | | | | Gross β | 10 | - |
| | | | | $^3H$ | <7 | <0.01 |
| Malaga, N. Mex. Pecos River Pumping Station | 4/28 | | 23 | Gross α | <5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <8 | <0.01 |
| Loving, N. Mex. City Well No. 2 | 4/27 | | 23 | Gross α | 3.4 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <8 | <0.01 |
| Carlsbad, N. Mex. City Well No. 7 | 4/27 | | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 12 | <0.01 |
| PROJECT SHOAL | | | | | | |
| Frenchman, Nev. Frenchman Station | 3/22 | | 23 | Gross α | <5 | - |
| | | | | Gross β | 7.9 | - |
| | | | | $^3H$ | <8 | <0.01 |
| Frenchman, Nev. Well HS-1 | 3/23 | | 23 | Gross α | <3 | - |
| | | | | Gross β | 7.7 | - |
| | | | | $^3H$ | <9 | <0.01 |
| Frenchman, Nev. Well H-3 | 3/22 | | 23 | Gross α | <6 | - |
| | | | | Gross β | 5.6 | - |
| | | | | $^3H$ | <7 | <0.01 |
| Frenchman, Nev. Flowing Well | 3/22 | | 23 | Gross α | <0.7 | - |
| | | | | Gross β | <32 | - |
| | | | | $^3H$ | <9 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radioactivity | Radioactivity Conc. ($10^{-9}$ µCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Frenchman, Nev. Hunts Station | 3/22 | | 23 | Gross α | <4 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <9 | <0.01 |
| PROJECT DRIBBLE | | | | | | |
| Baxterville, Miss. City Supply | 4/22 | | 23 | Gross α | <0.9 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 89 | <0.01 |
| Baxterville, Miss. Lower Little Creek | 4/22 | | 22 | Gross α | <0.4 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 55 | <0.01 |
| Baxterville, Miss. Well HT-1 | 4/23 | 378 | 23 | Gross α | <4 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 39 | <0.01 |
| Baxterville, Miss. Well HT-2c | 4/16 | 108 | 23 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 28 | <0.01 |
| Baxterville, Miss. Well HT-4 | 4/17 | 122 | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 9.0 | <0.01 |
| Baxterville, Miss. Well HT-5 | 4/17 | 183 | 23 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <9 | <0.01 |
| Baxterville, Miss. Well E-7 | 4/16 | 282 | 23 | Gross α | <4 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 13 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Baxterville, Miss. Well Ascot No. 2 | 4/19 | 651 | 23 | Gross α | <30[5] | - |
| | | | | Gross β | <20[5] | - |
| | | | | $^{3}H$ | 7.8 | <0.01 |
| Baxterville, Miss. Half Moon Creek | 4/20 | | 22 | Gross α | <0.9 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 80 | <0.01 |
| Baxterville, Miss. Half Moon Creek Overflow | 4/20 | | 22 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 1,800 | 0.06 |
| Baxterville, Miss. T. Speights Residence | 4/21 | | 23 | Gross α | <0.8 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 130 | <0.01 |
| Baxterville, Miss. R. L. Anderson Residence | 4/19 | | 23 | Gross α | 1.6 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | [6] | |
| Baxterville, Miss. Mark Lowe Residence | 4/22 | | 23 | Gross α | <0.7 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 71 | <0.01 |
| Baxterville, Miss. R. Ready Residence | 4/22 | | 23 | Gross α | 0.78 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 54 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide(3) |
|---|---|---|---|---|---|---|
| Baxterville, Miss. W. Daniels Residence | 4/16 | | 23 | Gross α | <0.9 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 54 | <0.01 |
| Lumberton, Miss. City Supply Well No. 2 | 4/22 | | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <7 | <0.01 |
| Purvis, Miss. City Supply | 4/20 | | 23 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <7 | <0.01 |
| Columbia, Miss. City Supply | 4/22 | | 23 | Gross α | <2 | - |
| | | | | Gross β | 26 | - |
| | | | | $^3H$ | 11 | <0.01 |
| Lumberton, Miss. North Lumberton City Supply | 4/22 | | 23 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <7 | <0.01 |
| Baxterville, Miss. Pond W of GZ | 4/17 | | 21 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 37 | <0.01 |
| PROJECT GASBUGGY | | | | | | |
| Gobernador, N. Mex. Arnold Ranch | 5/24 | | 27 | Gross α | <7 | - |
| | | | | Gross β | <5 | - |
| | | | | $^3H$ | <8 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide(3) |
|---|---|---|---|---|---|---|
| Gobernador, | 5/23 | | 23 | Gross α | <6 | - |
| N. Mex. | | | | Gross β | <4 | - |
| Apache Reservation Well South | | | | $^3H$ | 93 | <0.01 |
| Gobernador, | 5/23 | | 23 | Gross α | <6 | - |
| N. Mex. | | | | Gross β | <5 | - |
| Lower Burro Canyon | | | | $^3H$ | <9 | <0.01 |
| Gobernador, | 5/24 | | 23 | Gross α | <5 | - |
| N. Mex. | | | | Gross β | <4 | - |
| Fred Bixler Ranch | | | | $^3H$ | 11 | <0.01 |
| Gobernador, | 5/23 | | 27 | Gross α | 5.8 | - |
| N. Mex. | | | | Gross β | <4 | - |
| Cave Springs | | | | $^3H$ | 12 | <0.01 |
| Gobernador, | 5/23 | | 23 | Gross α | <6 | - |
| N. Mex. | | | | Gross β | <4 | - |
| Windmill No. 2 | | | | $^3H$ | <30 | <0.01 |
| Gobernador, | 5/24 | | 27 | Gross α | <4 | - |
| N. Mex. | | | | Gross β | <4 | - |
| Bubbling Springs | | | | $^3H$ | 110 | <0.01 |
| Gobernador, | 5/24 | | 22 | Gross α | <20 | - |
| N. Mex. | | | | Gross β | 47 | - |
| La Jara Creek | | | | $^3H$ | 110 | <0.01 |
| Gobernador, | 5/22 | 1097 | 23 | Gross α | 7.6 | - |
| N. Mex. | | | | Gross β | <5 | - |
| EPNG Well 10-36 | | | | $^3H$ | 17 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| | | | PROJECT RULISON | | | |
| Rulison, Colo. Lee L. Hayward Ranch | 5/20 | | 23 | Gross α | 10 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 440 | 0.01 |
| Rulison, Colo. Glen Schwab Ranch | 5/20 | | 23 | Gross α | 14 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 430 | 0.01 |
| Grand Valley, Colo. Albert Gardner Ranch | 5/20 | | 23 | Gross α | 7.5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 390 | 0.01 |
| Grand Valley, Colo. City Water Suppy | 5/19 | | 27 | Gross α | 2.9 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 56 | <0.01 |
| Grand Valley, Colo. Spring 300 Yds. NW of GZ | 5/19 | | 27 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 170 | <0.01 |
| Rulison, Colo. Felix Sefcovic Ranch | 5/20 | | 23 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 520 | 0.02 |
| Grand Valley, Colo. Battlement Creek | 5/19 | | 22 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 330 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Grand Valley, Colo. CER Well | 5/19 | | 23 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | 560 | 0.02 |
| Rulison, Colo. Potter Ranch | 5/20 | | 27 | Gross α | 6.1 | - |
| | | | | Gross β | 5.6 | - |
| | | | | $^3H$ | 460 | 0.02 |
| PROJECT FAULTLESS | | | | | | |
| Blue Jay, Nev. Highway Maint. Station | 6/15 | | 23 | Gross α | 3.4 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <8 | <0.01 |
| Blue Jay, Nev. Sixmile Well | 6/15 | | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <9 | <0.01 |
| Blue Jay, Nev. Jim Bias Well | 3/04 | | 27 | Gross α | 5.5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <10 | <0.01 |
| Blue Jay, Nev. Well HTH-1 | 3/03 | 259 | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <9 | <0.01 |
| Blue Jay, Nev. Well HTH-2 | 3/03 | 184 | 23 | Gross α | 14 | - |
| | | | | Gross β | <4 | - |
| | | | | $^3H$ | <9 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| PROJECT RIO BLANCO | | | | | | |
| Rio Blanco, Colo. Fawn Creek 6800 ft Upstream | 5/17 | | 22 | Gross α | <5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 85 | <0.01 |
| Rio Blanco, Colo. Fawn Creek 500 ft Upstream | 5/17 | | 22 | Gross α | <4 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 51 | <0.01 |
| Rio Blanco, Colo. Fawn Creek 500 ft Downstream | 5/17 | | 22 | Gross α | <5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 52 | <0.01 |
| Rio Blanco, Colo. Fawn Creek 8400 ft Downstream | 5/17 | | 22 | Gross α | <5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 53 | <0.01 |
| Rio Blanco, Colo. Fawn Creek No. 1 | 5/18 | | 27 | Gross α | <5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 36 | <0.01 |
| Rio Blanco, Colo. Fawn Creek No. 3 | 5/17 | | 27 | Gross α | <5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 42 | <0.01 |
| Rio Blanco, Colo. CER No. 1 Black Sulphur | 5/18 | | 27 | Gross α | <5 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 64 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ µCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Rio Blanco, | 5/18 | | 27 | Gross α | <4 | - |
| Colo. | | | | Gross β | 7.5 | - |
| CER No. 4 | | | | $^{3}H$ | 130 | <0.01 |
| Black Sulphur | | | | | | |
| Rio Blanco, | 5/18 | | 27 | Gross α | <4 | - |
| Colo. | | | | Gross β | <4 | - |
| B-1 Equity Camp | | | | $^{3}H$ | 140 | <0.01 |
| Rio Blanco, | 5/18 | | 23 | Gross α | 9.3 | - |
| Colo. | | | | Gross β | <4 | - |
| Brennan Windmill | | | | $^{3}H$ | <8 | <0.01 |
| Rio Blanco, | 5/18 | | 23 | Gross α | <6 | - |
| Colo. | | | | Gross β | <4 | - |
| Johnson Artesian Well | | | | $^{3}H$ | <8 | <0.01 |
| Rio Blanco, | 5/17 | | 23 | Gross α | <9 | - |
| Colo. | | | | Gross β | <6 | - |
| Well RB-D-01 | | | | $^{3}H$ | <8 | <0.01 |
| Rio Blanco, | 5/18 | | 23 | Gross α | <4 | - |
| Colo. | | | | Gross β | <4 | - |
| Well RB-S-03 | | | | $^{3}H$ | <20 | <0.01 |
| PROJECT CANNIKIN | | | | | | |
| Amchitka, Alas. | 10/11 | | 21 | Gross α | <4 | - |
| South End of | | | | Gross β | <4 | - |
| Cannikin Lake | | | | $^{3}H$ | 100 | <0.01 |
| | | | | $^{89}Sr$ | <2 | <0.07 |
| | | | | $^{90}Sr$ | 1.8 | 0.6 |
| | | | | $^{234}U$ | 0.074 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | <0.03 | <0.01 |
| | | | | $^{238}Pu$ | 0.041 | <0.01 |
| | | | | $^{239}Pu$ | <0.03 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Amchitka, Alas. North End of Cannikin Lake | 10/11 | | 21 | Gross α | <4 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 40 | <0.01 |
| | | | | $^{89}Sr$ | <2 | <0.07 |
| | | | | $^{90}Sr$ | 2.2 | 0.7 |
| | | | | $^{234}U$ | <0.04 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | <0.03 | <0.01 |
| | | | | $^{238}Pu$ | <0.06 | <0.01 |
| | | | | $^{239}Pu$ | <0.06 | <0.01 |
| Amchitka, Alas. Well HTH-3 | 10/11 | 41 | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | <6 | <0.01 |
| | | | | $^{89}Sr$ | <2 | <0.07 |
| | | | | $^{90}Sr$ | 1.7 | 0.6 |
| | | | | $^{234}U$ | 0.057 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | 0.040 | <0.01 |
| | | | | $^{238}Pu$ | <0.02 | <0.01 |
| | | | | $^{239}Pu$ | <0.03 | <0.01 |
| Amchitka, Alas. Ice Box Lake | 10/11 | | 21 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 68 | <0.01 |
| | | | | $^{89}Sr$ | <3 | <0.1 |
| | | | | $^{90}Sr$ | 1.6 | 0.53 |
| | | | | $^{234}U$ | 0.049 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | 0.060 | <0.01 |
| | | | | $^{238}Pu$ | 0.029 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)(1) | Sample Type(2) | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide(3) |
|---|---|---|---|---|---|---|
| Amchitka, Alas. White Alice Creek | 10/11 | | 22 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 83 | <0.01 |
| | | | | $^{89}Sr$ | <3 | <0.1 |
| | | | | $^{90}Sr$ | 2.3 | 0.77 |
| | | | | $^{234}U$ | 0.019 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | 0.023 | <0.01 |
| | | | | $^{238}Pu$ | 0.042 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |
| Amchitka, Alas. Pit South of Cannikin GZ | 10/11 | | 21 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 31 | <0.01 |
| | | | | $^{89}Sr$ | <2 | <0.07 |
| | | | | $^{90}Sr$ | 2.3 | 0.8 |
| | | | | $^{234}U$ | 0.034 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | 0.034 | <0.01 |
| | | | | $^{238}Pu$ | 0.043 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |
| PROJECT MILROW | | | | | | |
| Amchitka, Alas. Heart Lake | 10/12 | | 21 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 45 | <0.01 |
| | | | | $^{89}Sr$ | <2 | <0.07 |
| | | | | $^{90}Sr$ | 2.0 | 0.7 |
| | | | | $^{234}U$ | 0.042 | <0.01 |
| | | | | $^{235}U$ | <0.03 | <0.01 |
| | | | | $^{238}U$ | <0.03 | <0.01 |
| | | | | $^{238}Pu$ | 0.046 | <0.01 |
| | | | | $^{239}Pu$ | <0.03 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radioactivity | Radioactivity Conc. ($10^{-9}$ µCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Amchitka, Alas. Well W-5 | 10/12 | 0.83 | 23 | $^{3}H$ | 35 | <0.01 |
| Amchitka, Alas. Well W-6 | 10/12 | 0.94 | 23 | $^{3}H$ | 91 | <0.01 |
| Amchitka, Alas. Well W-8 | 10/12 | 1.6 | 23 | $^{3}H$ | 96 | <0.01 |
| Amchitka, Alas. Well W-15 | 10/12 | 1.1 | 23 | $^{3}H$ | 53 | <0.01 |
| Amchitka, Alas. Well W-10 | 10/12 | 2.0 | 23 | $^{3}H$ | 27 | <0.01 |
| Amchitka, Alas. Well W-11 | 10/12 | 1.5 | 23 | $^{3}H$ | 88 | <0.01 |
| Amchitka, Alas. Well W-3 | 10/12 | 1.1 | 23 | $^{3}H$ | 79 | <0.01 |
| Amchitka, Alas Well W-2 | 10/12 | 0.30 | 23 | $^{3}H$ | 77 | <0.01 |
| Clevenger Creek | 10/12 | | 22 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 72 | <0.01 |
| | | | | $^{89}Sr$ | <2 | <0.07 |
| | | | | $^{90}Sr$ | 1.5 | 0. 5 |
| | | | | $^{234}U$ | 0.038 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | 0.044 | <0.01 |
| | | | | $^{238}Pu$ | 0.034 | <0.01 |
| | | | | $^{239}Pu$ | <0.008 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| | | | | **PROJECT LONG SHOT** | | |
| Amchitka, Alas. Well WL-2 | 10/12 | 3.0 | 23 | $^{3}H$ | 730 | 0.02 |
| Amchitka, Alas. EPA Well-1 | 10/12 | 7.9 | 23 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 1200 | <0.01 |
| Reed Pond | 10/12 | | 21 | Gross α | 2.2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 220 | <0.01 |
| | | | | $^{89}Sr$ | <3 | <0.1 |
| | | | | $^{90}Sr$ | 2.1 | 0.7 |
| | | | | $^{234}U$ | <0.03 | <0.01 |
| | | | | $^{235}U$ | <0.01 | <0.01 |
| | | | | $^{238}U$ | <0.02 | <0.01 |
| | | | | $^{238}Pu$ | <0.03 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |
| Well GZ No. 1 | 10/12 | 30 | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 5300 | 0.2 |
| | | | | $^{89}Sr$ | <2 | <0.07 |
| | | | | $^{90}Sr$ | 1.5 | 0.5 |
| | | | | $^{234}U$ | 0.11 | <0.01 |
| | | | | $^{235}U$ | <0.01 | <0.01 |
| | | | | $^{238}U$ | 0.048 | <0.01 |
| | | | | $^{238}Pu$ | 0.042 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Well GZ No. 2 | 10/12 | 15 | 23 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 1800 | 0.06 |
| | | | | $^{89}Sr$ | <5 | <0.2 |
| | | | | $^{90}Sr$ | <0.7 | <0.3 |
| | | | | $^{234}U$ | <0.03 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | <0.03 | <0.01 |
| | | | | $^{238}Pu$ | <0.03 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |
| Well WL-1 | 10/12 | 1.7 | 23 | Gross α | 7.1 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 120 | <0.01 |
| | | | | $^{89}Sr$ | <5 | <0.2 |
| | | | | $^{90}Sr$ | <0.7 | <0.3 |
| | | | | $^{226}Ra$ | 0.15 | 0.5 |
| | | | | $^{234}U$ | <0.08 | <0.01 |
| | | | | $^{235}U$ | <0.04 | <0.01 |
| | | | | $^{238}U$ | <0.08 | <0.01 |
| | | | | $^{238}Pu$ | 0.042 | <0.01 |
| | | | | $^{239}Pu$ | <0.03 | <0.01 |
| Mud Pit No. 1 | 10/12 | | 21 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 2000 | 0.07 |
| | | | | $^{89}Sr$ | <5 | <0.2 |
| | | | | $^{90}Sr$ | <0.8 | <0.3 |
| | | | | $^{234}U$ | <0.03 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | <0.03 | <0.01 |
| | | | | $^{238}Pu$ | <0.04 | <0.01 |
| | | | | $^{239}Pu$ | 0.030 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Mud Pit No. 2 | 10/12 | | 21 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 2500 | 0.08 |
| | | | | $^{89}Sr$ | <5 | <0.2 |
| | | | | $^{90}Sr$ | <0.7 | <0.3 |
| | | | | $^{234}U$ | <0.03 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | <0.03 | <0.01 |
| | | | | $^{238}Pu$ | <0.03 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |
| Mud Pit No. 3 | 10/12 | | 21 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 3400 | 0.1 |
| | | | | $^{89}Sr$ | <5 | <0.2 |
| | | | | $^{90}Sr$ | <0.7 | <0.3 |
| | | | | $^{234}U$ | <0.04 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | <0.03 | <0.01 |
| | | | | $^{238}Pu$ | 0.032 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |
| **AMCHITKA BACKGROUND SAMPLES** | | | | | | |
| Amchitka, Alas. Constantine Spring | 10/13 | | 27 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}H$ | 100 | <0.01 |
| | | | | $^{89}Sr$ | <4 | <0.02 |
| | | | | $^{90}Sr$ | <0.7 | <0.3 |
| | | | | $^{234}U$ | 0.046 | <0.01 |
| | | | | $^{235}U$ | 0.014 | <0.01 |
| | | | | $^{238}U$ | 0.037 | <0.01 |
| | | | | $^{238}Pu$ | <0.03 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Amchitka, Alas. Jones Lake | 10/13 | | 21 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}$H | 77 | <0.01 |
| | | | | $^{89}$Sr | <5 | <0.2 |
| | | | | $^{90}$Sr | 0.70 | 0.3 |
| | | | | $^{234}$U | <0.02 | <0.01 |
| | | | | $^{235}$U | <0.02 | <0.01 |
| | | | | $^{238}$U | <0.02 | <0.01 |
| | | | | $^{238}$Pu | 0.042 | <0.01 |
| | | | | $^{239}$Pu | <0.04 | <0.01 |
| Duck Cove Creek | 10/13 | | 22 | Gross α | <3 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}$H | 86 | <0.01 |
| | | | | $^{89}$Sr | <5 | <0.2 |
| | | | | $^{90}$Sr | <0.8 | <0.3 |
| | | | | $^{234}$U | 0.030 | <0.01 |
| | | | | $^{235}$U | <0.02 | <0.01 |
| | | | | $^{238}$U | 0.030 | <0.01 |
| | | | | $^{238}$Pu | <0.03 | <0.01 |
| | | | | $^{239}$Pu | <0.02 | <0.01 |
| Mile 27 Stream | 10/14 | | 22 | Gross α | <2 | - |
| | | | | Gross β | <4 | - |
| | | | | $^{3}$H | 77 | <0.01 |
| | | | | $^{89}$Sr | <6 | <0.2 |
| | | | | $^{90}$Sr | <0.7 | <0.3 |
| | | | | $^{234}$U | <0.05 | <0.01 |
| | | | | $^{235}$U | <0.02 | <0.01 |
| | | | | $^{238}$U | <0.03 | <0.01 |
| | | | | $^{238}$Pu | <0.03 | <0.01 |
| | | | | $^{239}$Pu | <0.03 | <0.01 |

Table A-10. (continued)

| Sampling Location | Date | Depth (m)[1] | Sample Type[2] | Type of Radio-activity | Radioactivity Conc. ($10^{-9}$ μCi/ml) | % of Conc. Guide[3] |
|---|---|---|---|---|---|---|
| Amchitka, Alas. | 10/14 | | 26 | Gross α | <0.6 | |
| Base Camp Maint. Bldg. | | | | Gross β | 45 | - |
| | | | | $^{3}H$ | 78 | <0.01 |
| | | | | $^{89}Sr$ | <5 | <0.2 |
| | | | | $^{90}Sr$ | <0.7 | <0.3 |
| | | | | $^{95}Zr$[5] | 19 | <0.01 |
| | | | | $^{234}U$ | <0.03 | <0.01 |
| | | | | $^{235}U$ | <0.02 | <0.01 |
| | | | | $^{238}U$ | <0.02 | <0.01 |
| | | | | $^{238}Pu$ | <0.04 | <0.01 |
| | | | | $^{239}Pu$ | <0.02 | <0.01 |

(1) If depth not shown, water was collected at surface

(2) 21 - Pond, lake, reservoir, stock tank, or stock pond
22 - Stream, river, or creek
23 - Well
26 - Rain
27 - Spring

(3) Concentration Guides (CG) for drinking water at on-site locations are the same as those for off-site locations. See Appendix B for Concentration Guides. As gross α and gross β radioactivity concentrations were used only for identifying gross radioactivity concentration increases and as more complete radionuclide analyses were made in the past, the calculation of % CG's was not considered appropriate.

(4) High MDC due to high concentration of dissolved solids.

(5) Observed in suspended solids only.

(6) Sample lost in analysis.

# APPENDIX B. RADIATION PROTECTION STANDARDS FOR EXTERNAL AND INTERNAL EXPOSURE

## DOE ANNUAL DOSE COMMITMENT(1)

| Type of Exposure | Dose Limit to Critical Individuals in Uncontrolled Area at Points of Maximum Probable Exposure (rem) | Dose Limit to Suitable Sample of the Exposed Population in an Uncontrolled Area (rem) |
|---|---|---|
| Whole Body, gonads or bone marrow | 0.5 | 0.17 |
| Other organs | 1.5 | 0.5 |

## DOE CONCENTRATION GUIDES (CG's)(1)

| Network or Program | Sampling Medium | Radio-nuclide | CG (μCi/ml) | Basis of Exposure |
|---|---|---|---|---|
| Air Surveillance Network | air | $^{7}Be$ | $1.1\times10^{-8}$ | Suitable sample of the exposed population in uncontrolled area. |
| | | $^{95}Zr$ | $3.3\times10^{-10}$ | |
| | | $^{131}I$ | $3.3\times10^{-11}$ | |
| | | $^{132}Te$ | $1.0\times10^{-9}$ | |
| | | $^{137}Cs$ | $1.7\times10^{-10}$ | |
| | | $^{140}Ba$ | $3.3\times10^{-10}$ | |
| Noble Gas and Tritium Surveillance Network, On-NTS | air | $^{85}Kr$ | $1.0\times10^{-5}$ | Individual in controlled area. |
| | | $^{3}H$ | $5.0\times10^{-6}$ | |
| | | $^{133}Xe$ | $1.0\times10^{-5}$ | |
| Noble Gas and Tritium Surveillance Network, Off-NTS | air | $^{85}Kr$ | $1.0\times10^{-7}$ | Suitable sample of the exposed population in uncontrolled area. |
| | | $^{3}H$ | $6.7\times10^{-8}$ | |
| | | $^{133}Xe$ | $1.0\times10^{-7}$ | |
| Long-Term Hydrological Program | water | $^{3}H$ | $3.0\times10^{-3}$ | Individual in a controlled or an uncontrolled area. |
| | | $^{89}Sr$ | $3.0\times10^{-6}$ | |
| | | $^{90}Sr$ | $3.0\times10^{-7}$ | |
| | | $^{137}Cs$ | $2.0\times10^{-5}$ | |
| | | $^{226}Ra$ | $3.0\times10^{-8}$ | |
| | | $^{234}U$ | $3.0\times10^{-5}$ | |
| | | $^{235}U$ | $3.0\times10^{-5}$ | |
| | | $^{238}U$ | $4.0\times10^{-5}$ | |
| | | $^{238}Pu$ | $5.0\times10^{-6}$ | |
| | | $^{239}Pu$ | $5.0\times10^{-6}$ | |

## EPA DRINKING WATER REGULATIONS FOR RADIONUCLIDES(2)

Maximum Contaminant Levels for Beta Particles and Photon Radioactivity from Man-Made Radionuclides in Community Water Systems(3)

(a) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.

(b) Except for the radionuclides listed in Table B-1, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2-liter per day drinking water intake using the 168 hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year.

TABLE B-1. AVERAGE ANNUAL CONCENTRATION ASSUMED TO PRODUCE A TOTAL BODY OR ORGAN DOSE OF 4 MREM/YR

| Radionuclide | Critical Organ | pCi per liter |
|---|---|---|
| Tritium | Total body | 20,000 |
| Strontium-90 | Bone marrow | 8 |

(1) "Radiation Protection Standards," DOE Manual, Chapter 0524.

(2) "Drinking Water Regulations Radionuclides." Title 40 Code of Federal Regulations, Chapter 1, Part 141. Federal Register, Vol. 41, No. 133. U.S. Government Printing Office, Washington, D.C. July 9, 1976.

(3) Community water system is a public water system which serves a population of which 70 percent or greater are residents. A public water system is a system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of 25 individuals daily at least 3 months out of the year.

## APPENDIX C. DETECTION OF AIRBORNE RADIOACTIVITY FROM ATMOSPHERIC NUCLEAR TEST BY THE PEOPLE'S REPUBLIC OF CHINA

Following the atmospheric nuclear test by the People's Republic of China on September 17, 1977, at 0300 hours EDT, samples of airborne radioactivity within the Western United States were obtained from the Air Surveillance Network of the Environmental Monitoring and Support Laboratory, Las Vegas. Samples were collected to determine the effect of the Chinese test on ambient levels of airborne radioactivity, which are routinely monitored around the Nevada Test Site in support of underground nuclear tests. Special samples of raw milk and cow feed were also collected from a local milk producer to determine whether radioiodine from the test could be detected in milk. From the concentration of radioiodine observed in the air and milk samples, an estimate of the radiation dose equivalent to the thyroid gland of a hypothetical infant receptor at each sampling location was calculated. The following is a summary of the procedures and results.

### PROCEDURE

In addition to the 48 active stations of the Air Surveillance Network (ASN), 67 of the 73 standby stations were activated for the period September 18 through October 19, 1977. All operators of active and standby stations were requested to use a charcoal cartridge behind the particulate filter for the collection of gaseous radioiodine. Complete sampling over the desired period was performed by 89 out of the 115 total stations; 26 of the stations had equipment problems or did not mail in one or more samples during the period.

The particulate filters from all stations were counted for gross beta radioactivity at 7 days and 14 days after collection to allow for the decay of naturally occurring radioactivity and for the purpose of extrapolating the concentration to the midtime of collection.

About 5 days after collection, the filters from each station were analyzed for gamma-emitting radionuclides by gamma spectrometry techniques. The charcoal cartridges were initially counted for gross gamma radioactivity; those cartridges having a count rate greater than 300 cpm were then quantitated for specific radionuclides.

During the period September 27 to October 31, raw milk samples were collected daily from the LDS Dairy Farm, a local milk producer in

Las Vegas, and analyzed for gamma-emitters by gamma spectrometry. Three samples were also selected for radiostrontium analysis. Cow feed samples were collected; however, the presence of radioiodine could only be qualitatively determined.

RESULTS

The airborne concentration of gross beta radioactivity estimated from the analysis of filters collected from the ASN stations over the period September 18 through October 19 was detected at most stations throughout the Network and reached its peak over the period September 21-30. Typical time series plots of the gross beta radioactivity concentrations in air are in Figures C-1 and C-2 for Vernal, Utah, and Ely, Nevada, where the maximum individual concentration of gross beta radioactivity occurred ($1.2\times10^{-10}$ μCi/ml) and the maximum quarterly average concentration of gross beta radioactivity occurred ($3.5\times10^{-12}$ μCi/ml) at a continuously operating active station.

As indicated by the results of gamma spectrometry analyses on air samples, airborne fresh fission products from the Chinese test were first detected on September 21-22 in Idaho and Utah. The ASN stations in Washington, Oregon, and southeastern California first detected the radioactivity during the period September 22-23 (Washington and California). Air sampling stations farthest to the east in the Network (Minnesota, Iowa, Missouri, Arkansas, and Louisiana) first detected radioactivity in samples collected during the period September 23-26 (Missouri). Fresh fission products ($^{95}$Zr, $^{99}$Mo, $^{103}$Ru, $^{131}$I, $^{132}$Te, $^{137}$Cs, $^{140}$Ba, $^{141}$Ce, $^{144}$Ce, and $^{147}$Nd), an activation product ($^{239}$Np), and naturally occurring $^{7}$Be were detected in various combinations on the filters. Only $^{131}$I was detected on the charcoal cartridges. Due to the counting workload and interferences within the gamma spectra, only the radionuclides $^{7}$Be, $^{95}$Zr, $^{131}$I, $^{132}$Te, $^{137}$Cs, and $^{140}$Ba were quantitated. Tables C-2 and C-3 summarize the radionuclide concentrations detected in filter samples collected at all sampling locations for CY 1977. The locations and sampling periods during which the maximum concentrations of each radionuclide was detected are shown in the following table:

TABLE C-1. AIR SAMPLING STATIONS HAVING THE MAXIMUM RADIONUCLIDE CONCENTRATIONS

| Location | Sampling Period | Radio-nuclide | Half Life (days) | Maximum Conc. (pCi/m$^3$) | % CG* |
|---|---|---|---|---|---|
| Ely, Nev. | 09/20-09/21 | $^{95}Zr$ | 65 | 8.5 | 3 |
| Ridgecrest, Calif. | 09/28-09/29 | $^{131}I$ | 8.04 | 8.8 | 30 |
| Vernal, Utah | 09/23-09/24 | $^{132}Te$ | 3.3 | 14 | 1 |
| Milford, Utah | 09/05-09/07 | $^{137}Cs$ | 30.1(y) | 0.031 | 0.02 |
| Ely, Nev. | 09/26-09/28 | $^{140}Ba$ | 13 | 17 | 5 |

*Percents of Concentration Guides (CG), as specified in DOE Manual, Chapter 0524 for suitable sample of the exposed population, were determined assuming that the maximum concentration persisted for a full year.

From the concentrations of $^{131}I$ and $^{132}Te$ determined in samples from each air sampling location, the radiation dose equivalent (D.E.) to the thyroid gland of a hypothetical 1-year-old infant receptor was calculated for each sampling location*. The resultant D.E.'s for each sampling location are shown in Figures C-3 and C-4 with isopleth lines for the D.E.'s of 0.5 mrem, 1.0 mrem, and 1.5 mrem. The highest infant thyroid D.E. from air was estimated to be 1.6 mrem from the samples collected at Lund and Hiko, Nevada. This dose is 0.3 percent of the Radiation Protection Standard of 500 mrem for the general population, as specified by the DOE Manual, Chapter 0524.

Table C-4 lists the gamma spectrometry results for the milk samples collected at the LDS Dairy Farm near Las Vegas, Nevada. As indicated by this table, $^{131}I$ was detected in 26 of the total of 31 samples collected; the maximum concentration measured was 57 pCi/l in the sample collected September 29. Samples of cow feed (green chop) were collected during the period September 27 through October 31. Those samples collected during the period September 27 through October 23 were qualitatively positive for $^{131}I$. Two of the three milk samples selected for radiostrontium analysis had concentrations of radiostrontium that were barely above the minimum detectable concentration. One sample collected on September 29 had a $^{89}Sr$ con-

*Calculational procedures were the same as those specified in Appendix B, "Final Report of Off-Site Surveillance for the Baneberry Event," Report No. SWRHL-107r. WERL/EPA, Las Vegas, Nevada. Feb. 1972.

centration and two-sigma counting error of 6.2±3.3 pCi/l. The other collected on October 1 had a $^{90}Sr$ concentration and counting error of 1.3±0.78 pCi/l.

Figures C-5 and C-6, respectively, show how the $^{131}I$ concentrations in milk and air samples from Las Vegas varied with time. Decay curves for 8-day and 5-day half-lives are superimposed on the graph for comparison. Normally the decrease in $^{131}I$ concentrations in milk following a single contaminating event follow the curve for a 5-day half-life. Due to the fact that significant airborne concentrations of $^{131}I$ (≥ 1 pCi/m$^3$) persisted for 5 consecutive days, the decrease of the $^{131}I$ concentration in milk samples initially followed the curve for the 8.04-day half-life. The noticeable departure from this curve observed for samples collected October 9 and 12 and during the period October 14-19 cannot be explained by the $^{131}I$ concentrations in air samples. The air concentrations of $^{131}I$ were well below the level (3-5 pCi/m$^3$) required on or after October 7 to have caused the levels observed in milk (19-42 pCi/l).

Based on the time-integrated concentrations of $^{131}I$ in the Las Vegas milk and the air samples, the estimated D.E. to the thyroid gland of a hypothetical 1-year-old infant receptor was 12 mrem and 1.2 mrem, respectively. These doses, collectively, are 3 percent of the Radiation Protection Standard of 500 mrem for exposures to the general population. The estimated D.E. from milk is 0.1 percent of the Protective Action Guide* of 10 rads (or rem) at which protective actions would be necessary to reduce human intake of the radioiodine.

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*"Background Material for the Development of Radiation Protection Standards," Report No. 2, Federal Radiation Council, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., September 1961, P. 8.

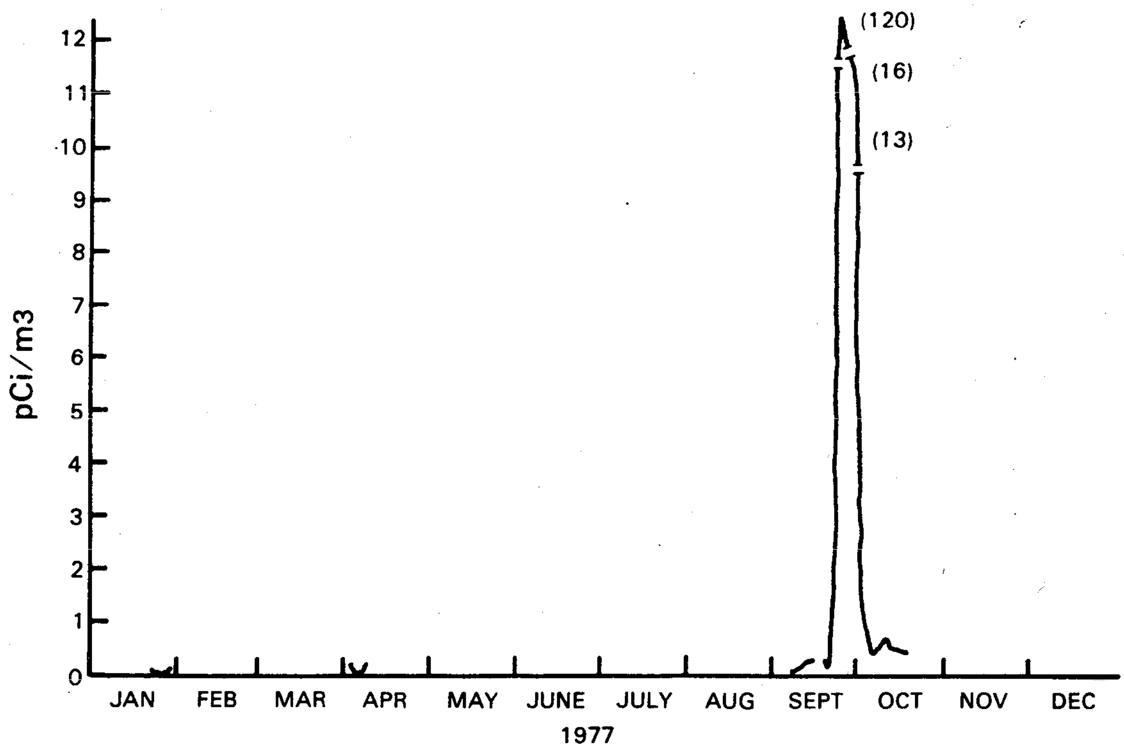



Figure C-1. Gross Beta Radioactivity Concentrations in Air at Vernal, Utah

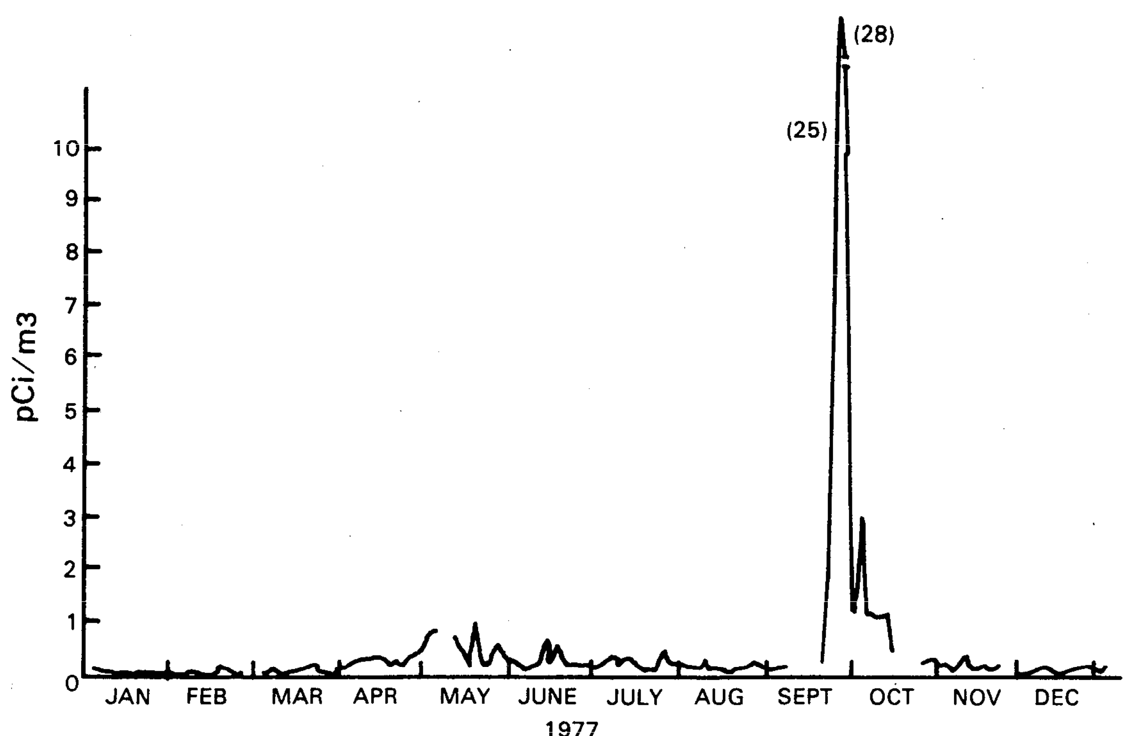
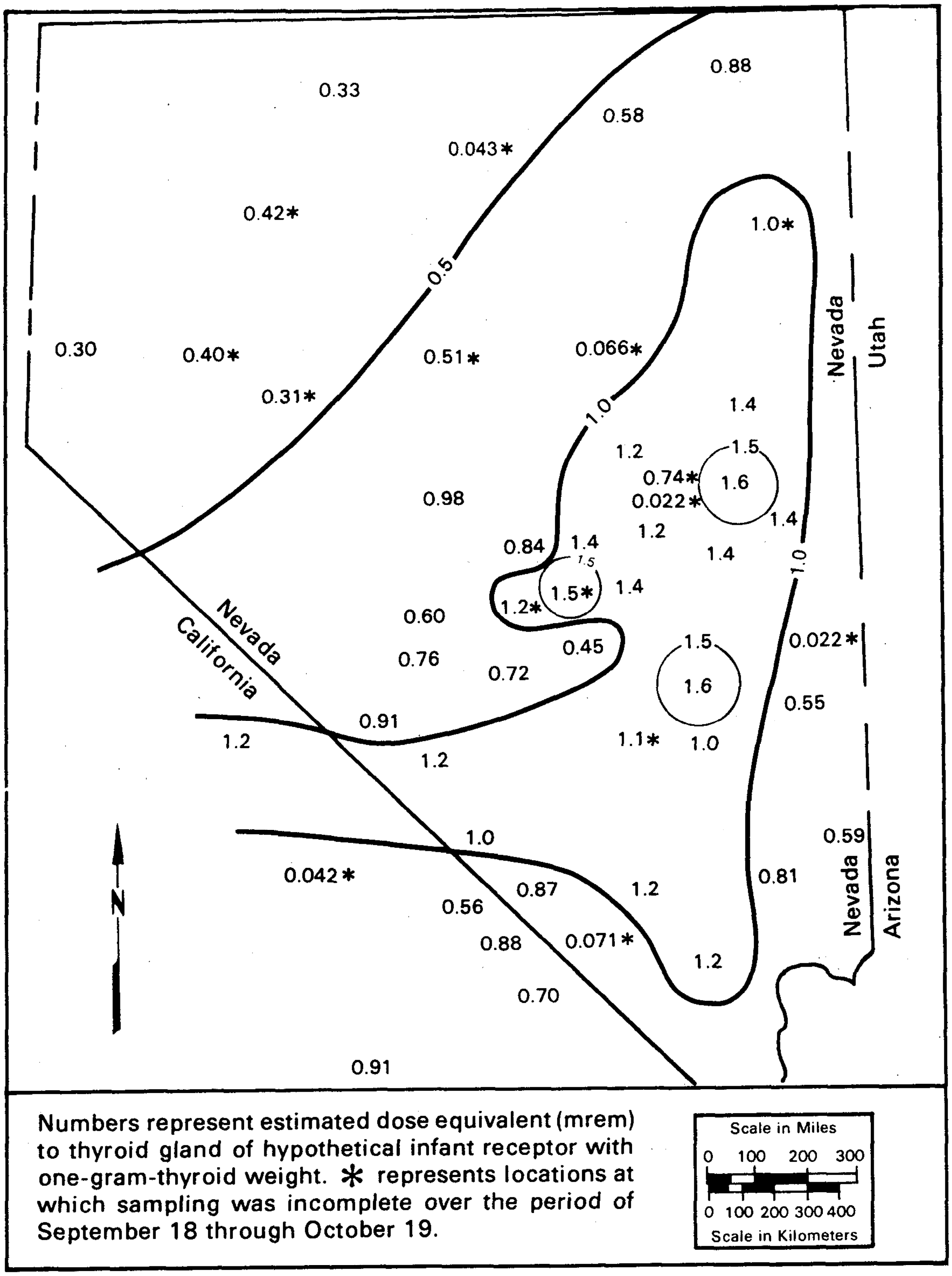



Figure C-2. Gross Beta Radioactivity Concentrations in Air at Ely, Nevada




Numbers represent estimated dose equivalent (mrem) to thyroid gland of hypothetical infant receptor with one-gram-thyroid weight. * represents locations at which sampling was incomplete over the period of September 18 through October 19.

Figure C-3. Infant Thyroid Dose Equivalents (mrem) Estimated from Air Sampling Results of Air Surveillance Network (Nevada), September-October 1977


Figure C-4. Infant Thyroid Dose Equivalents (mrem) Estimated from Air Sampling Results of Air Surveillance Network (Western United States), September-October 1977

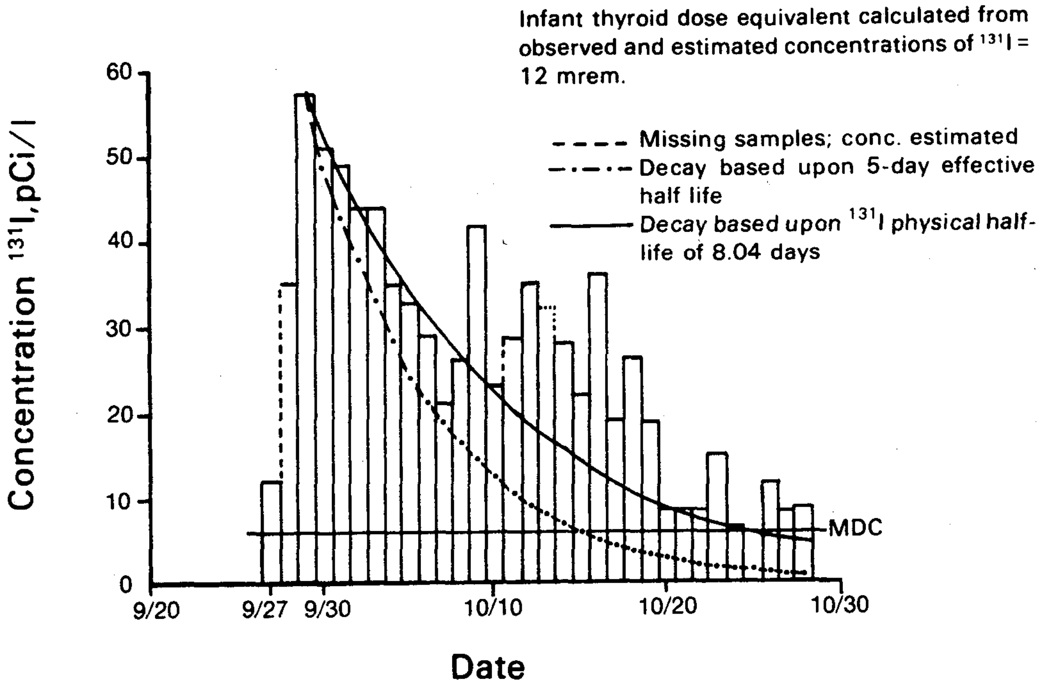



Figure C-5. $^{131}$I Concentrations in Milk Samples Collected in Las Vegas, Nevada

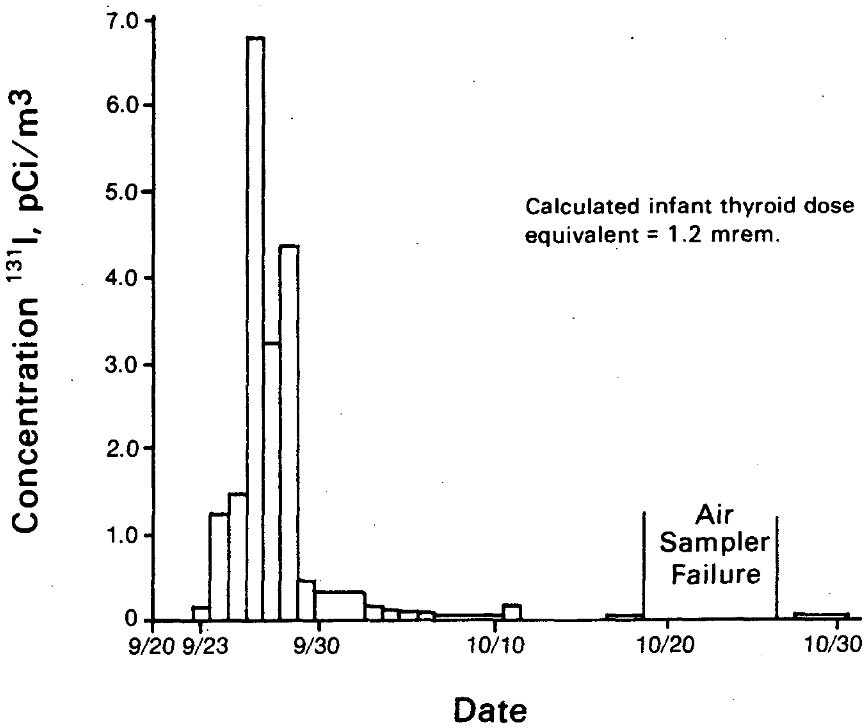



Figure C-6. $^{131}$I Concentrations in Air Samples Collected in Las Vegas, Nevada

Table C-2. 1977 Summary of Analytical Results for Air Surveillance Network Active Stations

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$ µCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Kingman, Ariz. | 14.0 | $^{7}Be$ | 0.36 | 0.20 | 0.011 |
| | 325.1 | $^{95}Zr$ | 3.0 | 0.013 | <0.2 |
| | 27.0 | $^{131}I$ | 3.2 | 0.029 | 0.039 |
| | 14.0 | $^{132}Te$ | 2.6 | 0.036 | 0.022 |
| | 11.0 | $^{137}Cs$ | 0.027 | 0.020 | <0.001 |
| | 38.0 | $^{140}Ba$ | 7.1 | 0.037 | 0.067 |
| Seligman, Ariz. | 25.0 | $^{7}Be$ | 0.49 | 0.15 | 0.021 |
| | 282.0 | $^{95}Zr$ | 1.4 | 0.015 | <0.2 |
| | 14.0 | $^{131}I$ | 1.4 | 0.074 | 0.027 |
| | 10.0 | $^{132}Te$ | 1.5 | 0.14 | 0.014 |
| | 2.0 | $^{137}Cs$ | 0.020 | 0.020 | <0.001 |
| | 14.0 | $^{140}Ba$ | 4.3 | 0.18 | 0.041 |
| Baker, Calif. | 34.0 | $^{7}Be$ | 0.53 | 0.13 | 0.026 |
| | 271.4 | $^{95}Zr$ | 2.4 | <0.02 | <0.2 |
| | 26.7 | $^{131}I$ | 2.2 | 0.032 | 0.034 |
| | 10.0 | $^{132}Te$ | 2.0 | 0.05 | 0.020 |
| | 4.9 | $^{137}Cs$ | 0.017 | 0.0073 | <0.001 |
| | 35.7 | $^{140}Ba$ | 4.3 | 0.061 | 0.056 |
| Barstow, Calif. | 27.9 | $^{7}Be$ | 0.72 | 0.15 | <0.03 |
| | 273.5 | $^{95}Zr$ | 2.6 | 0.016 | 0.13 |
| | 23.7 | $^{131}I$ | 2.2 | 0.054 | 0.026 |
| | 10.7 | $^{132}Te$ | 2.2 | 0.089 | 0.019 |
| | 4.0 | $^{137}Cs$ | 0.023 | 0.015 | <0.001 |
| | 35.7 | $^{140}Ba$ | 3.9 | 0.056 | 0.051 |
| Bishop, Calif. | 20.9 | $^{7}Be$ | 0.6 | 0.043 | <0.02 |
| | 305.9 | $^{95}Zr$ | 5.4 | 0.021 | 0.17 |
| | 22.0 | $^{131}I$ | 5.3 | 0.068 | 0.055 |
| | 11.0 | $^{132}Te$ | 6.0 | 0.087 | 0.042 |
| | 2.0 | $^{137}Cs$ | 0.028 | 0.028 | <0.001 |
| | 31.0 | $^{140}Ba$ | 9.2 | 0.046 | 0.077 |
| Death Valley Jct., Calif. | 33.8 | $^{7}Be$ | 0.28 | 0.11 | 0.019 |
| | 284.8 | $^{95}Zr$ | 3.6 | <0.02 | <0.2 |
| | 21.0 | $^{131}I$ | 2.7 | 0.037 | 0.044 |
| | 11.0 | $^{132}Te$ | 2.8 | 0.056 | 0.026 |
| | 4.0 | $^{137}Cs$ | 0.023 | 0.016 | <0.001 |
| | 32.0 | $^{140}Ba$ | 5.3 | 0.049 | 0.059 |

Table C-2. (continued)

| Sampling Location | No. Days Sampled | Type of Radio-activity | Radioactivity Concentration $(10^{-9} \mu Ci/ml)$ Max | Min | Avg |
|---|---|---|---|---|---|
| Furnace Creek, Calif. | 33.0 | $^{7}Be$ | 0.91 | 0.12 | 0.032 |
| | 264.1 | $^{95}Zr$ | 3.4 | 0.015 | <0.2 |
| | 23.1 | $^{131}I$ | 2.1 | 0.029 | 0.029 |
| | 7.0 | $^{132}Te$ | 2.1 | 0.40 | 0.020 |
| | 13.7 | $^{137}Cs$ | 0.030 | 0.021 | <0.001 |
| | 30.6 | $^{140}Ba$ | 5.3 | 0.071 | 0.055 |
| Lone Pine, Calif. | 2.7 | $^{7}Be$ | 0.52 | 0.52 | 0.0071 |
| | 179.9 | $^{95}Zr$ | 0.63 | 0.02 | 0.15 |
| | 9.0 | $^{131}I$ | 0.35 | 0.019 | 0.004 |
| | 4.0 | $^{132}Te$ | 0.20 | 0.031 | 0.0015 |
| | 6.0 | $^{137}Cs$ | 0.034 | 0.0066 | <0.001 |
| | 18.0 | $^{140}Ba$ | 0.78 | 0.019 | 0.011 |
| Needles, Calif. | 8.4 | $^{7}Be$ | 0.22 | 0.22 | 0.0059 |
| | 246.0 | $^{95}Zr$ | 3.2 | 0.014 | <0.2 |
| | 21.1 | $^{131}I$ | 1.9 | 0.031 | 0.045 |
| | 7.3 | $^{132}Te$ | 1.5 | 0.25 | 0.023 |
| | 7.4 | $^{137}Cs$ | 0.023 | 0.014 | <0.001 |
| | 32.8 | $^{140}Ba$ | 4.1 | 0.046 | 0.076 |
| Ridgecrest, Calif. | 31.9 | $^{7}Be$ | 0.46 | 0.14 | 0.025 |
| | 299.5 | $^{95}Zr$ | 1.5 | 0.016 | <0.2 |
| | 17.9 | $^{131}I$ | 8.5 | 0.023 | 0.046 |
| | 12.9 | $^{132}Te$ | 1.6 | 0.11 | 0.019 |
| | 4.0 | $^{137}Cs$ | 0.03 | 0.024 | <0.001 |
| | 34.9 | $^{140}Ba$ | 2.7 | 0.033 | 0.038 |
| Shoshone, Calif. | 12.9 | $^{7}Be$ | 0.32 | 0.15 | 0.0085 |
| | 308.1 | $^{95}Zr$ | 3.5 | 0.013 | <0.2 |
| | 26.0 | $^{131}I$ | 2.4 | 0.028 | 0.035 |
| | 12.9 | $^{132}Te$ | 2.2 | 0.033 | 0.020 |
| | 2.0 | $^{137}Cs$ | 0.024 | 0.024 | <0.001 |
| | 32.5 | $^{140}Ba$ | 6.2 | 0.045 | 0.064 |
| Alamo, Nev. | 19.9 | $^{7}Be$ | 0.43 | 0.15 | 0.015 |
| | 302.7 | $^{95}Zr$ | 4.1 | 0.010 | <0.2 |
| | 26.0 | $^{131}I$ | 3.8 | 0.026 | 0.051 |
| | 12.1 | $^{132}Te$ | 3.1 | 0.097 | 0.032 |
| | 1.9 | $^{137}Cs$ | 0.025 | 0.025 | <0.001 |
| | 38.0 | $^{140}Ba$ | 8.4 | 0.025 | 0.080 |

Table C-2. (continued)

| Sampling Location | No. Days Sampled | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$ µCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Austin, Nev. | 21.9 | $^{7}Be$ | 0.35 | 0.11 | 0.017 |
| | 226.2 | $^{95}Zr$ | 3.4 | 0.011 | 0.13 |
| | 19.8 | $^{131}I$ | 2.9 | 0.024 | 0.031 |
| | 7.0 | $^{132}Te$ | 3.2 | 0.039 | 0.028 |
| | 7.0 | $^{137}Cs$ | 0.027 | 0.020 | <0.001 |
| | 27.7 | $^{140}Ba$ | 6.3 | 0.043 | 0.068 |
| Beatty, Nev. | 29.9 | $^{7}Be$ | 0.45 | 0.15 | 0.018 |
| | 282.8 | $^{95}Zr$ | 3.5 | 0.012 | <0.2 |
| | 26.0 | $^{131}I$ | 3.7 | 0.027 | 0.049 |
| | 15.1 | $^{132}Te$ | 3.7 | 0.056 | 0.035 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 33.0 | $^{140}Ba$ | 5.3 | 0.056 | 0.063 |
| Blue Eagle Ranch, Nev. | 20.0 | $^{7}Be$ | 0.39 | 0.15 | 0.012 |
| | 275.6 | $^{95}Zr$ | 4.0 | 0.016 | 0.12 |
| | 23.3 | $^{131}I$ | 3.5 | 0.036 | 0.065 |
| | 15.5 | $^{132}Te$ | 3.0 | 0.036 | 0.033 |
| | 2.0 | $^{137}Cs$ | 0.024 | 0.024 | <0.001 |
| | 32.1 | $^{140}Ba$ | 8.6 | 0.027 | 0.079 |
| Blue Jay, Nev. | 12.0 | $^{7}Be$ | 0.25 | 0.16 | 0.0069 |
| | 317.0 | $^{95}Zr$ | 3.4 | 0.001 | <0.2 |
| | 28.0 | $^{131}I$ | 5.8 | 0.025 | 0.063 |
| | 14.0 | $^{132}Te$ | 8.5 | 0.030 | 0.062 |
| | 3.8 | $^{137}Cs$ | 0.028 | 0.024 | 0.062 |
| | 38.0 | $^{140}Ba$ | 6.9 | 0.043 | 0.077 |
| Caliente, Nev. | 28.7 | $^{7}Be$ | 0.46 | 0.19 | 0.023 |
| | 295.0 | $^{95}Zr$ | 2.6 | 0.014 | <0.2 |
| | 22.0 | $^{131}I$ | 3.1 | 0.030 | 0.026 |
| | 7.0 | $^{132}Te$ | 2.7 | 0.073 | 0.022 |
| | 2.0 | $^{137}Cs$ | 0.037 | 0.037 | <0.001 |
| | 32.8 | $^{140}Ba$ | 6.8 | 0.049 | 0.059 |
| Currant Ranch, Nev. | 17.6 | $^{7}Be$ | 0.81 | 0.13 | 0.027 |
| | 184.8 | $^{95}Zr$ | 0.49 | 0.018 | 0.015 |
| | 5.1 | $^{131}I$ | 0.11 | 0.069 | 0.0019 |
| | .0 | $^{132}Te$ | - | - | - |
| | 2.5 | $^{137}Cs$ | 0.033 | 0.033 | <0.001 |
| | 5.1 | $^{140}Ba$ | 0.29 | 0.15 | 0.0047 |

Table C-2. (continued)

| Sampling Location | No. Days Sampled | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$ μCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Diablo, Nev. | 11.1 | $^{7}Be$ | 0.41 | 0.20 | 0.015 |
| | 162.6 | $^{95}Zr$ | 1.4 | 0.015 | 0.095 |
| | 21.6 | $^{131}I$ | 1.6 | 0.031 | 0.039 |
| | 7.3 | $^{132}Te$ | 1.4 | 0.12 | 0.025 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 27.2 | $^{140}Ba$ | 2.4 | 0.030 | 0.055 |
| Duckwater, Nev. | 20.0 | $^{7}Be$ | 0.37 | 0.15 | <0.02 |
| | 245.2 | $^{95}Zr$ | 4.9 | 0.015 | 0.16 |
| | 21.0 | $^{131}I$ | 4.5 | 0.029 | 0.064 |
| | 13.0 | $^{132}Te$ | 5.1 | 0.088 | 0.053 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 29.0 | $^{140}Ba$ | 10.0 | 0.04 | 0.099 |
| Ely, Nev. | 17.7 | $^{7}Be$ | 0.41 | 0.12 | <0.02 |
| | 278.0 | $^{95}Zr$ | 8.5 | 0.014 | <0.2 |
| | 21.0 | $^{131}I$ | 7.0 | 0.046 | 0.068 |
| | 10.1 | $^{132}Te$ | 6.7 | 0.030 | 0.066 |
| | 16.9 | $^{137}Cs$ | 0.024 | <0.01 | <0.001 |
| | 31.0 | $^{140}Ba$ | 17 | 0.044 | 0.16 |
| Eureka, Nev. | 20.0 | $^{7}Be$ | 0.35 | 0.17 | 0.014 |
| | 285.1 | $^{95}Zr$ | 0.41 | 0.015 | <0.09 |
| | 15.0 | $^{131}I$ | 0.11 | 0.045 | 0.0035 |
| | 2.0 | $^{132}Te$ | 0.12 | 0.12 | <0.001 |
| | 1.0 | $^{137}Cs$ | 0.041 | 0.041 | <0.001 |
| | 24.0 | $^{140}Ba$ | 0.21 | 0.047 | 0.0081 |
| Fallini's Ranch, Nev. | 20.4 | $^{7}Be$ | 0.37 | 0.16 | 0.014 |
| | 305.2 | $^{95}Zr$ | 5.7 | 0.012 | <0.2 |
| | 17.2 | $^{131}I$ | 6.8 | 0.027 | 0.071 |
| | 15.2 | $^{132}Te$ | 7.6 | 0.071 | 0.055 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 28.4 | $^{140}Ba$ | 9.9 | 0.027 | 0.083 |
| Geyser Ranch, Nev. | 15.7 | $^{7}Be$ | 0.4 | 0.13 | 0.009 |
| | 286.6 | $^{95}Zr$ | 4.2 | 0.014 | <0.2 |
| | 28.0 | $^{131}I$ | 4.3 | 0.02 | 0.066 |
| | 12.0 | $^{132}Te$ | 7.0 | 0.06 | 0.05 |
| | 7.0 | $^{137}Cs$ | 0.024 | 0.011 | <0.001 |
| | 39.1 | $^{140}Ba$ | 7.3 | 0.026 | 0.072 |

Table C-2. (continued)

| Sampling Location | No. Days Sampled | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$ µCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Goldfield, Nev. | 27.0 | $^{7}Be$ | 0.49 | 0.14 | 0.020 |
| | 294.4 | $^{95}Zr$ | 3.6 | 0.012 | <0.2 |
| | 26.0 | $^{131}I$ | 3.1 | 0.033 | 0.036 |
| | 10.0 | $^{132}Te$ | 3.2 | 0.071 | 0.027 |
| | 8.0 | $^{137}Cs$ | 0.025 | 0.021 | <0.001 |
| | 34.0 | $^{140}Ba$ | 6.0 | 0.050 | 0.061 |
| Area 51, NTS, Nev. (1) | 13.7 | $^{7}Be$ | 0.44 | 0.20 | 0.012 |
| | 245.4 | $^{95}Zr$ | 2.6 | 0.014 | 0.014 |
| | 16.9 | $^{131}I$ | 1.9 | 0.023 | 0.063 |
| | 15.1 | $^{132}Te$ | 1.6 | 0.041 | 0.031 |
| | 4.1 | $^{137}Cs$ | 0.0085 | 0.0085 | <0.001 |
| | 28.1 | $^{140}Ba$ | 4.6 | 0.038 | 0.083 |
| Hiko, Nev. | 20.9 | $^{7}Be$ | 0.47 | 0.14 | 0.015 |
| | 299.1 | $^{95}Zr$ | 5.3 | 0.015 | 0.16 |
| | 21.8 | $^{131}I$ | 7.8 | 0.032 | 0.073 |
| | 8.9 | $^{132}Te$ | 11 | 0.060 | 0.074 |
| | 8.0 | $^{137}Cs$ | 0.027 | 0.019 | <0.001 |
| | 32.7 | $^{140}Ba$ | 9.4 | 0.54 | 0.085 |
| Indian Springs, Nev. | 24.0 | $^{7}Be$ | 0.42 | 0.11 | 0.015 |
| | 299.9 | $^{95}Zr$ | 3.9 | 0.013 | <0.2 |
| | 26.0 | $^{131}I$ | 4.2 | 0.030 | 0.057 |
| | 7.0 | $^{132}Te$ | 3.7 | 0.75 | 0.032 |
| | 4.0 | $^{137}Cs$ | 0.021 | 0.020 | <0.001 |
| | 33.0 | $^{140}Ba$ | 9.0 | 0.052 | 0.083 |
| Las Vegas, Nev. | 23.0 | $^{7}Be$ | 0.42 | 0.25 | 0.030 |
| | 168.1 | $^{95}Zr$ | 5.1 | 0.017 | 0.13 |
| | 24.0 | $^{131}I$ | 4.5 | 0.033 | 0.084 |
| | 12.0 | $^{132}Te$ | 4.9 | 0.045 | 0.057 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 31.0 | $^{140}Ba$ | 10 | 0.038 | 0.12 |
| Lathrop Wells, Nev. | 19.0 | $^{7}Be$ | 0.38 | 0.21 | 0.016 |
| | 290.0 | $^{95}Zr$ | 2.3 | 0.020 | <0.2 |
| | 19.0 | $^{131}I$ | 2.6 | 0.034 | 0.042 |
| | 10.0 | $^{132}Te$ | 3.7 | 0.082 | 0.030 |
| | 5.0 | $^{137}Cs$ | 0.013 | 0.012 | <0.001 |
| | 30.0 | $^{140}Ba$ | 3.4 | 0.054 | 0.048 |

Table C-2. (continued)

| Sampling Location | No. Days Sampled | Type of Radio-activity | Radioactivity Concentration (10$^{-9}$ μCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Lida, Nev. | 22.0 | $^{7}$Be | 0.49 | 0.15 | 0.016 |
| | 289.8 | $^{95}$Zr | 6.7 | 0.015 | <0.2 |
| | 28.0 | $^{131}$I | 3.7 | 0.026 | 0.044 |
| | 9.0 | $^{132}$Te | 3.3 | 0.053 | 0.028 |
| | .0 | $^{137}$Cs | - | - | - |
| | 37.0 | $^{140}$Ba | 7.5 | 0.041 | 0.10 |
| Lund, Nev. | 21.8 | $^{7}$Be | 0.35 | 0.17 | 0.018 |
| | 295.6 | $^{95}$Zr | 7.0 | 0.018 | 0.20 |
| | 28.0 | $^{131}$I | 7.7 | 0.027 | 0.080 |
| | 12.0 | $^{132}$Te | 6.2 | 0.055 | 0.057 |
| | 4.0 | $^{137}$Cs | 0.027 | 0.019 | <0.001 |
| | 36.0 | $^{140}$Ba | 15 | 0.042 | 0.14 |
| Mesquite, Nev. | 34.0 | $^{7}$Be | 0.37 | 0.12 | 0.025 |
| | 280.5 | $^{95}$Zr | 1.7 | 0.016 | <0.2 |
| | 27.0 | $^{131}$I | 1.6 | 0.023 | 0.030 |
| | 9.0 | $^{132}$Te | 1.9 | 0.078 | 0.021 |
| | 2.0 | $^{137}$Cs | 1.6 | 0.016 | <0.001 |
| | 36.0 | $^{140}$Ba | 3.5 | 0.019 | 0.056 |
| Moapa, Nev. | 13.1 | $^{7}$Be | 0.38 | 0.24 | 0.034 |
| | 96.3 | $^{95}$Zr | 2.4 | 0.018 | 0.17 |
| | 21.0 | $^{131}$I | 1.9 | 0.037 | 0.12 |
| | 9.0 | $^{132}$Te | 2.3 | 0.22 | 0.085 |
| | .0 | $^{137}$Cs | - | - | - |
| | 25.9 | $^{140}$Ba | 4.8 | 0.059 | 0.20 |
| Nyala, Nev. | 22.0 | $^{7}$Be | 0.33 | 0.10 | 0.014 |
| | 283.0 | $^{95}$Zr | 3.6 | 0.015 | <0.15 |
| | 24.0 | $^{131}$I | 3.9 | 0.037 | 0.064 |
| | 9.0 | $^{132}$Te | 4.6 | 0.17 | 0.063 |
| | 5.0 | $^{137}$Cs | 0.022 | 0.013 | <0.001 |
| | 33.0 | $^{140}$Ba | 6.6 | 0.035 | 0.096 |
| Pahrump, Nev. | 24.0 | $^{7}$Be | 0.40 | 0.14 | 0.018 |
| | 225.7 | $^{95}$Zr | 0.57 | 0.012 | <0.1 |
| | 6.1 | $^{131}$I | 0.34 | 0.12 | 0.0048 |
| | .0 | $^{132}$Te | - | - | - |
| | .0 | $^{137}$Cs | - | - | - |
| | .0 | $^{140}$Ba | - | - | - |

Table C-2. (continued)

| Sampling Location | No. Days Sampled | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$ μCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Pioche, Nev. | 24.0 | $^{7}Be$ | 0.36 | 0.17 | <0.02 |
| | 281.8 | $^{95}Zr$ | 0.49 | 0.011 | <0.2 |
| | 7.0 | $^{131}I$ | 0.10 | 0.037 | 0.0013 |
| | .0 | $^{132}Te$ | - | - | - |
| | 9.0 | $^{137}Cs$ | 0.025 | 0.013 | <0.001 |
| | 15.0 | $^{140}Ba$ | 0.28 | 0.048 | 0.0052 |
| Round Mountain, Nev. | 22.8 | $^{7}Be$ | 0.43 | 0.17 | 0.016 |
| | 293.3 | $^{95}Zr$ | 3.3 | 0.02 | <0.2 |
| | 22.5 | $^{131}I$ | 3.4 | 0.047 | 0.047 |
| | 11.1 | $^{132}Te$ | 3.7 | 0.082 | 0.030 |
| | 3.0 | $^{137}Cs$ | 0.014 | 0.014 | <0.001 |
| | 32.3 | $^{140}Ba$ | 5.7 | 0.034 | 0.057 |
| Scotty's Junction, Nev. | 19.8 | $^{7}Be$ | 0.51 | 0.13 | 0.014 |
| | 298.9 | $^{95}Zr$ | 3.7 | 0.016 | <0.2 |
| | 22.0 | $^{131}I$ | 4.6 | 0.048 | 0.058 |
| | 17.0 | $^{132}Te$ | 5.3 | 0.075 | 0.046 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 33.0 | $^{140}Ba$ | 6.1 | 0.044 | 0.067 |
| Stone Cabin Ranch, Nev. | 30.7 | $^{7}Be$ | 0.48 | 0.16 | 0.023 |
| | 297.7 | $^{95}Zr$ | 3.4 | 0.014 | <0.2 |
| | 15.6 | $^{131}I$ | 3.2 | 0.027 | 0.040 |
| | 6.7 | $^{132}Te$ | 3.6 | 0.53 | 0.026 |
| | 5.0 | $^{137}Cs$ | 0.024 | 0.022 | <0.0001 |
| | 26.2 | $^{140}Ba$ | 6.9 | 0.027 | 0.055 |
| Sunnyside, Nev. | 23.9 | $^{7}Be$ | 0.34 | 0.13 | 0.017 |
| | 290.6 | $^{95}Zr$ | 5.2 | 0.016 | <0.2 |
| | 24.2 | $^{131}I$ | 4.6 | 0.041 | 0.071 |
| | 10.0 | $^{132}Te$ | 5.4 | 0.073 | 0.049 |
| | 8.8 | $^{137}Cs$ | 0.031 | 0.017 | <0.001 |
| | 33.0 | $^{140}Ba$ | 11.0 | 0.039 | 0.11 |
| Tonopah, Nev. | 23.0 | $^{7}Be$ | 0.26 | 0.14 | 0.014 |
| | 294.8 | $^{95}Zr$ | 3.2 | 0.013 | <0.2 |
| | 18.0 | $^{131}I$ | 2.5 | 0.040 | 0.031 |
| | 8.0 | $^{132}Te$ | 2.5 | 0.10 | 0.016 |
| | 8.0 | $^{137}Cs$ | 0.024 | 0.019 | <0.001 |
| | 31.1 | $^{140}Ba$ | 4.1 | 0.058 | 0.039 |

Table C-2. (continued)

| Sampling Location | No. Days Sampled | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$ μCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Tonopah Test Range, Nev. | 10.1 | $^{7}Be$ | 0.49 | 0.15 | 0.010 |
| | 236.0 | $^{95}Zr$ | 2.9 | 0.012 | 0.14 |
| | 22.9 | $^{131}I$ | 4.0 | 0.045 | 0.42 |
| | 10.8 | $^{132}Te$ | 4.7 | 0.086 | 0.037 |
| | 1.9 | $^{137}Cs$ | 0.028 | 0.028 | <0.001 |
| | 28.9 | $^{140}Ba$ | 6.0 | 0.040 | 0.062 |
| Cedar City, Utah | 11.8 | $^{7}Be$ | 0.31 | 0.18 | 0.0089 |
| | 274.2 | $^{95}Zr$ | 3.6 | 0.015 | <0.2 |
| | 27.0 | $^{131}I$ | 3.0 | 0.021 | 0.074 |
| | 16.0 | $^{132}Te$ | 4.6 | 0.041 | 0.056 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 35.8 | $^{140}Ba$ | 0.057 | 0.035 | 0.095 |
| Delta, Utah | 16.1 | $^{7}Be$ | 0.32 | 0.16 | 0.018 |
| | 161.8 | $^{95}Zr$ | 4.2 | 0.017 | <0.3 |
| | 8.6 | $^{131}I$ | 4.6 | 0.19 | 0.069 |
| | 4.0 | $^{132}Te$ | 5.7 | 2.7 | 0.069 |
| | 3.7 | $^{137}Cs$ | 0.045 | 0.027 | <0.001 |
| | 10.5 | $^{140}Ba$ | 8.7 | 0.23 | 0.14 |
| Garrison, Utah | 28.0 | $^{7}Be$ | 0.53 | 0.17 | 0.020 |
| | 269.1 | $^{95}Zr$ | 0.53 | 0.013 | <0.2 |
| | 12.0 | $^{131}I$ | 0.057 | 0.026 | 0.0016 |
| | 2.0 | $^{132}Te$ | 0.087 | 0.087 | <0.001 |
| | 9.0 | $^{137}Cs$ | 0.020 | 0.0089 | <0.001 |
| | 16.8 | $^{140}Ba$ | 0.26 | 0.066 | 0.0064 |
| Milford, Utah | 19.9 | $^{7}Be$ | 0.37 | 0.14 | 0.002 |
| | 214.2 | $^{95}Zr$ | 3.2 | 0.018 | <0.2 |
| | 12.1 | $^{131}I$ | 2.5 | 0.05 | 0.042 |
| | 7.0 | $^{132}Te$ | 2.8 | 0.98 | 0.043 |
| | 4.7 | $^{137}Cs$ | 0.031 | 0.012 | <0.001 |
| | 13.7 | $^{140}Ba$ | 5.5 | 0.073 | 0.094 |
| St. George, Utah | 25.8 | $^{7}Be$ | 0.31 | 0.15 | 0.018 |
| | 297.0 | $^{95}Zr$ | 1.7 | 0.015 | <0.2 |
| | 20.9 | $^{131}I$ | 1.5 | 0.034 | 0.025 |
| | 12.7 | $^{132}Te$ | 1.4 | 0.038 | 0.023 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 34.9 | $^{140}Ba$ | 3.3 | 0.029 | 0.060 |

(1) Also known as Groom Lake.

Table C-3. 1977 Summary of Analytical Results for Air Surveillance Network Standby Stations

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration (10-μCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Phoenix, Ariz. | 6.0 | $^{7}Be$ | 0.18 | 0.18 | 0.023 |
| | 35.3 | $^{95}Zr$ | 0.81 | 0.032 | 0.15 |
| | 22.1 | $^{131}I$ | 0.65 | 0.029 | 0.13 |
| | 8.1 | $^{132}Te$ | 0.55 | 0.039 | 0.045 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.1 | $^{140}Ba$ | 1.8 | 0.065 | 0.23 |
| Winslow, Ariz. | .0 | $^{7}Be$ | - | - | - |
| | 35.8 | $^{95}Zr$ | 0.61 | 0.029 | 0.12 |
| | 26.0 | $^{131}I$ | 0.56 | 0.023 | 0.099 |
| | 5.0 | $^{132}Te$ | 0.49 | 0.21 | 0.033 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.0 | $^{140}Ba$ | 1.2 | 0.044 | 0.18 |
| Little Rock, Ark. | 1.5 | $^{7}Be$ | 0.22 | 0.22 | 0.0077 |
| | 30.6 | $^{95}Zr$ | 0.89 | 0.039 | 0.081 |
| | 9.1 | $^{131}I$ | 1.0 | 0.048 | 0.061 |
| | 11.8 | $^{132}Te$ | 1.4 | 0.019 | 0.076 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 19.9 | $^{140}Ba$ | 1.7 | 0.022 | 0.12 |
| Indio, Calif. | .0 | $^{7}Be$ | - | - | - |
| | 36.7 | $^{95}Zr$ | 1.4 | 0.089 | 0.25 |
| | 23.0 | $^{131}I$ | 1.3 | 0.032 | 0.21 |
| | 14.0 | $^{132}Te$ | 1.2 | 0.03 | 0.12 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.0 | $^{140}Ba$ | 2.7 | 0.092 | 0.35 |
| Denver, Colo. | .0 | $^{7}Be$ | - | - | - |
| | 40.7 | $^{95}Zr$ | 2.3 | 0.017 | 0.23 |
| | 18.0 | $^{131}I$ | 2.9 | 0.023 | 0.35 |
| | 11.0 | $^{132}Te$ | 4.0 | 0.075 | 0.26 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 25.8 | $^{140}Ba$ | 6.4 | 0.063 | 0.46 |
| Durango, Colo. | 4.0 | $^{7}Be$ | 0.21 | 0.19 | 0.015 |
| | 38.4 | $^{95}Zr$ | 1.4 | 0.024 | 0.17 |
| | 20.8 | $^{131}I$ | 2.0 | 0.036 | 0.22 |
| | 13.5 | $^{132}Te$ | 2.6 | 0.076 | 0.19 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 25.9 | $^{140}Ba$ | 3.7 | 0.072 | 0.33 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$μCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Grand Junction, Colo. | 5.0 | $^{7}Be$ | 0.22 | 0.13 | 0.017 |
| | 37.0 | $^{95}Zr$ | 1.4 | 0.05 | 0.22 |
| | 22.9 | $^{131}I$ | 1.7 | 0.026 | 0.28 |
| | 13.1 | $^{132}Te$ | 1.7 | 0.086 | 0.19 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 27.0 | $^{140}Ba$ | 3.0 | 0.085 | 0.42 |
| Pueblo, Colo. | .0 | $^{7}Be$ | - | - | - |
| | 36.0 | $^{95}Zr$ | 1.9 | 0.043 | 0.30 |
| | 18.2 | $^{131}I$ | 2.2 | 0.036 | 0.32 |
| | 8.0 | $^{132}Te$ | 2.7 | 0.33 | 0.29 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 27.1 | $^{140}Ba$ | 4.0 | 0.048 | 0.56 |
| Boise, Idaho | .0 | $^{7}Be$ | - | - | - |
| | 41.8 | $^{95}Zr$ | 0.29 | 0.016 | 0.12 |
| | 19.4 | $^{131}I$ | 0.16 | 0.019 | 0.038 |
| | 9.4 | $^{132}Te$ | 0.15 | 0.032 | 0.023 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 23.4 | $^{140}Ba$ | 0.32 | 0.042 | 0.078 |
| Idaho Falls, Idaho | 6.8 | $^{7}Be$ | 0.26 | 0.20 | 0.033 |
| | 35.1 | $^{95}Zr$ | 1.4 | 0.037 | 0.18 |
| | 18.0 | $^{131}I$ | 1.3 | 0.035 | 0.11 |
| | 10.0 | $^{132}Te$ | 1.2 | 0.026 | 0.091 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.0 | $^{140}Ba$ | 2.3 | 0.033 | 0.24 |
| Mountain Home, Idaho | .0 | $^{7}Be$ | - | - | - |
| | 38.2 | $^{95}Zr$ | 0.48 | 0.045 | 0.12 |
| | 16.2 | $^{131}I$ | 0.37 | 0.033 | 0.036 |
| | 10.4 | $^{132}Te$ | 0.34 | 0.063 | 0.030 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.0 | $^{140}Ba$ | 0.62 | 0.056 | 0.068 |
| Pocatello, Idaho | 4.8 | $^{7}Be$ | 0.32 | 0.22 | 0.024 |
| | 37.5 | $^{95}Zr$ | 2.4 | 0.044 | 0.25 |
| | 23.8 | $^{131}I$ | 2.5 | 0.029 | 0.25 |
| | 16.3 | $^{132}Te$ | 2.1 | 0.056 | 0.16 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 25.8 | $^{140}Ba$ | 5.2 | 0.069 | 0.38 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max | Min | Avg |
|---|---|---|---|---|---|
| Preston, Idaho | 6.0 | $^{7}Be$ | 0.41 | 0.29 | 0.042 |
| | 38.9 | $^{95}Zr$ | 3.2 | 0.015 | 0.32 |
| | 19.0 | $^{131}I$ | 2.7 | 0.025 | 0.27 |
| | 7.0 | $^{132}Te$ | 3.0 | 0.048 | 0.20 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.0 | $^{140}Ba$ | 6.3 | 0.07 | 0.51 |
| Twin Falls, Idaho | 3.0 | $^{7}Be$ | 0.21 | 0.21 | 0.013 |
| | 37.0 | $^{95}Zr$ | 0.62 | 0.059 | 0.14 |
| | 24.0 | $^{131}I$ | 0.53 | 0.031 | 0.076 |
| | 13.0 | $^{132}Te$ | 0.66 | 0.087 | 0.060 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.0 | $^{140}Ba$ | 1.1 | 0.045 | 0.13 |
| Iowa City, Iowa | .0 | $^{7}Be$ | - | - | - |
| | 23.0 | $^{95}Zr$ | 0.23 | 0.03 | 0.051 |
| | 7.0 | $^{131}I$ | 0.25 | 0.055 | 0.017 |
| | 7.0 | $^{132}Te$ | 0.18 | 0.083 | 0.018 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 10.0 | $^{140}Ba$ | 0.42 | 0.059 | 0.037 |
| Sioux City, Iowa | 3.0 | $^{7}Be$ | 0.15 | 0.15 | 0.0085 |
| | 31.0 | $^{95}Zr$ | 0.15 | 0.03 | 0.038 |
| | 11.0 | $^{131}I$ | 0.18 | 0.031 | 0.014 |
| | 7.0 | $^{132}Te$ | 0.21 | 0.042 | 0.012 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 18.0 | $^{140}Ba$ | 0.42 | 0.041 | 0.039 |
| Dodge City, Kans. | .0 | $^{7}Be$ | - | - | - |
| | 33.0 | $^{95}Zr$ | 0.77 | 0.021 | 0.075 |
| | 15.0 | $^{131}I$ | 0.53 | 0.019 | 0.039 |
| | 10.0 | $^{132}Te$ | 0.79 | 0.026 | 0.046 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.0 | $^{140}Ba$ | 1.3 | 0.024 | 0.098 |
| Lake Charles, La. | .0 | $^{7}Be$ | - | - | - |
| | 25.3 | $^{95}Zr$ | 0.17 | 0.019 | 0.052 |
| | 4.0 | $^{131}I$ | 0.067 | 0.059 | 0.0071 |
| | 6.9 | $^{132}Te$ | 0.068 | 0.042 | 0.0098 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 11.9 | $^{140}Ba$ | 0.21 | 0.05 | 0.038 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$µCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Monroe, La. | .0 | $^{7}Be$ | - | - | - |
| | 26.9 | $^{95}Zr$ | 3.5 | 0.039 | 0.29 |
| | 13.0 | $^{131}I$ | 4.0 | 0.021 | 0.28 |
| | 10.9 | $^{132}Te$ | 3.7 | 0.041 | 0.25 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 17.9 | $^{140}Ba$ | 7.7 | 0.025 | 0.54 |
| New Orleans, La. | .0 | $^{7}Be$ | - | - | - |
| | 26.1 | $^{95}Zr$ | 1.6 | 0.022 | 0.16 |
| | 8.1 | $^{131}I$ | 1.9 | 0.047 | 0.12 |
| | 6.0 | $^{132}Te$ | 2.8 | 0.062 | 0.15 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 13.0 | $^{140}Ba$ | 4.8 | 0.096 | 0.30 |
| Minneapolis, Minn. | .0 | $^{7}Be$ | - | - | - |
| | 9.0 | $^{95}Zr$ | 0.14 | 0.027 | 0.018 |
| | 2.0 | $^{131}I$ | 0.038 | 0.038 | 0.0024 |
| | 2.0 | $^{132}Te$ | 0.061 | 0.061 | 0.0033 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 4.0 | $^{140}Ba$ | 0.17 | 0.07 | 0.013 |
| Clayton, Mo. | 3.0 | $^{7}Be$ | 0.15 | 0.15 | 0.0092 |
| | 34.0 | $^{95}Zr$ | 0.22 | 0.023 | 0.057 |
| | 16.0 | $^{131}I$ | 0.16 | 0.037 | 0.037 |
| | 10.0 | $^{132}Te$ | 0.17 | 0.11 | 0.026 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 21.0 | $^{140}Ba$ | 0.3 | 0.02 | 0.057 |
| Joplin, Mo. | .0 | $^{7}Be$ | - | - | - |
| | 31.5 | $^{95}Zr$ | 0.3 | 0.034 | 0.073 |
| | 15.0 | $^{131}I$ | 0.39 | 0.022 | 0.040 |
| | 10.0 | $^{132}Te$ | 0.50 | 0.042 | 0.034 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 19.9 | $^{140}Ba$ | 0.99 | 0.068 | 0.096 |
| St. Joseph, Mo. | .0 | $^{7}Be$ | - | - | - |
| | 35.9 | $^{95}Zr$ | 0.17 | 0.026 | 0.066 |
| | 19.0 | $^{131}I$ | 0.010 | 0.024 | 0.022 |
| | 10.7 | $^{132}Te$ | 0.13 | 0.063 | 0.024 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 20.7 | $^{140}Ba$ | 0.21 | 0.035 | 0.046 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max | Min | Avg |
|---|---|---|---|---|---|
| Billings, Mont. | 3.0 | $^{7}Be$ | 0.34 | 0.34 | 0.022 |
| | 35.9 | $^{95}Zr$ | 0.26 | 0.034 | 0.083 |
| | 11.7 | $^{131}I$ | 0.19 | 0.059 | 0.026 |
| | 10.0 | $^{132}Te$ | 0.32 | 0.06 | 0.034 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.0 | $^{140}Ba$ | 0.37 | 0.031 | 0.066 |
| Bozeman, Mont. | 5.0 | $^{7}Be$ | 0.28 | 0.22 | 0.030 |
| | 34.1 | $^{95}Zr$ | 1.3 | 0.036 | 0.13 |
| | 19.1 | $^{131}I$ | 1.4 | 0.022 | 0.097 |
| | 9.1 | $^{132}Te$ | 1.8 | 0.094 | 0.10 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.2 | $^{140}Ba$ | 3.5 | 0.027 | 0.22 |
| Missoula, Mont. | .0 | $^{7}Be$ | - | - | - |
| | 32.1 | $^{95}Zr$ | 0.21 | 0.045 | 0.083 |
| | 15.7 | $^{131}I$ | 0.92 | 0.034 | 0.070 |
| | 7.1 | $^{132}Te$ | 0.12 | 0.062 | 0.015 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 25.0 | $^{140}Ba$ | 0.18 | 0.03 | 0.053 |
| North Platte, Nebr. | .0 | $^{7}Be$ | - | - | - |
| | 34.9 | $^{95}Zr$ | 0.49 | 0.028 | 0.089 |
| | 20.0 | $^{131}I$ | 0.50 | 0.029 | 0.057 |
| | 10.0 | $^{132}Te$ | 0.47 | 0.047 | 0.043 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 21.9 | $^{140}Ba$ | 1.2 | 0.046 | 0.11 |
| Battle Mountain, Nev. | 2.0 | $^{7}Be$ | 0.17 | 0.17 | 0.034 |
| | 2.0 | $^{95}Zr$ | 0.82 | 0.10 | 0.087 |
| | .9 | $^{131}I$ | 0.73 | 0.73 | 0.068 |
| | .9 | $^{132}Te$ | 0.85 | 0.85 | 0.080 |
| | .0 | $^{137}Cs$ | - | - | - |
| | .9 | $^{140}Ba$ | 1.0 | 1.0 | 0.094 |
| Currant Maint. Sta., Nev. | 2.3 | $^{7}Be$ | 0.15 | 0.15 | 0.0099 |
| | 27.9 | $^{95}Zr$ | 1.3 | 0.093 | 0.28 |
| | 24.2 | $^{131}I$ | 1.7 | 0.039 | 0.40 |
| | 3.0 | $^{132}Te$ | 1.1 | 1.1 | 0.094 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.9 | $^{140}Ba$ | 1.7 | 0.071 | 0.36 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max | Min | Avg |
|---|---|---|---|---|---|
| Currie, Nev. | 2.9 | $^{7}Be$ | 0.72 | 0.33 | 0.048 |
| | 20.6 | $^{95}Zr$ | 4.1 | 0.083 | 0.53 |
| | 10.0 | $^{131}I$ | 4.5 | 0.04 | 0.65 |
| | 10.0 | $^{132}Te$ | 3.7 | 0.11 | 0.48 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 10.0 | $^{140}Ba$ | 9.0 | 0.11 | 1.06 |
| Elko, Nev. | .0 | $^{7}Be$ | - | - | - |
| | 40.5 | $^{95}Zr$ | 2.0 | 0.017 | 0.23 |
| | 23.9 | $^{131}I$ | 2.4 | 0.027 | 0.21 |
| | 10.0 | $^{132}Te$ | 1.9 | 0.032 | 0.13 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 25.9 | $^{140}Ba$ | 4.7 | 0.077 | 0.37 |
| Fallon, Nev. | 2.0 | $^{7}Be$ | 0.32 | 0.32 | 0.018 |
| | 24.9 | $^{95}Zr$ | 1.0 | 0.069 | 0.19 |
| | 14.0 | $^{131}I$ | 0.91 | 0.075 | 0.20 |
| | 9.0 | $^{132}Te$ | 1.1 | 0.079 | 0.12 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 14.0 | $^{140}Ba$ | 2.0 | 0.14 | 0.26 |
| Frenchman Sta., Nev. | 1.9 | $^{7}Be$ | 0.19 | 0.19 | 0.014 |
| | 13.0 | $^{95}Zr$ | 1.8 | 0.071 | 0.21 |
| | 4.9 | $^{131}I$ | 1.8 | 0.13 | 0.19 |
| | 4.9 | $^{132}Te$ | 1.8 | 0.58 | 0.19 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 4.9 | $^{140}Ba$ | 3.3 | 0.61 | 0.30 |
| Lovelock, Nev. | .0 | $^{7}Be$ | - | - | - |
| | 17.1 | $^{95}Zr$ | 1.2 | 0.066 | 0.24 |
| | 10.9 | $^{131}I$ | 1.1 | 0.043 | 0.27 |
| | 9.0 | $^{132}Te$ | 0.80 | 0.11 | 0.14 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 10.9 | $^{140}Ba$ | 1.7 | 0.077 | 0.26 |
| Reno, Nev. | 4.8 | $^{7}Be$ | 0.70 | 0.18 | 0.037 |
| | 34.1 | $^{95}Zr$ | 1.6 | 0.03 | 0.19 |
| | 25.7 | $^{131}I$ | 0.75 | 0.027 | 0.12 |
| | 11.8 | $^{132}Te$ | 0.72 | 0.073 | 0.091 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 25.7 | $^{140}Ba$ | 2.0 | 0.061 | 0.22 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}$μCi/ml) Max | Min | Avg |
|---|---|---|---|---|---|
| Warm Springs, Nev. | .0 | $^{7}Be$ | - | - | - |
| | 24.9 | $^{95}Zr$ | 5.5 | 0.044 | 0.70 |
| | 16.0 | $^{131}I$ | 6.3 | 0.45 | 0.76 |
| | 10.0 | $^{132}Te$ | 7.4 | 0.053 | 0.72 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 16.0 | $^{140}Ba$ | 9.1 | 0.12 | 0.11 |
| Wells, Nev. | 3.0 | $^{7}Be$ | 0.58 | 0.38 | 0.044 |
| | 17.7 | $^{95}Zr$ | 3.2 | 0.054 | 0.41 |
| | 8.0 | $^{131}I$ | 3.2 | 0.16 | 0.49 |
| | 7.0 | $^{132}Te$ | 3.2 | 0.38 | 0.32 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 8.0 | $^{140}Ba$ | 7.3 | 0.29 | 0.74 |
| Winnemucca, Nev. | .0 | $^{7}Be$ | - | - | - |
| | 29.7 | $^{95}Zr$ | 1.6 | 0.053 | 0.19 |
| | 18.0 | $^{131}I$ | 1.3 | 0.043 | 0.15 |
| | 12.3 | $^{132}Te$ | 1.2 | 0.071 | 0.10 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.9 | $^{140}Ba$ | 2.7 | 0.046 | 0.22 |
| Albuquerque, N. Mex. | 3.0 | $^{7}Be$ | 0.20 | 0.20 | 0.012 |
| | 33.7 | $^{95}Zr$ | 0.75 | 0.030 | 0.12 |
| | 20.1 | $^{131}I$ | 1.2 | 0.018 | 0.16 |
| | 10.0 | $^{132}Te$ | 1.7 | 0.058 | 0.12 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 25.9 | $^{140}Ba$ | 2.6 | 0.067 | 0.25 |
| Carlsbad, N. Mex. | .0 | $^{7}Be$ | - | - | - |
| | 8.1 | $^{95}Zr$ | 1.2 | 0.062 | 0.15 |
| | 4.1 | $^{131}I$ | 1.7 | 0.078 | 0.24 |
| | 4.1 | $^{132}Te$ | 2.4 | 0.16 | 0.25 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 4.1 | $^{140}Ba$ | 3.4 | 0.25 | 0.35 |
| Muskogee, Okla. | .0 | $^{7}Be$ | - | - | - |
| | 34.9 | $^{95}Zr$ | 0.27 | 0.049 | 0.069 |
| | 14.0 | $^{131}I$ | 0.36 | 0.031 | 0.03 |
| | 7.0 | $^{132}Te$ | 0.59 | 0.031 | 0.03 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 21.0 | $^{140}Ba$ | 1.2 | 0.028 | 0.099 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max | Min | Avg |
|---|---|---|---|---|---|
| Norman, Okla. | 2.0 | $^{7}Be$ | 0.55 | 0.55 | 0.022 |
| | 34.6 | $^{95}Zr$ | 0.44 | 0.05 | 0.12 |
| | 14.9 | $^{131}I$ | 0.24 | 0.041 | 0.048 |
| | 10.9 | $^{132}Te$ | 0.36 | 0.075 | 0.052 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.9 | $^{140}Ba$ | 0.63 | 0.042 | 0.14 |
| Burns, Oreg. | .0 | $^{7}Be$ | - | - | - |
| | 30.0 | $^{95}Zr$ | 0.27 | 0.053 | 0.095 |
| | 14.0 | $^{131}I$ | 0.26 | 0.043 | 0.034 |
| | 12.0 | $^{132}Te$ | 0.29 | 0.049 | 0.035 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 21.0 | $^{140}Ba$ | 0.63 | 0.044 | 0.081 |
| Medford, Oreg. | .0 | $^{7}Be$ | - | - | - |
| | 23.8 | $^{95}Zr$ | 0.17 | 0.041 | 0.053 |
| | 4.9 | $^{131}I$ | 0.085 | 0.048 | 0.0069 |
| | 1.0 | $^{132}Te$ | 0.16 | 0.16 | 0.0034 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 10.8 | $^{140}Ba$ | 0.19 | 0.058 | 0.030 |
| Aberdeen, S. Dak. | .0 | $^{7}Be$ | - | - | - |
| | 26.0 | $^{95}Zr$ | 0.15 | 0.024 | 0.039 |
| | 5.0 | $^{131}I$ | 0.17 | 0.044 | 0.0088 |
| | 4.0 | $^{132}Te$ | 0.14 | 0.087 | 0.0088 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 7.0 | $^{140}Ba$ | 0.16 | 0.06 | 0.013 |
| Rapid City, S. Dak. | .0 | $^{7}Be$ | - | - | - |
| | 34.7 | $^{95}Zr$ | 0.17 | 0.016 | 0.063 |
| | 14.1 | $^{131}I$ | 0.23 | 0.020 | 0.023 |
| | 7.2 | $^{132}Te$ | 0.11 | 0.064 | 0.012 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 20.1 | $^{140}Ba$ | 0.48 | 0.047 | 0.052 |
| Abilene, Tex. | 1.9 | $^{7}Be$ | 0.29 | 0.29 | 0.011 |
| | 35.9 | $^{95}Zr$ | 0.77 | 0.047 | 0.13 |
| | 17.8 | $^{131}I$ | 0.81 | 0.049 | 0.014 |
| | 10.0 | $^{132}Te$ | 1.0 | 0.092 | 0.083 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 25.9 | $^{140}Ba$ | 1.9 | 0.045 | 0.22 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max | Min | Avg |
|---|---|---|---|---|---|
| Amarillo, Tex. | 5.0 | $^{7}Be$ | 0.32 | 0.16 | 0.024 |
| | 36.0 | $^{95}Zr$ | 0.26 | 0.035 | 0.087 |
| | 20.0 | $^{131}I$ | 0.52 | 0.018 | 0.080 |
| | 9.0 | $^{132}Te$ | 0.19 | 0.042 | 0.022 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.0 | $^{140}Ba$ | 0.54 | 0.028 | 0.097 |
| Austin, Tex. | 3.1 | $^{7}Be$ | 0.12 | 0.12 | 0.010 |
| | 17.0 | $^{95}Zr$ | 0.20 | 0.05 | 0.05 |
| | 12.0 | $^{131}I$ | 0.41 | 0.032 | 0.056 |
| | 7.1 | $^{132}Te$ | 0.15 | 0.11 | 0.023 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 14.0 | $^{140}Ba$ | 0.29 | 0.053 | 0.053 |
| Fort Worth, Tex. | .0 | $^{7}Be$ | - | - | - |
| | 17.0 | $^{95}Zr$ | 0.26 | 0.026 | 0.067 |
| | 7.0 | $^{131}I$ | 0.22 | 0.05 | 0.043 |
| | 5.0 | $^{132}Te$ | 0.31 | 0.15 | 0.039 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 7.0 | $^{140}Ba$ | 0.66 | 0.042 | 0.075 |
| Bryce Canyon, Utah | 3.5 | $^{7}Be$ | 0.27 | 0.17 | 0.015 |
| | 32.2 | $^{95}Zr$ | 1.7 | 0.046 | 0.26 |
| | 20.1 | $^{131}I$ | 2.5 | 0.039 | 0.34 |
| | 13.0 | $^{132}Te$ | 2.6 | 0.084 | 0.24 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 21.9 | $^{140}Ba$ | 3.7 | 0.047 | 0.46 |
| Capitol Reef, Utah | .0 | $^{7}Be$ | - | - | - |
| | 37.6 | $^{95}Zr$ | 1.6 | 0.025 | 0.26 |
| | 15.9 | $^{131}I$ | 1.7 | 0.044 | 0.27 |
| | 7.0 | $^{132}Te$ | 1.8 | 0.14 | 0.18 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 23.8 | $^{140}Ba$ | 3.5 | 0.10 | 0.39 |
| Dugway, Utah | 3.0 | $^{7}Be$ | 0.47 | 0.43 | 0.056 |
| | 12.5 | $^{95}Zr$ | 3.9 | 0.063 | 0.50 |
| | 6.5 | $^{131}I$ | 4.3 | 0.27 | 0.50 |
| | 4.5 | $^{132}Te$ | 4.0 | 0.54 | 0.40 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 6.5 | $^{140}Ba$ | 8.7 | 0.61 | 0.96 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max | Min | Avg |
|---|---|---|---|---|---|
| Enterprise, Utah | 7.1 | $^{7}Be$ | 0.21 | 0.15 | 0.025 |
| | 37.8 | $^{95}Zr$ | 2.9 | 0.063 | 0.32 |
| | 26.0 | $^{131}I$ | 2.4 | 0.027 | 0.28 |
| | 7.0 | $^{132}Te$ | 2.6 | 0.83 | 0.21 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.0 | $^{140}Ba$ | 5.2 | 0.056 | 0.51 |
| Logan, Utah | 5.0 | $^{7}Be$ | 0.21 | 0.098 | 0.028 |
| | 18.2 | $^{95}Zr$ | 3.5 | 0.035 | 0.46 |
| | 6.9 | $^{131}I$ | 2.9 | 0.071 | 0.51 |
| | 6.9 | $^{132}Te$ | 3.1 | 0.12 | 0.33 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 7.9 | $^{140}Ba$ | 6.2 | 0.056 | 0.74 |
| Monticello, Utah | .0 | $^{7}Be$ | - | - | - |
| | 33.3 | $^{95}Zr$ | 0.58 | 0.034 | 0.13 |
| | 22.0 | $^{131}I$ | 0.84 | 0.043 | 0.11 |
| | 8.0 | $^{132}Te$ | 0.49 | 0.068 | 0.029 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.0 | $^{140}Ba$ | 1.3 | 0.06 | 0.16 |
| Parowan, Utah | 3.0 | $^{7}Be$ | 0.28 | 0.28 | 0.033 |
| | 7.9 | $^{95}Zr$ | 0.44 | 0.046 | 0.045 |
| | 1.9 | $^{131}I$ | 0.46 | 0.11 | 0.021 |
| | 1.9 | $^{132}Te$ | 1.1 | 0.32 | 0.052 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 1.9 | $^{140}Ba$ | 0.66 | 0.26 | 0.034 |
| Provo, Utah | 4.0 | $^{7}Be$ | 0.24 | 0.20 | 0.019 |
| | 37.4 | $^{95}Zr$ | 3.8 | 0.065 | 0.37 |
| | 24.8 | $^{131}I$ | 3.6 | 0.028 | 0.44 |
| | 8.8 | $^{132}Te$ | 4.3 | 0.055 | 0.32 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 24.8 | $^{140}Ba$ | 8.5 | 0.087 | 0.70 |
| Salt Lake City, Utah | 4.9 | $^{7}Be$ | 0.21 | 0.18 | 0.022 |
| | 29.8 | $^{95}Zr$ | 3.1 | 0.062 | 0.29 |
| | 17.3 | $^{131}I$ | 3.6 | 0.033 | 0.36 |
| | 7.3 | $^{132}Te$ | 3.5 | 0.11 | 0.23 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 19.2 | $^{140}Ba$ | 6.3 | 0.093 | 0.50 |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max | Min | Avg |
|---|---|---|---|---|---|
| Vernal, Utah | 6.0 | $^{7}Be$ | 0.27 | 0.16 | 0.028 |
| | 31.5 | $^{95}Zr$ | 5.2 | 0.026 | 0.25 |
| | 16.5 | $^{131}I$ | 7.6 | 0.037 | 0.38 |
| | 9.5 | $^{132}Te$ | 14 | 0.078 | 0.40 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 20.5 | $^{140}Ba$ | 15 | 0.059 | 0.55 |
| Wendover, Utah | 2.0 | $^{7}Be$ | 0.21 | 0.21 | 0.016 |
| | 14.0 | $^{95}Zr$ | 0.25 | 0.031 | 0.058 |
| | 5.0 | $^{131}I$ | 0.045 | 0.02 | 0.0059 |
| | .0 | $^{132}Te$ | - | - | - |
| | .0 | $^{137}Cs$ | - | - | - |
| | 7.0 | $^{140}Ba$ | 0.093 | 0.037 | 0.014 |
| Seattle, Wash. | .0 | $^{7}Be$ | - | - | - |
| | 35.7 | $^{95}Zr$ | 0.14 | 0.038 | 0.046 |
| | 2.0 | $^{131}I$ | 0.094 | 0.051 | 0.003 |
| | 2.0 | $^{132}Te$ | 0.15 | 0.092 | 0.0051 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 12.1 | $^{140}Ba$ | 0.11 | 0.032 | 0.012 |
| Spokane, Wash. | .0 | $^{7}Be$ | - | - | - |
| | 33.0 | $^{95}Zr$ | 0.80 | 0.019 | 0.090 |
| | 4.0 | $^{131}I$ | 0.054 | 0.023 | 0.0027 |
| | 3.0 | $^{132}Te$ | 0.022 | 0.022 | 0.0015 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 7.0 | $^{140}Ba$ | 0.80 | 0.02 | 0.021 |
| Casper, Wyo. | 2.0 | $^{7}Be$ | 0.37 | 0.37 | 0.015 |
| | 37.0 | $^{95}Zr$ | 1.3 | 0.097 | 0.18 |
| | 21.0 | $^{131}I$ | 1.4 | 0.032 | 0.25 |
| | 11.0 | $^{132}Te$ | 1.3 | 0.064 | 0.12 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 26.0 | $^{140}Ba$ | 3.0 | 0.072 | 0.30 |
| Rock Springs, Wyo. | .0 | $^{7}Be$ | - | - | - |
| | 10.0 | $^{95}Zr$ | 0.15 | 0.045 | 0.037 |
| | .0 | $^{131}I$ | - | - | - |
| | .0 | $^{132}Te$ | - | - | - |
| | .0 | $^{137}Cs$ | - | - | - |
| | .0 | $^{140}Ba$ | - | - | - |

Table C-3. (continued)

| Sampling Location | No. Days Detected | Type of Radio-activity | Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max | Min | Avg |
|---|---|---|---|---|---|
| Worland, Wyo. | 3.0 | $^{7}Be$ | 0.25 | 0.25 | 0.019 |
| | 32.0 | $^{95}Zr$ | 2.0 | 0.053 | 0.20 |
| | 13.0 | $^{131}I$ | 1.9 | 0.018 | 0.12 |
| | 3.0 | $^{132}Te$ | 0.12 | 0.077 | 0.0071 |
| | .0 | $^{137}Cs$ | - | - | - |
| | 19.0 | $^{140}Ba$ | 3.8 | 0.055 | 0.29 |

Table C-4. Special Milk Sampling Results for Las Vegas, Nevada

| Sampling Location | Collection Date | Sample Type(1) | Radio-nuclide | Radionuclide Concentrations ($10^{-9}$ μCi/ml)(2) |
|---|---|---|---|---|
| Las Vegas, Nev. LDS Dairy Farm | 09/27/77 | 12 | $^{131}I$ | 12 ± 4.6 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 09/29/77 | 12 | $^{89}Sr$ | 6.2 ± 3.3 |
| | | | $^{90}Sr$ | <2 |
| | | | $^{131}I$ | 57 ± 5.3 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 09/30/77 | 12 | $^{89}Sr$ | <3 |
| | | | $^{90}Sr$ | <1 |
| | | | $^{131}I$ | 51 ± 5.1 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/01/77 | 12 | $^{89}Sr$ | <2 |
| | | | $^{90}Sr$ | 1.3 ± 0.78 |
| | | | $^{131}I$ | 49 ± 5.4 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/02/77 | 12 | $^{131}I$ | 44 ± 5.5 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/03/77 | 12 | $^{131}I$ | 44 ± 5.0 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/04/77 | 12 | $^{131}I$ | 35 ± 6.4 |
| | | | $^{137}Cs$ | <7 |
| | | | $^{140}Ba$ | 5.2 ± 4.7 |
| Las Vegas, Nev. LDS Dairy Farm | 10/05/77 | 12 | $^{131}I$ | 33 ± 4.0 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <3 |

Table C-4. (continued)

| Sampling Location | Collection Date | Sample Type(1) | Radio-nuclide | Radionuclide Concentrations ($10^{-9}$ μCi/ml)(2) |
|---|---|---|---|---|
| Las Vegas, Nev. LDS Dairy Farm | 10/06/77 | 12 | $^{131}I$ | 29 ± 4.6 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/07/77 | 12 | $^{131}I$ | 21 ± 5.0 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/08/77 | 12 | $^{131}I$ | 26 ± 5.3 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/09/77 | 12 | $^{131}I$ | 42 ± 6.3 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <5 |
| Las Vegas, Nev. LDS Dairy Farm | 10/10/77 | 12 | $^{131}I$ | 23 ± 6.0 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/12/77 | 12 | $^{131}I$ | 35 ± 11 |
| | | | $^{137}Cs$ | <20 |
| | | | $^{140}Ba$ | <9 |
| Las Vegas, Nev. LDS Dairy Farm | 10/14/77 | 12 | $^{131}I$ | 28 ± 7.6 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <5 |
| Las Vegas, Nev. LDS Dairy Farm | 10/15/77 | 12 | $^{131}I$ | 22 ± 7.6 |
| | | | $^{137}Cs$ | <7 |
| | | | $^{140}Ba$ | <5 |
| Las Vegas, Nev. LDS Dairy Farm | 10/16/77 | 12 | $^{131}I$ | 36 ± 7.4 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <6 |

Table C-4. (continued)

| Sampling Location | Collection Date | Sample Type(1) | Radio-nuclide | Radionuclide Concentrations ($10^{-9}$ μCi/ml)(2) |
|---|---|---|---|---|
| Las Vegas, Nev. LDS Dairy Farm | 10/17/77 | 12 | $^{131}I$ | 19 ± 6.2 |
| | | | $^{137}Cs$ | <7 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/18/77 | 12 | $^{131}I$ | 26 ± 4.0 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/19/77 | 12 | $^{131}I$ | 19 ± 4.5 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/20/77 | 12 | $^{131}I$ | 8.8 ± 6.2 |
| | | | $^{137}Cs$ | <8 |
| | | | $^{140}Ba$ | <5 |
| Las Vegas, Nev. LDS Dairy Farm | 10/22/77 | 12 | $^{131}I$ | 8.5 ± 4.9 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/23/77 | 12 | $^{131}I$ | 15 ± 5.1 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/24/77 | 12 | $^{131}I$ | 6.5 ± 4.6 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/25/77 | 12 | $^{131}I$ | <6 |
| | | | $^{137}Cs$ | <7 |
| | | | $^{140}Ba$ | <5 |
| Las Vegas, Nev. LDS Dairy Farm | 10/26/77 | 12 | $^{131}I$ | 12 ± 4.2 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |

Table C-4. (continued)

| Sampling Location | Collection Date | Sample Type[1] | Radio-nuclide | Radionuclide Concentrations ($10^{-9}$ μCi/ml)[2] |
|---|---|---|---|---|
| Las Vegas, Nev. LDS Dairy Farm | 10/27/77 | 12 | $^{131}I$ | 8.2 ± 4.4 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/28/77 | 12 | $^{131}I$ | 9.1 ± 4.1 |
| | | | $^{137}Cs$ | <5 |
| | | | $^{140}Ba$ | <4 |
| Las Vegas, Nev. LDS Dairy Farm | 10/29/77 | 12 | $^{131}I$ | <9 |
| | | | $^{137}Cs$ | <9 |
| | | | $^{140}Ba$ | <7 |
| Las Vegas, Nev. LDS Dairy Farm | 10/30/77 | 12 | $^{131}I$ | <8 |
| | | | $^{137}Cs$ | <8 |
| | | | $^{140}Ba$ | <6 |
| Las Vegas, Nev. LDS Dairy Farm | 10/31/77 | 12 | $^{131}I$ | <5 |
| | | | $^{137}Cs$ | <6 |
| | | | $^{140}Ba$ | <4 |

(1) 12 = Raw Milk from Grade A Producer(s)

(2) All concentrations above the minimum detectable concentration (MDC) are shown with their 2-sigma counting error.

## APPENDIX D. LIST OF ABBREVIATIONS AND SYMBOLS

| | |
|---|---|
| μm | micrometer |
| μrem | micro-röntgen-equivalent-man |
| μCi/g | microcurie per gram |
| μCi/ml | microcurie per milliliter |
| AEC | Atomic Energy Commission |
| ASN | Air Surveillance Network |
| C | temperature in Celsius |
| CG | Concentration Guide |
| Ci | Curie |
| cm | centimeter |
| CP-1 | Control Point One |
| CY | Calendar Year |
| D.E. | Dose Equivalent |
| DOE | U.S. Department of Energy |
| EMSL-LV | Environmental Monitoring and Support Laboratory-Las Vegas |
| EPA | U.S. Environmental Protection Agency |
| ERDA | Energy Research and Development Administration |
| ERDA/NV | Energy Research and Development Administration/ Nevada Operations Office |
| ft | feet |
| GZ | Ground Zero |
| h | hour |
| kg | kilogram |
| km | kilometer |
| kt | kiloton |
| LCL | lower confidence limit |
| LLL | Lawrence Livermore Laboratory |
| LTHMP | Long-Term Hydrological Monitoring Program |
| m | meter |
| MDC | minimum detectable concentration |
| mm | millimeter |
| mrem/y | milli-röntgen-equivalent-man per year |
| mrem/d | milli-röntgen-equivalent-man per day |
| mR | milli-röntgen |
| mR/h | milli-röntgen per hour |
| MSL | Mean Sea Level |
| MSM | Milk Surveillance Network |
| nCi | nanocurie |
| NTS | Nevada Test Site |
| PHS | Public Health Service |
| pCi | picocurie |
| SMSN | Standby Milk Surveillance Network |
| TLD | thermoluminescent dosimeter |

| | |
|---|---|
| UCL | Upper Confidence Limit |
| USGS | United States Geological Survey |
| WSN | Water Surveillance Network |
| y | year |
| $^3H$ | tritium or hydrogen-3 |
| HT | tritiated hydrogen |
| HTC | tritiated water |
| $CH_3T$ | tritiated methane |
| Ba | barium |
| Be | berylium |
| Cs | cesium |
| I | iodine |
| K | potassium |
| Kr | krypton |
| Pu | plutonium |
| Ra | radium |
| Ru | ruthenium |
| Sr | strontium |
| Te | tellurium |
| U | uranium |
| Xe | xenon |
| Zr | zirconium |

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