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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 1976

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by

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

May 1977

This work performed under a Memorandum of Understanding No. EY-76-A-08-0539
for the
U.S. ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

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PREFACE

The Atomic Energy Commission (AEC) used the Nevada Test Site (NTS) from January 1951 through January 19, 1975, 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, 1975, these responsibilities were transferred to the newly-formed U.S. Energy Research and Development Administration (ERDA). 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 1953 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 1953 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 NTS or other test areas prior to each test.

In general, 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 (ERDA 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 1975, air and milk sample data have been reported quarterly. Dosimetry data were included beginning with the third quarter 1975.

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 quantitate 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 ERDA Manual, Chapter 0513.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF TABLES (continued)

INTRODUCTION

Under a Memorandum of Understanding, No. EY-76-A-08-0539, with the U.S. Energy Research and Development Administration (ERDA), 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 ERDA during CY 1976. This report, prepared in accordance with the ERDA Manual, Chapter 0513, contains summaries of EMSL-LV sampling methods, analytical procedures, and the analytical results of environmental samples collected in support of ERDA nuclear testing activities. Where applicable, sampling data are compared to appropriate guides for external and internal exposures to ionizing radiation. In addition, a brief summary of pertinent and 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, and Project Rover, which was terminated in January 1973. No Project Plowshare nuclear tests or Vela Uniform studies have been conducted at the NTS or any other site since 1970 and 1973, respectively. 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 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 1800-2100 m MSL.

The NTS is nearly surrounded 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, 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., 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 extremes 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 the Yucca observation station, 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 institutions 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 NTS or in the Pahute Mesa area has been reported (WASH-DRAFT, to be published) 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, et al., to be published).

The only industrial enterprises within the immediate off-NTS area are 25 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, 8900 dairy cows, 340 family goats, and 550 family 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 (Hiko and Alamo, Nevada, area), west-northwest (near Bishop, California), and southwest (near Barstow, California).

Population Distribution

The populated area of primary concern around the NTS which is sampled and monitored by surveillance Networks is shown in Figure 7 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 1975 by the U.S. Bureau of the Census and the 1976 projections for Washoe and Clark Counties by the University of Nevada (Reno), Figure 7 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 7. With the assumption that the total populations of the counties bisected by the 300-km radius lie within the inscribed area, there is primary concern, about 60 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 1975 projection is 2.1 people per km^2.

The off-site areas within about 80 km of 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 2500, 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 60. This area is about 55 km south-southwest 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 in 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 12,000 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 3600.

The extreme southwestern region of Utah is more developed than the adjacent part of Nevada. The largest town, Cedar City, with a population of 9900, 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 8000.

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 1976, 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 91 curies (Ci) of radioactivity which was reported by ERDA/NV as being released intermittently throughout the year and small undetermined amounts of tritium and ^{85}Kr which slowly seep to the surface from the underground test areas. The only off-NTS indication of this radioactivity was determined from an air sample of the Noble Gas and Tritium Surveillance Network collected at Death Valley Junction during the period August 24-31. This sample had a ^{3}H in air concentration of 2.7×10^{-11} µCi/ml above background. The estimated whole-body dose resulting from this concentration to a hypothetical receptor at this location was calculated as 1.3 µrem. Based upon this dose and the population of residents between the Nevada Test Site and Death Valley Junction, the estimated dose commitment[1] within a 80-km radius of the NTS Control Point was estimated to be 0.00078 man-rem.

All other measurements of radioactivity made by the Off-Site Radiological Safety Program were attributed to naturally occurring radioactivity or atmospheric fallout and not related to underground nuclear test operations during this report period. Radioactivity from both atmospheric nuclear tests by the People's Republic of China on September 25 at 2200 hours, PDT, and on November 16 at 2200 hours, PST, were detected on filter samples of the Air Surveillance Network beginning on samples collected on October 4 and continuing throughout this report

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[1]The dose commitment (product of estimated average dose and population) at Las Vegas from 1 year's exposure to natural background radiation is about 10,000 man-rem.

period. The tests resulted in increases of airborne radioactivity which were identified by the Air Surveillance Network as the fission products ^{95}Zr, ^{103}Ru, ^{106}Ru, ^{131}I, ^{132}Te, ^{140}Ba, ^{141}Ce, and ^{144}Ce. None of the other networks detected the radioactivity from the Chinese tests.

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 six other sites located elsewhere in Nevada, Colorado, New Mexico, and Mississippi. Naturally occurring radionuclides, such as uranium isotopes and radium-226, were detected in samples collected at most locations at levels which were comparable to concentrations measured for previous years. Tritium was measured in all surface water samples at levels up to 3.0×10^{-6} µCi/ml, which is not significantly different than the upper range in concentrations (2.5×10^{-6} µCi/ml) observed in the past from atmospheric fallout. Except for samples collected at wells known to be contaminated by the injection of high concentrations of radioactivity for tracer studies, no radioactivity related to past underground tests or to the contaminated wells was identified. However, three anomalies in ^{3}H concentrations were observed for well samples. One of the anomalies involved a monthly sample collected on-NTS from Well U3CN-5, which had a ^{3}H concentration of 3.3×10^{-7} µCi/ml. The concentration cannot be explained, as all concentrations prior to and after the sample have been 5.1×10^{-8} µCi/ml or less. The other two anomalies concern two semi-annual samples collected on-NTS at Well B, which were collected from the well this year for the first time. The Well B samples had concentrations of 2.5×10^{-7} µCi/ml and 2.6×10^{-7} µCi/ml. Although no explanation for all three results is available at this time, the concentrations are only <0.01 percent of the Concentration Guide (3×10^{-3} µCi/ml) for occupational exposures.

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 monitors 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, portable air samplers, and supplies for collecting environmental samples, were prepared to conduct a monitoring program directed from the NTS Control Point 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 monitors 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, ERDA, the following quantities of radionuclides were released into the atmosphere during CY 1976:

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

Radionuclide		Quantity Released (Ci)
^{3}H		3.11
^{133}Xe		87.70
^{133m}Xe		0.23
^{135}Xe		C.01
	Total	91.05

Continuous low-level releases of ^{3}H 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 quantitated, but are detected at on-site sampling 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 ERDA Concentration Guides (CG's) listed in Appendix B. Unless specificly 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 midpoint 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 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 basis. All quality assurance checks for the year identified no 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. A description of the procedures and results is presented in Appendix C. From the results of the program, the variances that have been 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 one 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), operated by the EMSL-LV, consisted of 48 active and 73 standby sampling stations located in 21 Western States (Figures 8 and 9). 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 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 67 standby stations could have been activated, if necessary, by a telephone request to station operators. 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 was believed to have 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 with station operators. In anticipation of airborne radioactivity from the atmospheric nuclear tests by the People's Republic of China on September 25 at 2200 hours PDT, and on November 16 at 2200 hours PST, 67 of the standby stations were activated with charcoal cartridges during the respective periods September 29 through October 15 and November 18-26.

During the report period, no airborne radioactivity related to the underground nuclear testing program at the Nevada Test Site was detected on filter samples or charcoal cartridges from the ASN. However, radioactivity from both nuclear tests by the People's Republic of China was detected on filter samples. Appendix D describes and summarizes the analytical results of those samples containing radioactivity from these tests.

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 10.

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 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 1.7×10^{-11} μCi/ml to 2.0×10^{-11} μCi/ml, with an overall average of 1.93×10^{-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 world-wide, primarily as a result of nuclear reactor operations. Based upon the Network average concentrations over a 5-year period, this increase amounts to 5×10^{-14} to 1.2×10^{-13} μCi/ml/y.

TABLE 3. ANNUAL AVERAGE CONCENTRATIONS OF ^{85}KR 1972-1976

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

The maximum concentrations for all stations ranged from 2.4×10^{-11} μCi/ml to 2.9×10^{-11} μCi/ml. Previously, those concentrations equal to or greater than 2.5×10^{-11} μCi/ml were attributed to some outside source or anomalous variations. However, from the expected geometric standard deviation resulting from the sampling and analytical/counting errors, as determined from the Replicate Sampling Program (Appendix C), the 99% upper confidence limits (UCL's) on the geometric mean concentrations of ^{85}Kr were determined as 3.0×10^{-11} μCi/ml or 3.6×10^{-11} μCi/ml depending upon whether one is considering the location having the lowest geometric mean concentration (1.67×10^{-11} μCi/ml at Hiko) for the year or the location with the highest geometric mean concentration (2.01×10^{-11} μCi/ml at BJY). Based upon the UCL's, all the Network stations had variations in ^{85}Kr concentrations which were consistent with variations one would expect from the total errors of sample collection and analysis determined from the Replicate Sampling Program.

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 above the expected upper limit of background (approximately 1.0×10^{-6} μCi/ml H_2O) used in the past. From the estimate of sampling and analytical counting errors for this type of sample (Appendix C), this upper limit appears to be reasonable; however, an evaluation of the cumulative frequency distributions of the annual data for each station indicates that occasional concentrations above this limit were all within the cumulative frequency distribution of environmental background except for Death Valley Junction, which had a ^3H concentration of 4.2×10^{-6} µCi/ml of atmospheric moisture during the period August 24-31. This indicates that the variances in concentrations for the other off-NTS stations were normal variations in environmental background. The total of the average ^3H concentrations ($HTO+HT+CH_3T$) at this location was 7.0×10^{-12} µCi/ml, or <0.01 percent of the Concentration Guide (CG) for continuous exposure to a suitable sample of the exposed population.

The average concentrations of ^3H as HT (Table A-3) at all off-NTS stations and at the on-NTS stations Mercury and Area 51 were generally less than the averages for these locations last year, whereas the average concentrations for Area 12 and BJY were slightly higher than last year's averages. From a review of the cumulative frequency distributions of the data for each station, all concentrations seemed to be part of the environmental background.

Concentrations of ^3H as CH_3T were below the MDC at all locations as normally observed except for a few detectable concentrations at all locations except Diablo during the months of September through November. The maximum concentrations for all locations ranged between 4.0×10^{-12} µCi/ml to 1.8×10^{-11} µCi/ml. The total of the average ^3H concentrations ($HTO+HT+CH_3T$) for the location having the highest CH_3T concentration (1.8×10^{-11} µCi/ml at Indian Springs) was <0.03 percent of the CG for exposure to a suitable sample of the exposed population. Since the detectable concentrations occurred generally throughout the Network during the same period, the concentrations were not attributed to NTS operations.

DOSIMETRY NETWORK

The Dosimetry Network during the first three quarters of 1976 consisted of 70 locations surrounding the Nevada Test Site which were monitored continuously with thermoluminescent dosimeters (TLD's). Eight stations were added to the network in the fourth quarter of 1976 in order to improve the geographic distribution and population coverage, but these will not be reported until 1977. The locations of all stations, shown in Figure 11, are within a 270-km radius of the center of the NTS and 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.

The model 2271-G2 dosimeters consist of two small "chips" of dysprosium-activated calcium fluoride, designated TLD-200 by Harshaw, 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 one metre 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 similar 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 at the particular station location. Experience has shown these variations to be significant from one monitoring period to another, occasionally approaching 20 percent, which is decidedly greater than the precision of the dosimeters themselves. From the results of the Replicate Sampling Program, Appendix C, the 99% upper confidence limit for variations from the geometric mean due to precision errors was estimated to be 14%. Typically, the smallest net exposure observable for a 90-day monitoring period would be 5-15mR in excess of background. 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/y) measured at each station in the network during 1976 due to penetrating gamma radiation. Only one station, a relatively new station, Mammoth Mountain, California, (260 km northwest of CP-1, NTS) showed a small (8mR) exposure in excess of the estimated background. Due to varying amounts of snow cover during the year, this station may exhibit unusually large variations in the observed exposure rate as a consequence of its location. Further investigation is necessary to determine the actual cause, though it is undoubtedly unrelated to the current testing program at NTS. Only one of the cooperating off-site residents exhibited exposures (3-4mR) in excess of the estimated background, but an investigation has indicated that this is probably due to local variations in natural background and is unrelated to NTS activities.

The average exposure rate for the Dosimetry Network was approximately the same in 1976 as in 1975, despite the fallout detected by the Air Surveillance Network from atmospheric tests conducted by the People's Republic of China in September and November. Unusually low levels of world-wide fallout prevailed throughout the year, though this may have been partially offset by the increased cosmic ray flux, as 1976 marked the minimum of the 11-year solar activity cycle (Anderson, 1972). The table below shows the decreasing trend of the dose due to environmental radiation from 1971 through 1976 for the Dosimetry Network.

TABLE 4. DOSIMETRY NETWORK SUMMARY FOR THE YEARS 1971-1976

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

During 1976, investigations continued into the calibration techniques for the TLD's used by the Dosimetry Network. Through EMSL-LV participation in an international dosimeter intercomparison as well as a series of laboratory studies, it was discovered that two significant factors were being underestimated, leading to a general underestimation of the exposure measured by the 2271-G2 dosimeters. First, inadequate allowance was being made for scattered radiation present during the calibration exposure process using ^{137}Cs. By changing to a more appropriate exposure geometry, a change of approximately 12% was noted. Secondly, inadequate allowance for fading of the stored TL signal within the dosimeter was being made. By exposing the calibration controls halfway through the issue-collection cycle, as well as placing pre-irradiated dosimeters at each station in addition to the routine ones, a more precise compensation for signal fading may be achieved. The data presented in this report have been calculated in this manner, as will the data in future reports. Similar corrections to the 1975 data resulted in the values shown in the above table which are 5-16% higher than those previously reported.

While it is nearly impossible to make comparisons of Dosimetry Network data with other in situ measurements - as very few have been made - comparisons of measurements taken with these dosimeters at other locations show reasonable agreement with recognized standards. For example, in the Second International Intercomparison of Environmental Dosimeters conducted during the winter of 1975-76 in New York, after corrections for fading and scattered radiation during calibration were made, the EPA estimate of the field exposure was 17.5mR compared to the accepted value of 17mR measured with a pressurized ionization chamber (Burke et al., 1976). This difference is well within the estimated precision of the EPA dosimetry system.

The function of the Dosimetry Network is to measure the radiation exposures, if any, due to releases of radioactivity from the NTS. To do this accurately requires establishment of the environmental background radiation exposure rate at each monitoring station so that an exposure in excess of that background can 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.

A network of 30 stationary gamma exposure rate recorders placed at selected air sampling locations was used to document gamma exposure rates at fixed locations (Figures 8 and 9). These recorders use a 2.5- by 30.5-cm constant-current ionization chamber detector filled with methane, and operate on either 110V a.c. or on a self-contained battery pack. They have a range of 0.004 mR/h to 40mR/h with an accuracy of about $\pm$ 10 percent. Beginning in October of this report period, all but the following 10 stations in Nevada were placed on standby: Alamo, Beatty, Diablo, Goldfield, Indian Springs, Lathrop Wells, Nyala, Scotty's Junction, Stone Cabin Ranch, Tonopah, and Twin Springs Ranch. During the year, no increase in exposure rates attributable to NTS operations was detected by the network of gamma-rate 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, $^{89,90}Sr$, ^{131}I, ^{137}Cs, and ^{140}Ba. A seventh radionuclide, ^{40}K, also occurs in milk at a reasonably constant concentration of about 1.2×10^{-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 1976 (Figure 12), consisted of 22 different locations where 3.8-litre milk samples were collected from 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 1975, 89 milk samples were collected from the MSN on a quarterly collection schedule. Sampling was terminated at the dairies in Bishop, Hiko, and Alamo, due to their going out of business. No replacements for the ones at Bishop and Alamo were available; however, sampling was begun at the Hansen Ranch as a replacement for the Schofield Dairy at Hiko.

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 158 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 year, 110 milk samples were collected and analyzed by gamma spectrometry. Samples selected from all Western States were also analyzed for ^{3}H and $^{89,90}Sr$.

The analytical results of milk samples collected from the MSN during 1976 are summarized in Table A-5, where the maximum, minimum, and average concentrations of the ^{137}Cs, $^{89,90}Sr$, and ^{3}H in samples collected during the year are shown for each sampling location. As shown by the following Table 5, the average radionuclide concentrations for the whole Network are comparable to those for the SMSN, if not slightly lower.

TABLE 5. 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	^{137}Cs	87	<10	<2	<4
	^{90}Sr	88	6.5	<0.6	<2
	^{3}H	23	<700	<300	<400
SMSN	^{137}Cs	110	11	<4	<7
	^{90}Sr	55	8.9	<0.7	<3
	^{3}H	29	1500	<300	<500

The observed levels of ^{90}Sr in milk from the area covered by the MSN are generally below concentrations measured in other locations in the United States due to the low rainfall and, subsequently, low deposition of ^{90}Sr in Nevada. As shown in Figure 13, higher concentrations of ^{90}Sr measured by this Network normally occur to the north of the NTS. This is suspected to be the result of close-in fallout following the atmospheric nuclear tests during the 1950's and the higher rainfall that occurs north of the NTS. These higher concentrations are still below the concentrations measured in many parts of the country and are distinguishable only because of the low concentrations which normally prevail in this area.

LONG-TERM HYDROIOGICAL 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 well heads or spring discharge points wherever possible. Prior to each sampling at a wellhead, water was pumped from the acquifer to assure the collection of representative samples. If pumps were not available, an electrical-mechanical water sampler capable of collecting 3-litre samples at depths to 1800 m was used.

Nevada Test Site

For the NTS, attempts were made to sample 10 locations monthly and 22 locations semi-annually (Figures 14 and 15). Additionally, samples were collected annually from 10 locations selected from the former Water Surveillance Network, which was discontinued in 1975. Not all stations could be sampled with the desired frequency because of inclement weather conditions and inoperative pumps.

During the year, sampling at Well 20A-2 and Well 19g-s was discontinued because of possible collapse of the wells from nuclear tests in the area. Also Well J-12 was redesignated as a standby to Well J-13. Well 2, which was previously sampled semi-annually, was added to the group of locations sampled monthly.

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 compares them to the CG's (Appendix B). As indicated by the tables, all observed concentrations of the man-made radionuclides ^{3}H, $^{89,90}Sr$, and $^{238,239}Pu$ were either below the MDC's or small fractions of the CG's. The concentrations of these radionuclides in all wells not contaminated by radioactive tracer studies were also in conformance with the recently promulgated EPA Drinking Water Regulations (Appendix B), even though few of the wells are used for drinking water.

As in the past, ^{3}H was detected in NTS Wells C and C-1 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.

Due to the absence of information on background levels of ^{3}H in all other deep wells, the ^{3}H concentrations measured by the program can only be compared to previous determinations. Such a comparison for each location indicated that there are no significant increases in concentrations which could be the result of ^{3}H migration from the sites of underground nuclear detonations. Many of the samples collected from wells had ^{3}H concentrations near the MDC with fluctuations occasionally above the MDC. These variations appear to be comparable to the variations from the sampling and analytical/counting errors estimated from samples receiving ^{238}U analyses. The 99% upper confidence limits for samples receiving ^{238}U analyses (Appendix C) were 4-9 times the geometric mean concentration, depending upon whether the samples were collected from well heads or with the electrical-mechanical water sampler. Assuming that the geometric mean for a given location is near the MDC for ^{3}H, (approximately 9.0×10^{-9} µCi/ml), the highest concentration of ^{3}H one would expect at the 99% confidence level would be 4.0×10^{-8} µCi/ml to 8.0×10^{-8} µCi/ml. All ^{3}H concentrations in samples from the wells were below these levels except for one sample from Well U3CN-5 (3.30×10^{-7} µCi/ml) and the two semi-annual samples from Well B (2.6×10^{-7} µCi/ml and 2.5×10^{-7} µCi/ml). Since the ^{3}H concentrations in samples from Well U3CN-5 in past years have never exceeded 5.1×10^{-8} µCi/ml, this value is considered an anomaly. Well B was sampled this year for the first time, so no past information on the ^{3}H concentration in this well is available.

The ^{226}Ra and $^{234,235,238}U$ detected in most of the water samples occur naturally in groundwater. The concentrations of these radionuclides for this reporting period were similar to the concentrations reported for previous years.

Tables A-7, A-8, and A-9 show concentrations of ^{90}Sr, ^{238}Pu, and ^{239}Pu which were above their respective MDC's. These concentrations, with two-sigma counting error and percentage of the appropriate Concentration Guide, are shown as follows in Table 6.

TABLE 6. DETECTABLE CONCENTRATIONS OF ^{90}SR, ^{238}PU, ^{239}PU IN WATER SAMPLES

Location	Radionuclide	Conc. ±3-Sigma Counting Error (10^{-9} µCi/ml)	% of Conc. Guide
Well UE5C	^{238}Pu	0.19 ± 0.10	<0.01
Beatty City Supply	^{239}Pu	0.062 ± 0.041	<0.01
Las Vegas Well 28	^{90}Sr	1.1 ± 0.72	0.4
Lathrop Wells City Supply	^{239}Pu	0.032 ± 0.030	<0.01
Twin Springs Ranch	^{239}Pu	0.024 ± 0.027	<0.01
Tonopah City Supply	^{238}Pu	0.027 ± 0.035	<0.01
	^{239}Pu	0.020 ± 0.024	<0.01

All of the preceding concentrations are less or only slightly greater than their respective three-sigma counting errors; therefore, all the concentrations are considered to be the result of statistical error and not necessarily true indications of the presence of these radionuclides.

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 except for Project Cannikin on Amchitka Island, Alaska, and Project Rio Blanco near Meeker, Colorado. The latter two sites are the responsibility of other agencies. 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; and Project Dribble at Tatum Dome, Mississippi. Figures 16 through 22 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 using the same criteria (Table A-6) as for samples from the NTS Programs. The analytical results of all water samples collected during CY 1976 are summarized in Table A-10 and compared to the CG's (Appendix B). In general, the concentrations of the man-made radionuclide ^{3}H, $^{89,90}Sr$, and $^{238,239}Pu$ were less than the MDC's or a small fraction of the CG's. The concentrations of these radionuclides in all wells not previously contaminated by radioactive tracer studies were also in conformance with the EPA Drinking Water Regulation (Appendix B), although few of the wells are actually used for drinking water. The concentrations of the naturally occurring radionuclides ^{226}Ra and $^{234,235,238}U$ were consistent with levels seen for previous years. All ^{3}H concentrations in well samples were similar to concentrations measured during previous years.

The only sample results showing radioactivity concentrations significantly above background levels were for USGS Wells Nos. 4 and 8 near Malaga, New Mexico. As mentioned in previous reports, these wells, which are fenced, posted, and locked to prevent their use by unauthorized personnel, were contaminated by the injection of high concentrations of radioactivity for a radioactive tracer study.

All surface water samples had ^{3}H concentrations no greater than 2.5×10^{-6} µCi/ml, a level considered from past experience to be the highest one would expect from atmospheric fallout, except for a sample ($3.0 \times 10^{-6} \pm 0.26 \times 10^{-6}$ µCi/ml) collected from Half Moon Creek Overflow, near Baxterville, Mississippi. Considering the counting error of this sample, the ^{3}H concentration was not considered to be significantly different from fluctuations in background.

One surface water sample from Battlement Creek near Grand Valley, Colorado, had a measured concentration of ^{90}Sr of $1.6 \pm 0.85 \times 10^{-9}$ µCi/ml, which is 0.5 percent of the CG. The concentration was only slightly greater than the 3-sigma counting error;

therefore, the concentration was considered to be the result of statistical error and was not necessarily a true indication of the presence of this radionuclide. The concentrations of this radionuclide in samples collected previously to this report period were all less than the MDC for ^{90}Sr.

WHOLE-BODY COUNTING

During 1976, the measurements of body burdens of radioactivity in selected off-site residents were continued. The whole-body counting facility was described in a previous report (NERC-LV-539-31, 1974).

About 49 off-site residents from 13 locations were examined twice during the year. The home locations of these individuals were Pahrump, Lund, Beatty, Caliente, Pioche, Nyala, Round Mountain, Ely, Tempiute, Goldfield, Lathrop Wells, Tonopah, and Spring Meadows Farms, Nevada. When possible, all members of a family were included.

The minimum detectable concentrations for ^{137}Cs by whole-body counting was $5x10^{-9}$ µCi/g for a body weight of 70 kg and a 40-minute count. Each individual was also given a complete hematological examination and a thyroid profile. A urine sample was collected from each individual for ^{3}H analysis, and composite urine samples from each family were analyzed for $^{238,239}Pu$.

From the results of whole-body counting, the fission product ^{137}Cs was detected above the detection limit in 82 individuals. The maximum, minimum, and average concentrations for this radionuclide were $2.8x10^{-8}$, $5.0x10^{-9}$, and $1.2x10^{-8}$ µCi/g body weight, respectively, which were similar to last year's concentrations (maximum of $4.3x10^{-8}$; minimum of $5.0x10^{-9}$; and average of $1.4x10^{-8}$ 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. The concentrations of ^{238}Pu and ^{239}Pu in all urine samples were $<3x10^{-10}$ µCi/ml and $<1x10^{-10}$ µCi/ml, respectively. Concentrations of ^{3}H in urine samples were observed above the MDC of the measurement; however, the levels observed (average of $0.7x10^{-6}$ µCi/ml with a range of $0.2x10^{-6}$ 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 ^3H at Death Valley Junction. The above background concentration of ^3H occurred only in one sample collected over the period August 24-31. The ^3H concentration in this sample was 4.2×10^{-6} µCi/ml H_2O or 2.9×10^{-11} µCi/ml air. Based upon an ambient ^3H concentration of 2.0×10^{-12} µCi/ml air, the net ^3H concentration at Death Valley Junction was 2.7×10^{-11} µCi/ml. The whole-body dose from this concentration was estimated as

$$\frac{(2.7 \times 10^{-11}\ \mu Ci/m^3)\ (7\ days)\ (500\ mrem/year)}{(2.0 \times 10^{-7}\ \mu Ci/m^3)\ (365\ days/year)} = 1.3\ \mu rem.$$

The 80-km dose commitment for the area between the NTS and Death Valley Junction (population of 600) was estimated to be 0.00078 man-rem.

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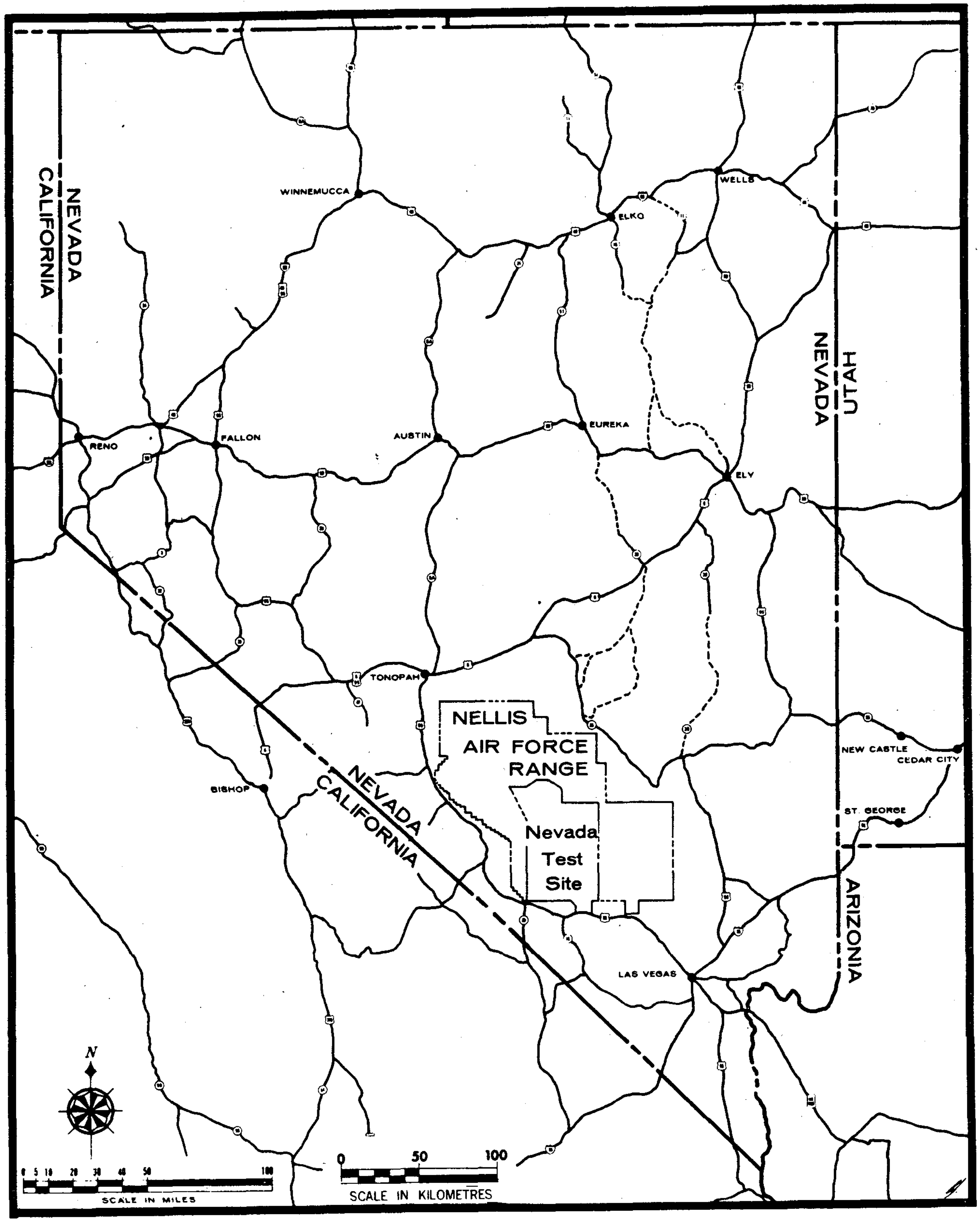


Figure 1. Nevada Test Site Location

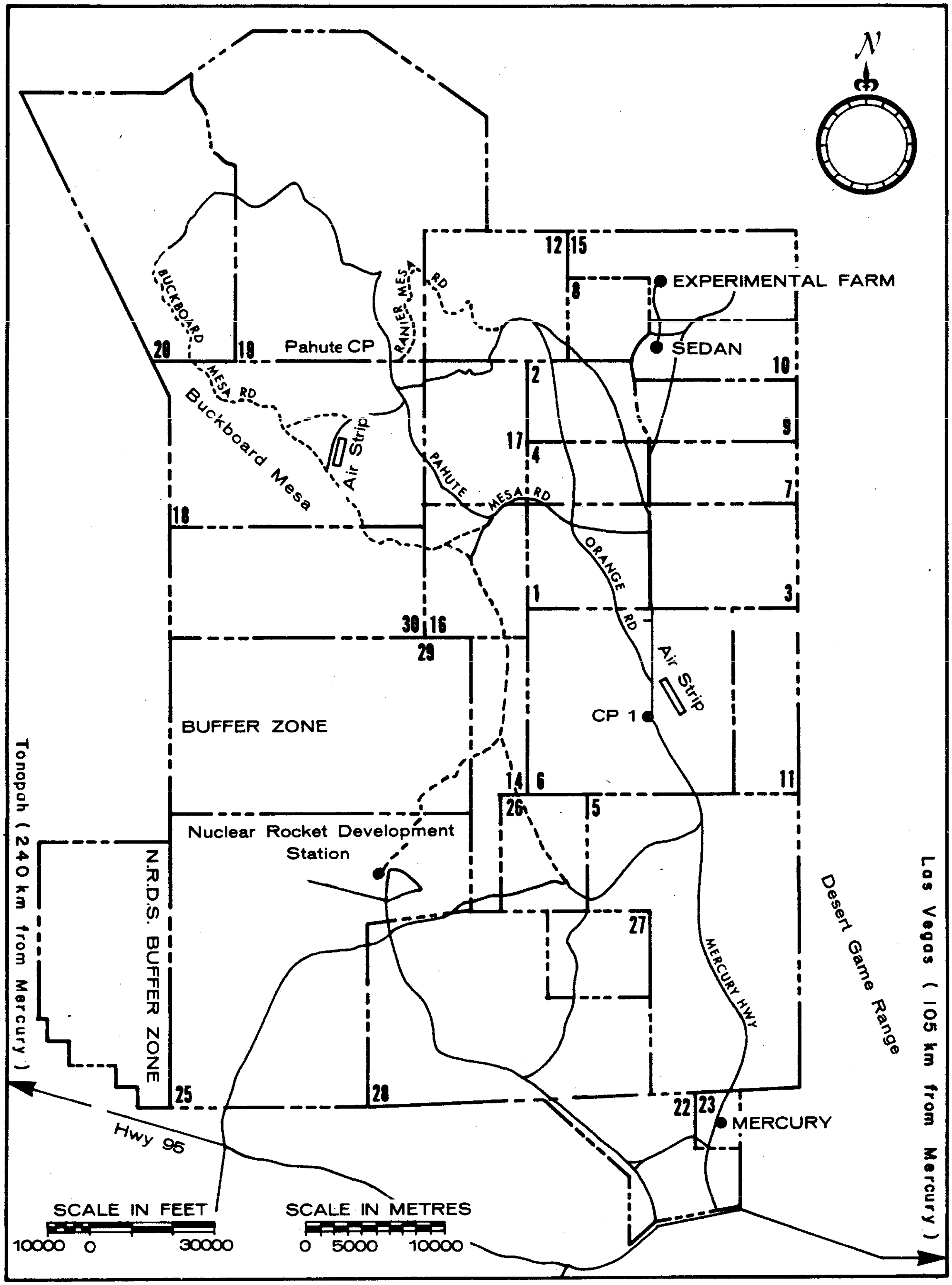


Figure 2. Nevada Test Site Road and Facility Map

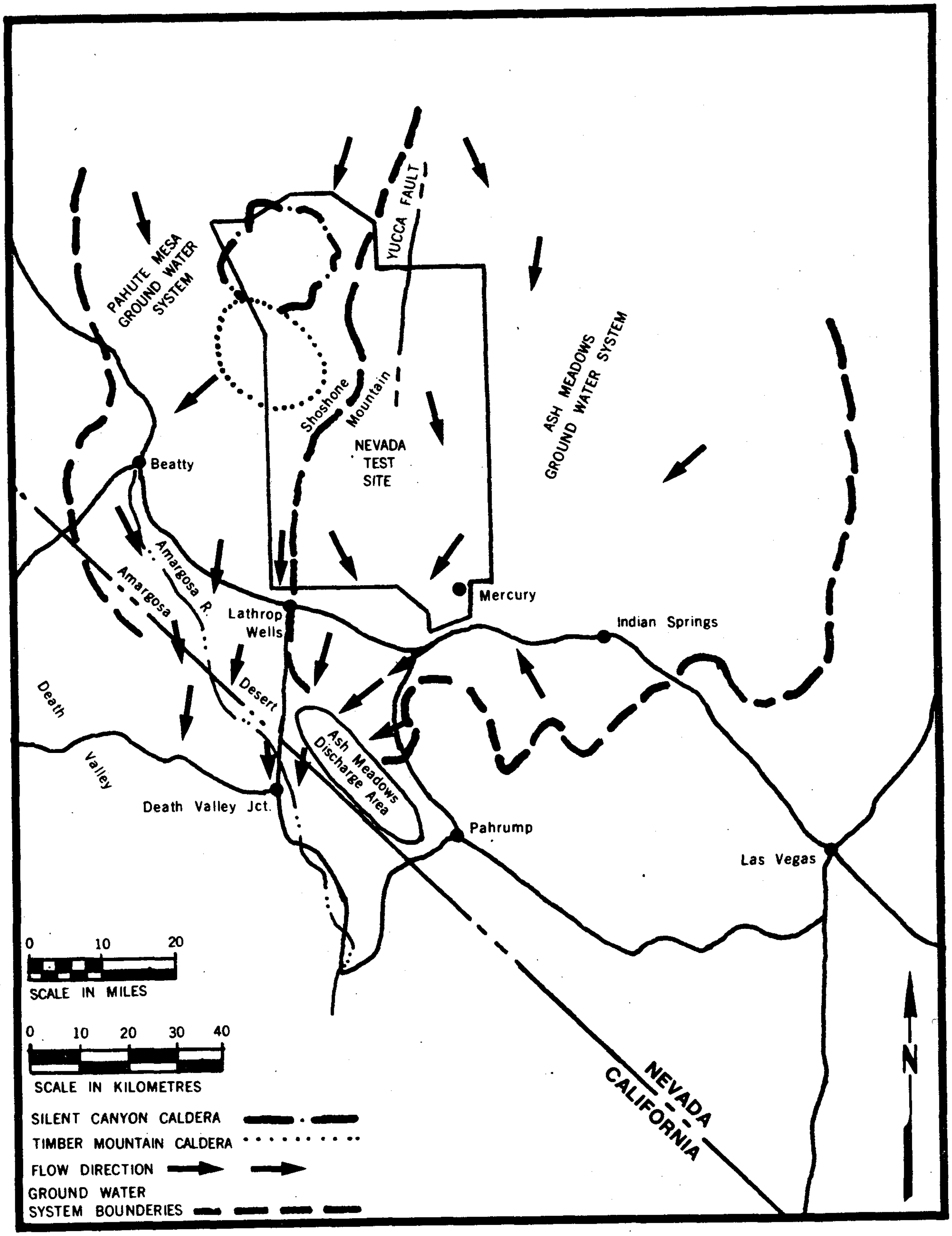
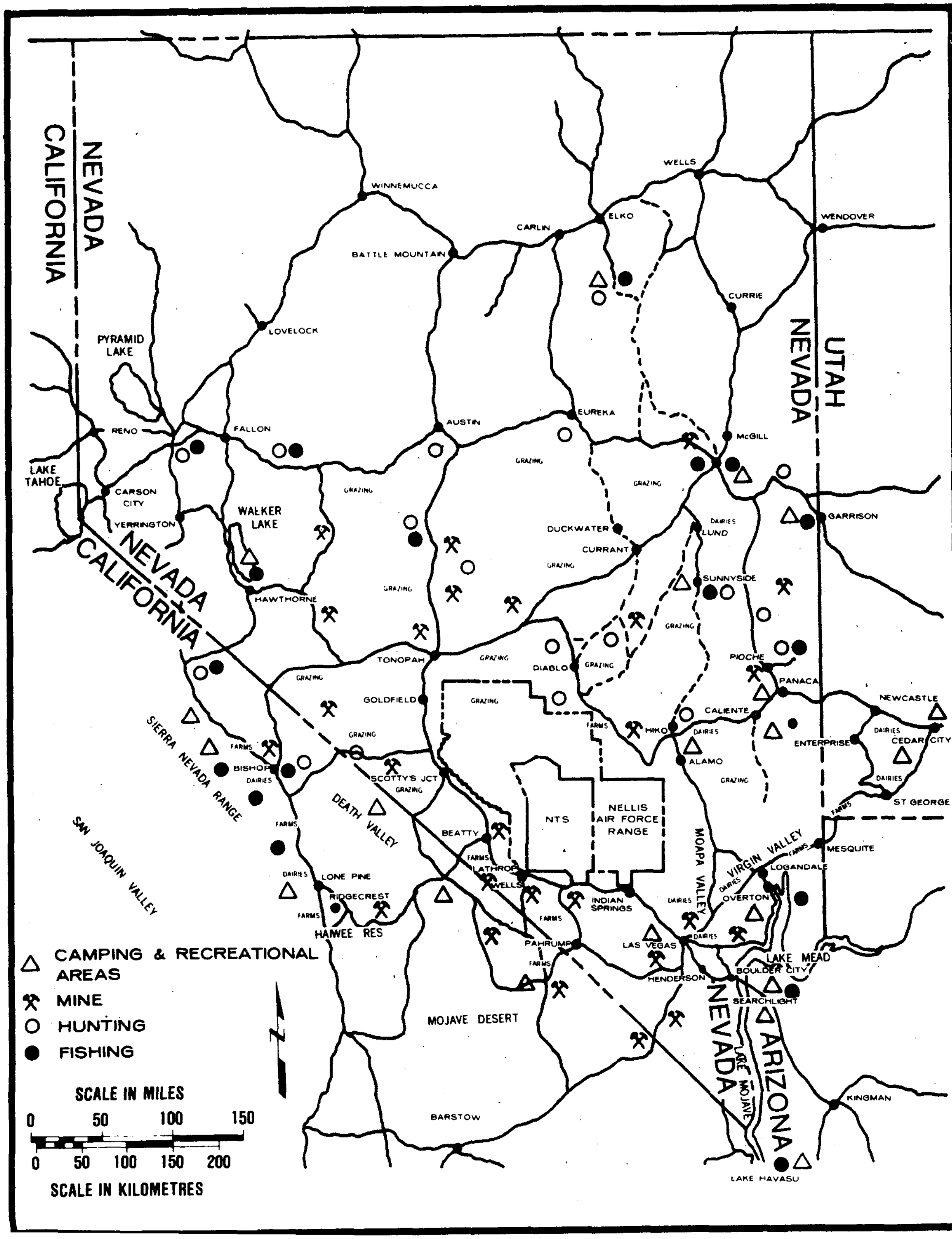


Figure 3. Groundwater Flow Systems - Nevada Test Site


NEVADA
CALIFORNIA
UTAH
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ARIZONA
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CALIFORNIA
WINNEMUCCA
WELLS
ELKO
CARLIN
WENDOVER
BATTLE MOUNTAIN
CURRIE
LOVELOCK
PYRAMID LAKE
RENO
FALLON
AUSTIN
EUREKA
McGILL
LAKE TAHOE
CARSON CITY
YERRINGTON
WALKER LAKE
GARRISON
DUCKWATER
LUND
CURRANT
SUNNYSIDE
HAWTHORNE
TONOPAH
DIABLO
PIOCHE
PANACA
GOLDFIELD
CALIENTE
NEWCASTLE
HIKO
ALAMO
ENTERPRISE
CEDAR CITY
ST GEORGE
SIERRA NEVADA RANGE
BISHOP
SCOTTY'S JCT
DEATH VALLEY
NTS
NELLIS AIR FORCE RANGE
MOAPA VALLEY
VIRGIN VALLEY
MESQUITE
LOGANDALE
OVERTON
SAN JOAQUIN VALLEY
BEATTY
LATHROP WELLS
INDIAN SPRINGS
LONE PINE
RIDGECREST
HAIWEE RES
LAS VEGAS
PAHRUMP
HENDERSON
LAKE MEAD
BOULDER CITY
SEARCHLIGHT
MOJAVE DESERT
LAKE MOJAVE
KINGMAN
BARSTOW
LAKE HAVASU
GRAZING
FARMS
DAIRIES
CAMPING & RECREATIONAL AREAS
MINE
HUNTING
FISHING
SCALE IN MILES
0 50 100 150
0 50 100 150 200
SCALE IN KILOMETRES

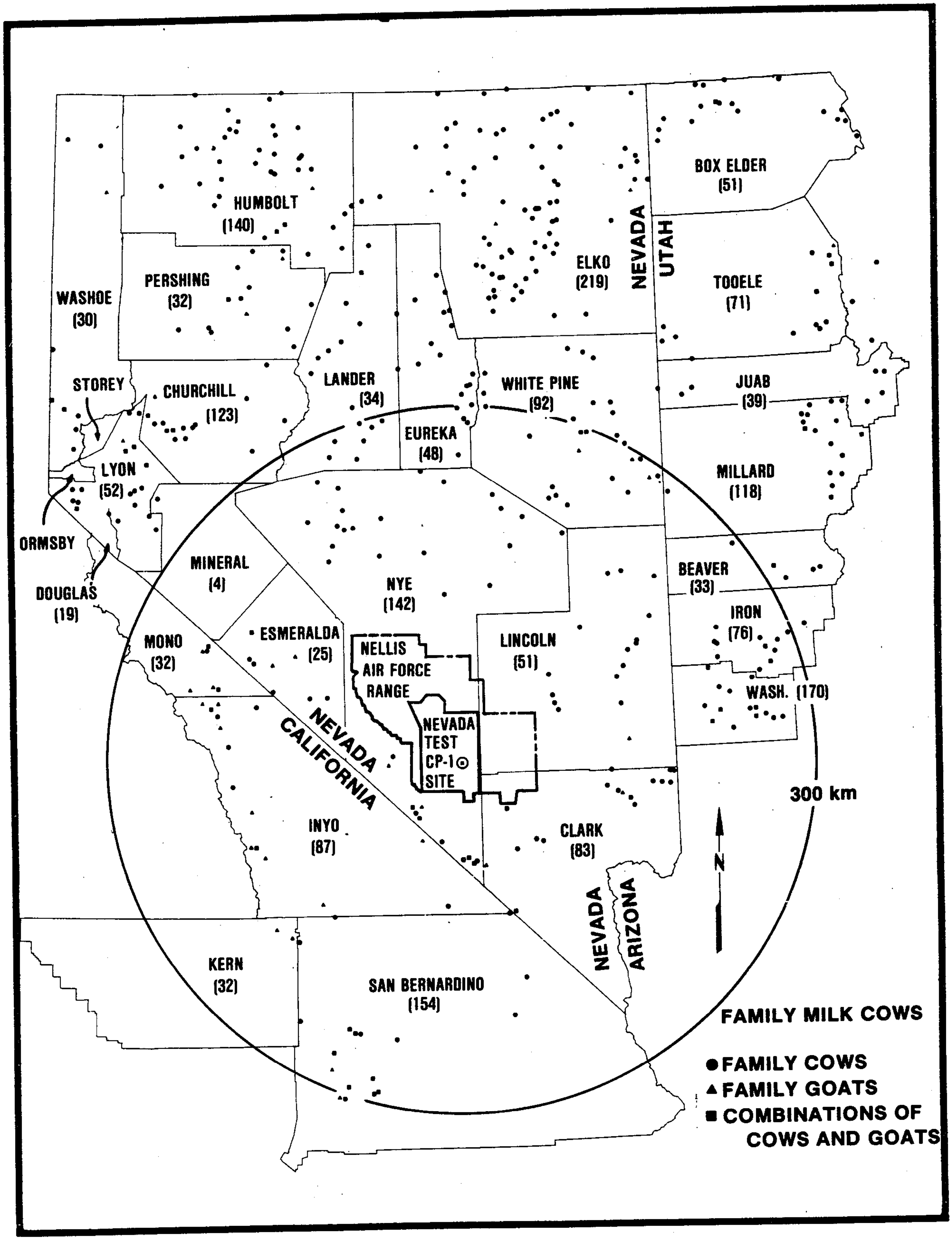

Figure 5. Location and Number of Family Milk Cows and Goats

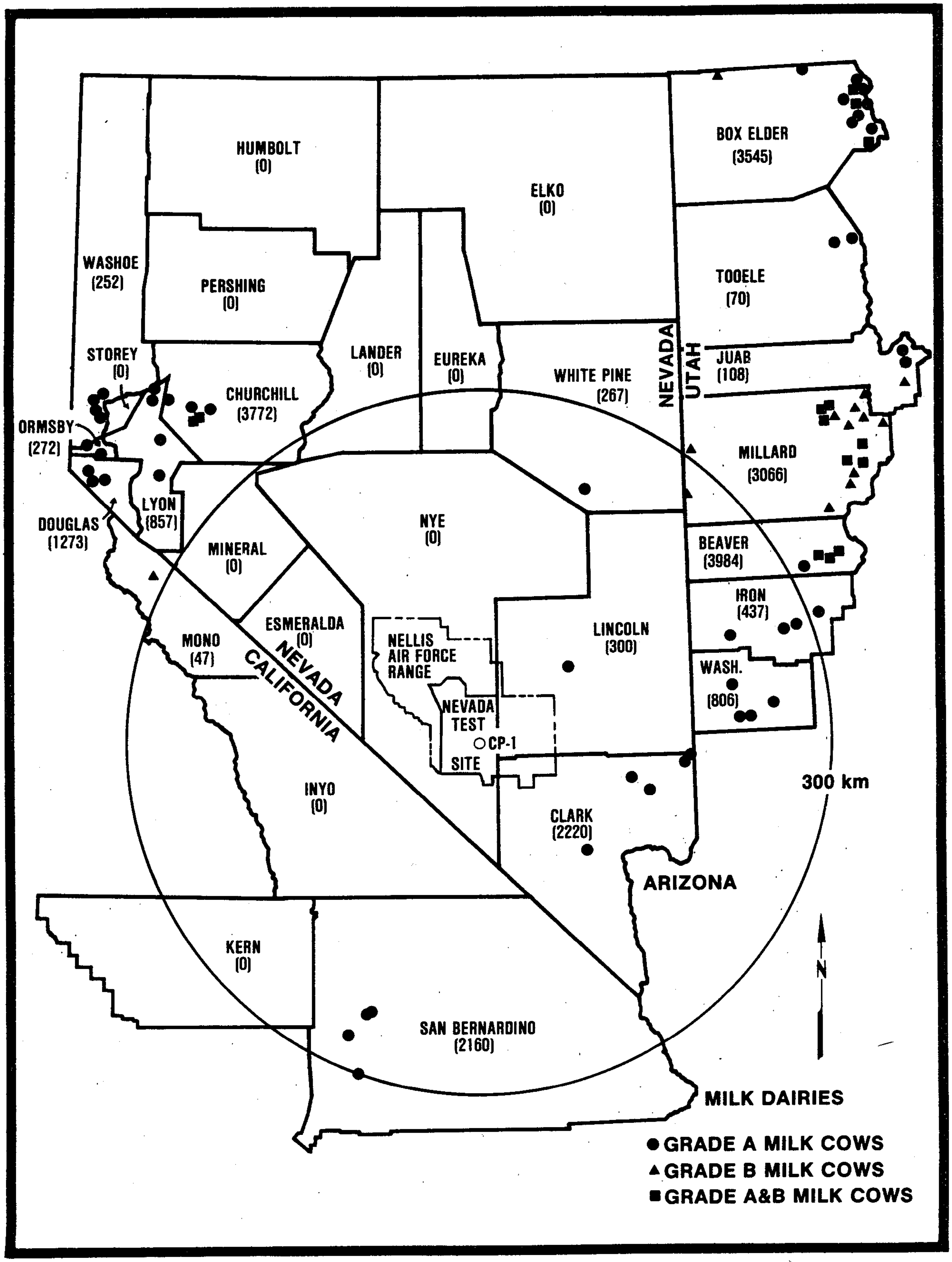

Figure 6. Location and Number of Dairy Cows

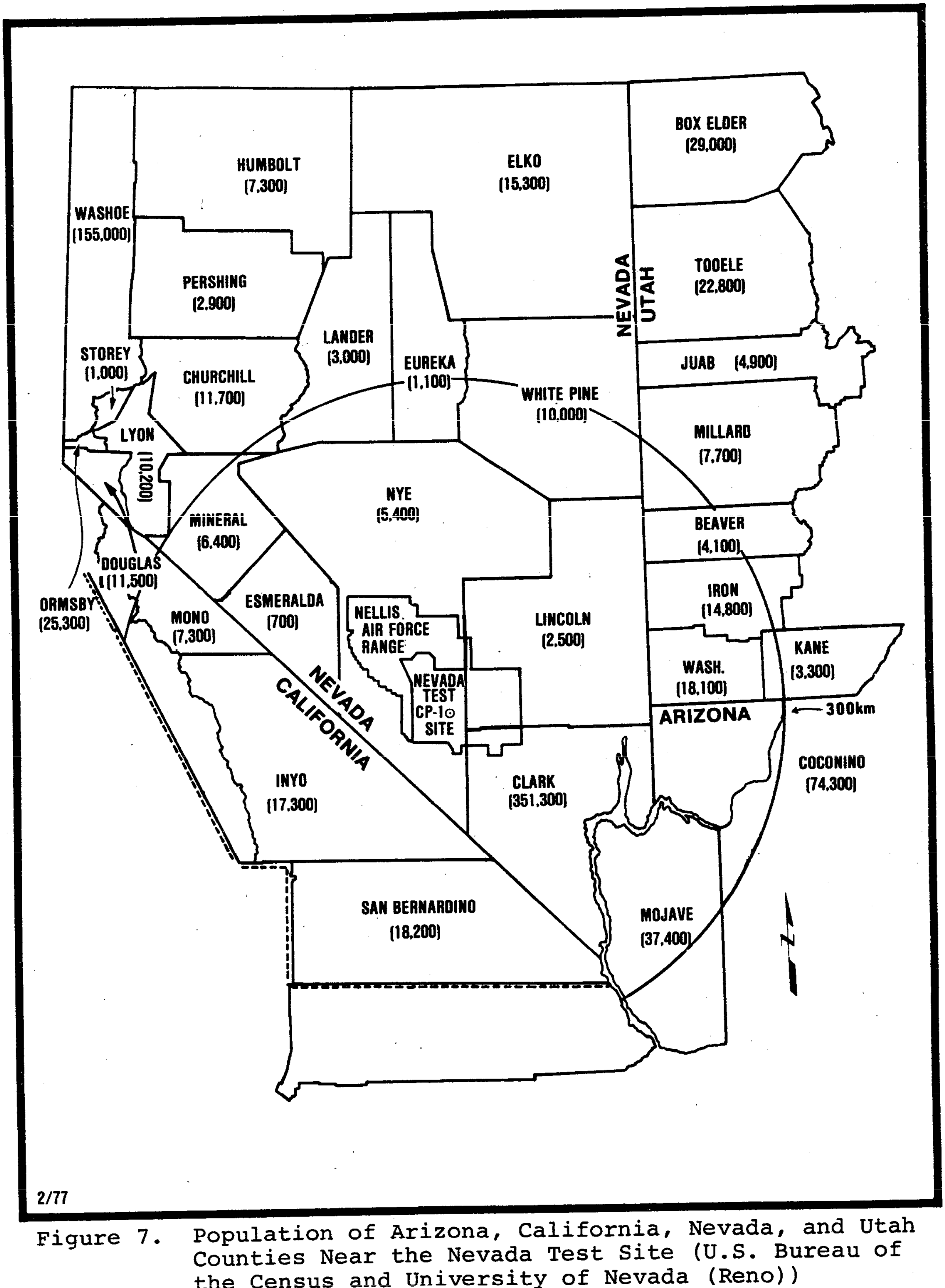

Figure 7. Population of Arizona, California, Nevada, and Utah Counties Near the Nevada Test Site (U.S. Bureau of the Census and University of Nevada (Reno))

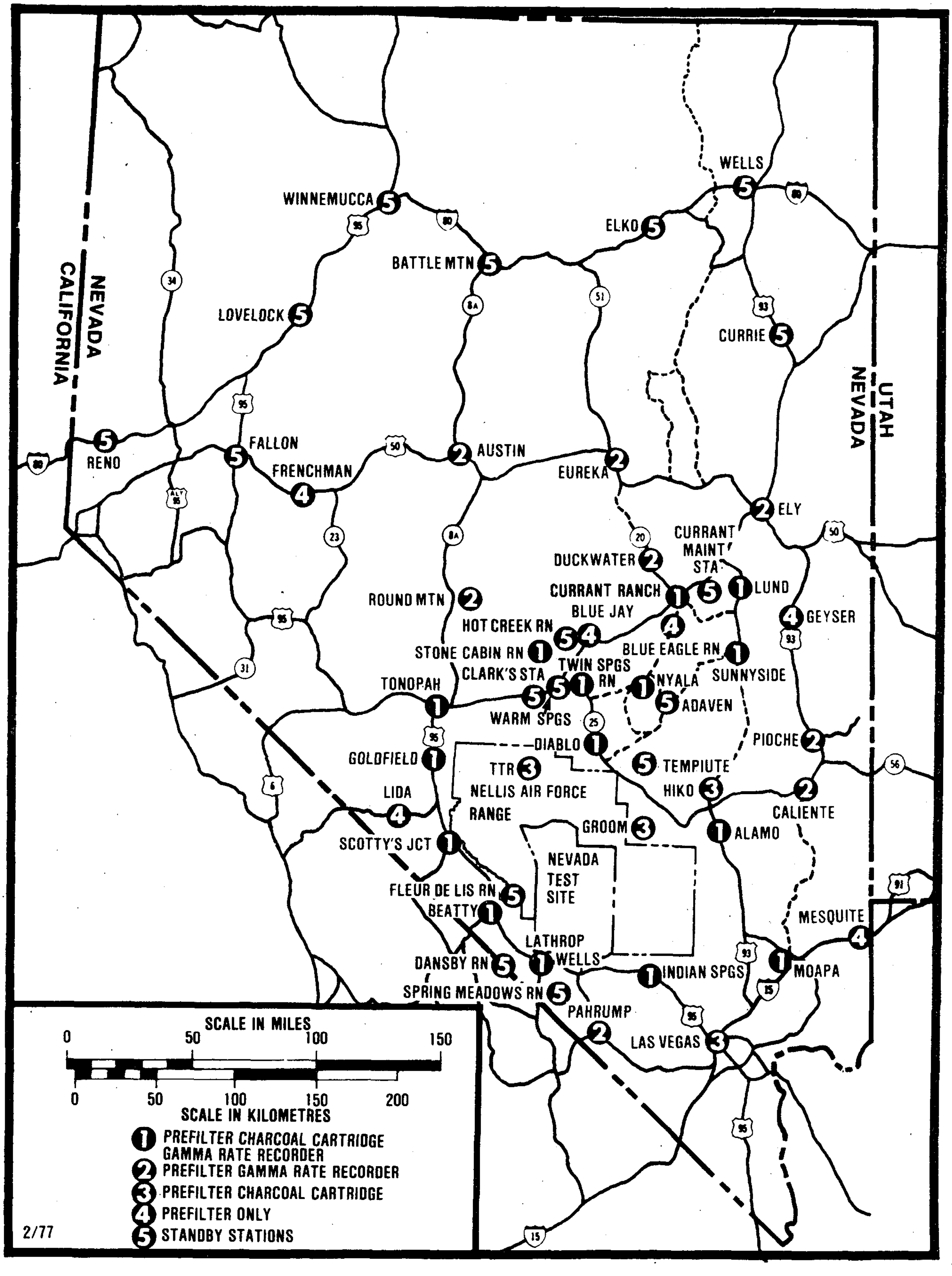

Figure 8. Nevada Air Surveillance Stations

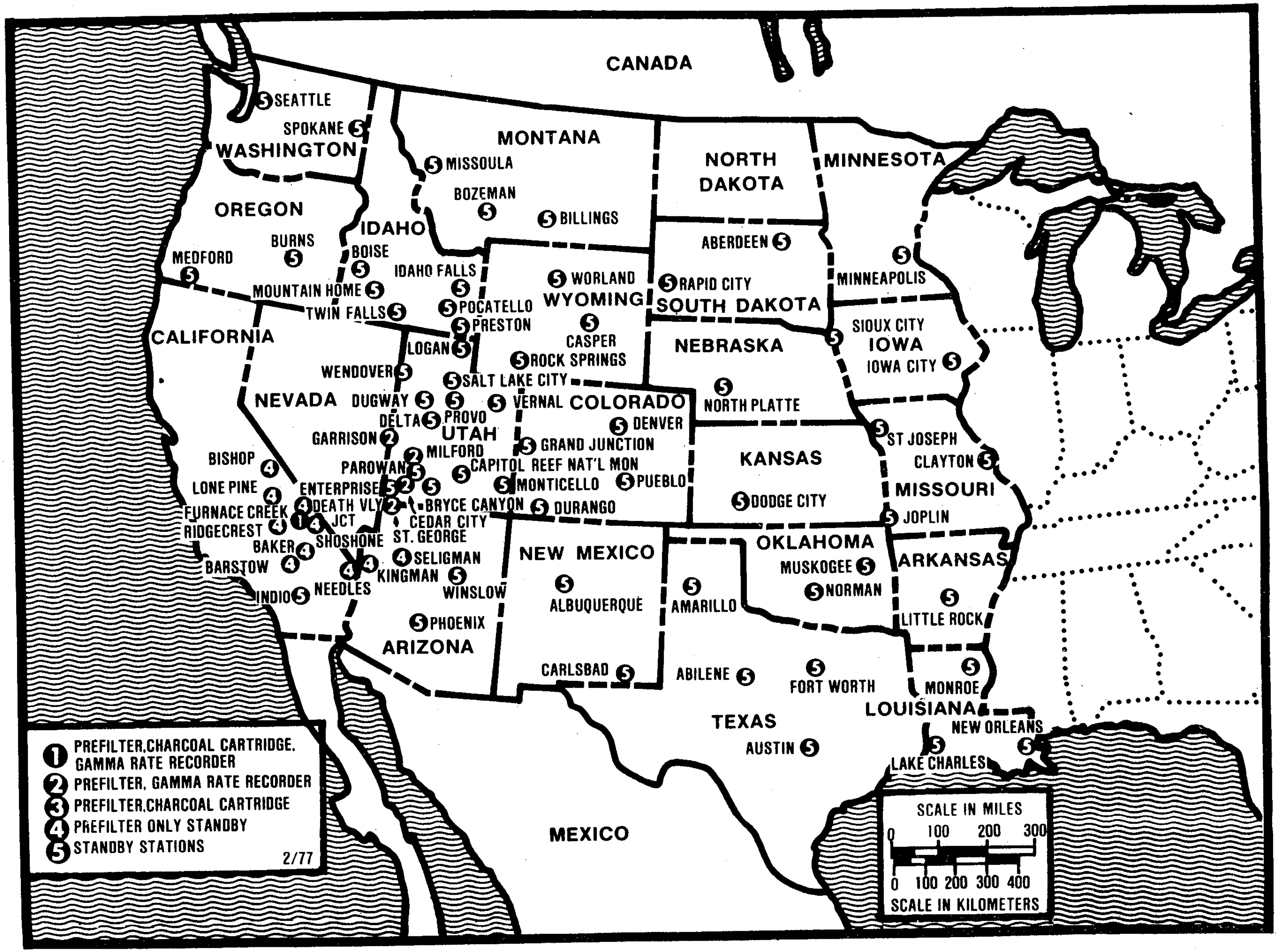

Figure 9. Air Surveillance Stations Outside of Nevada

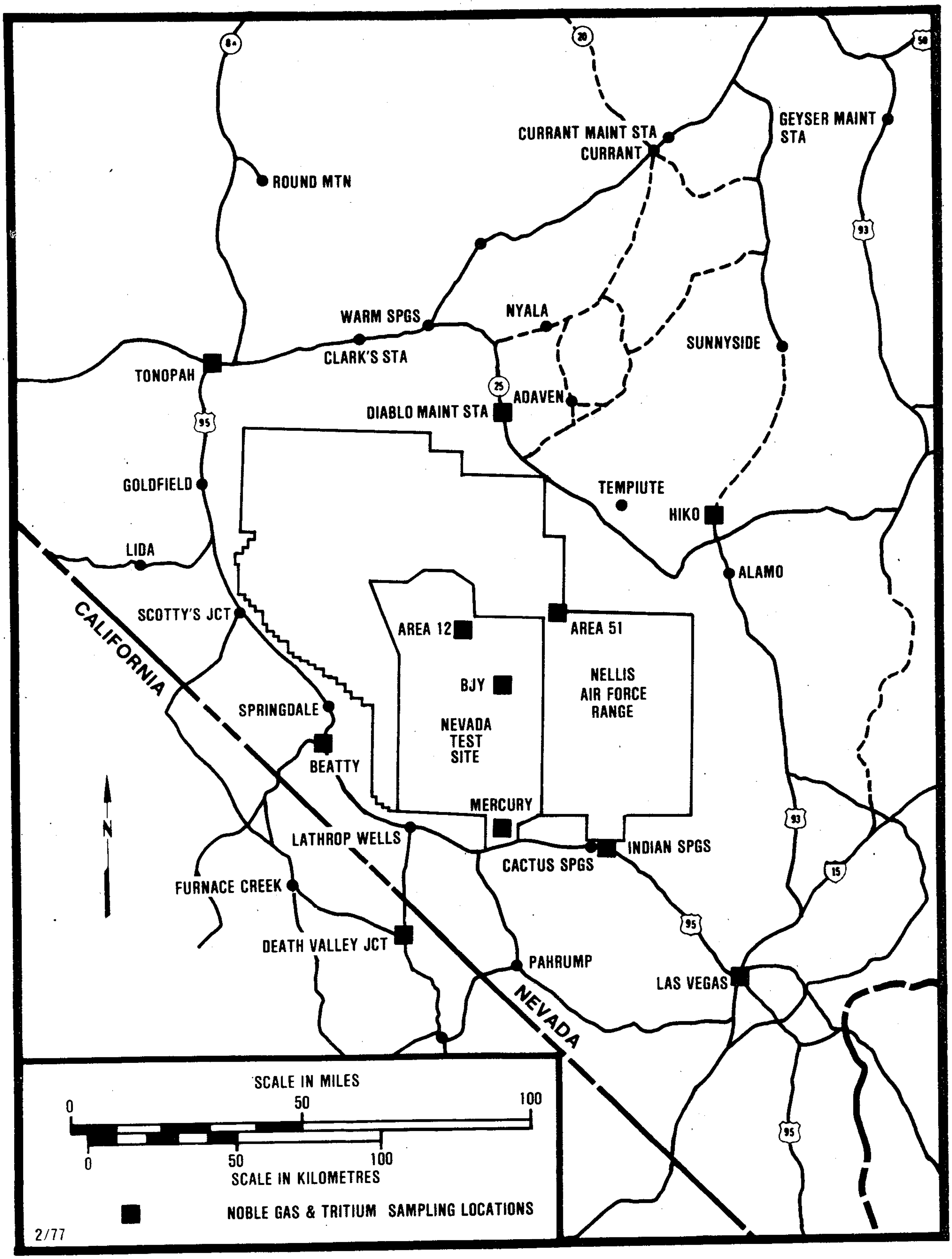

Figure 10. Noble Gas and Tritium Surveillance Network

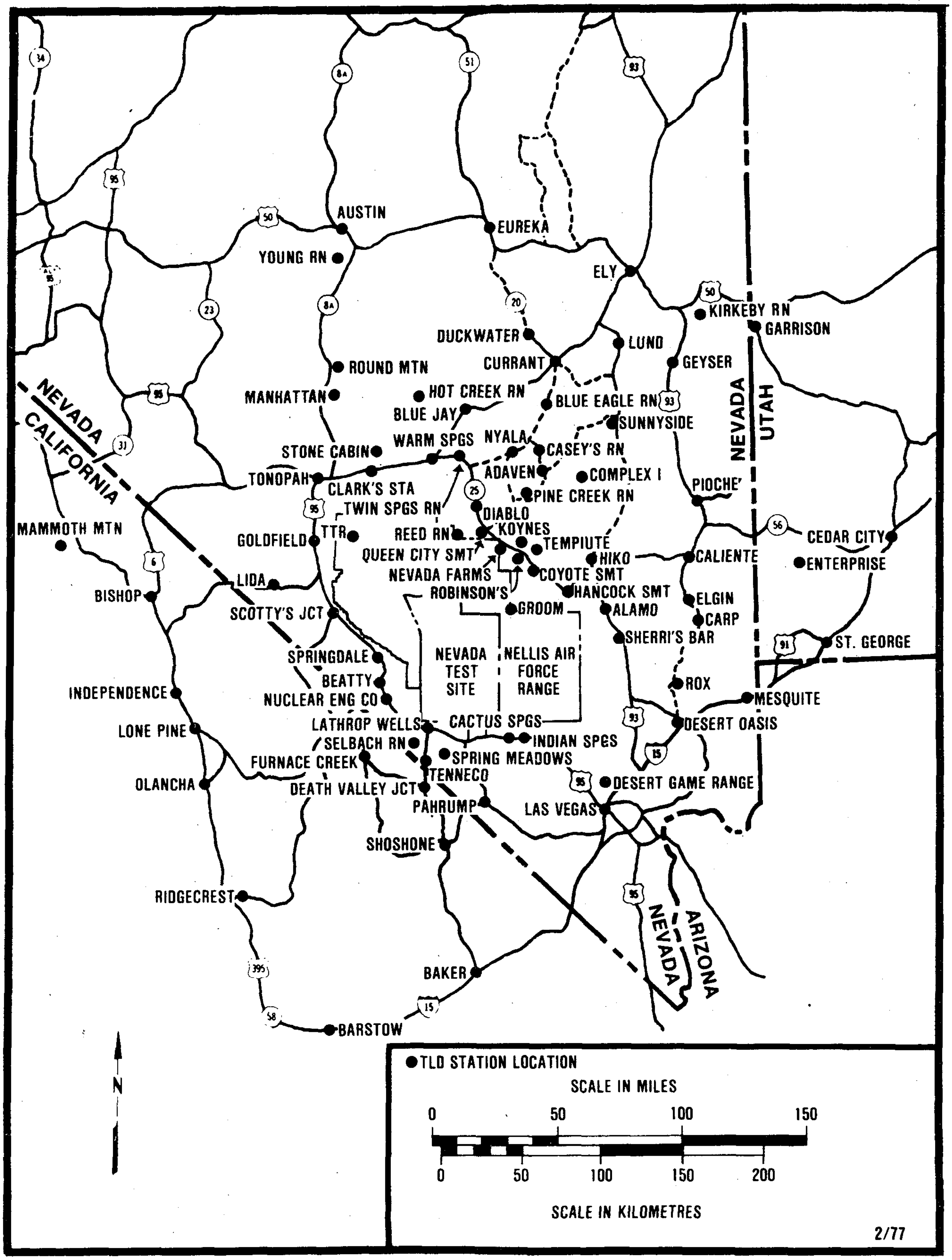

Figure 11. Dosimetry Network

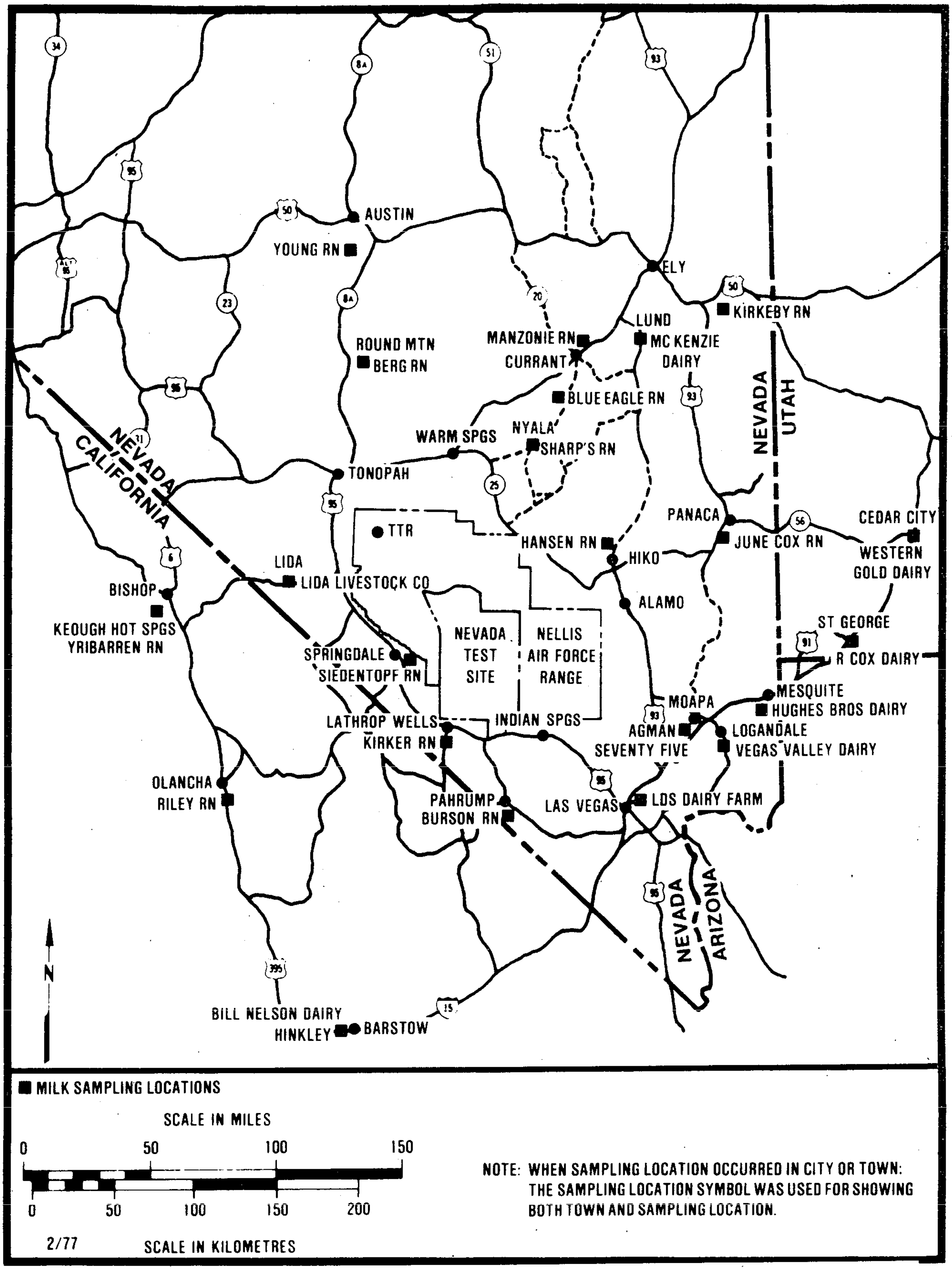

Figure 12. Milk Surveillance Network

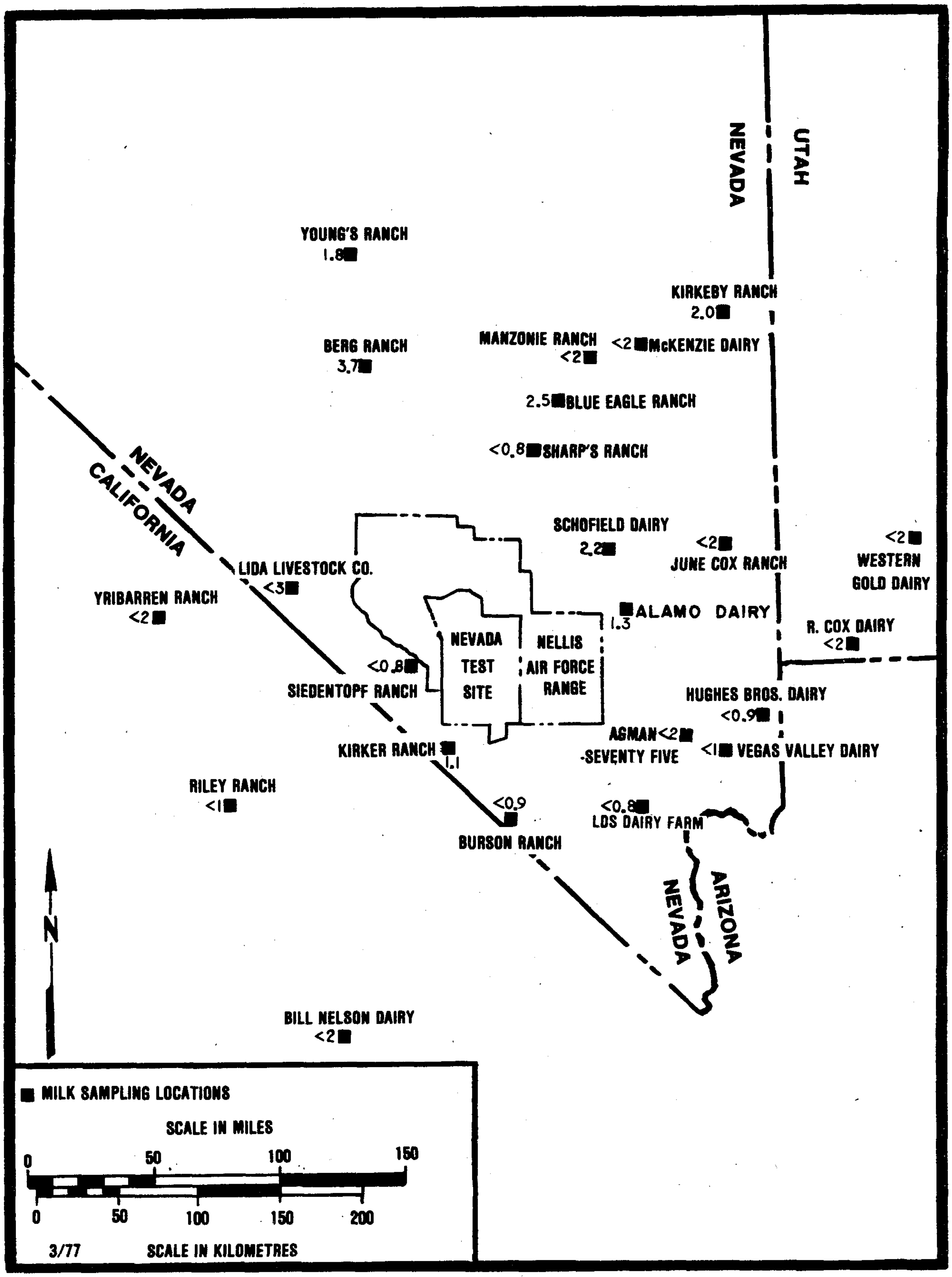

Figure 13. Annual Average Concentrations of ^{90}Sr (10^{-9} µCi/ml) Within Milk Surveillance Network, 1976

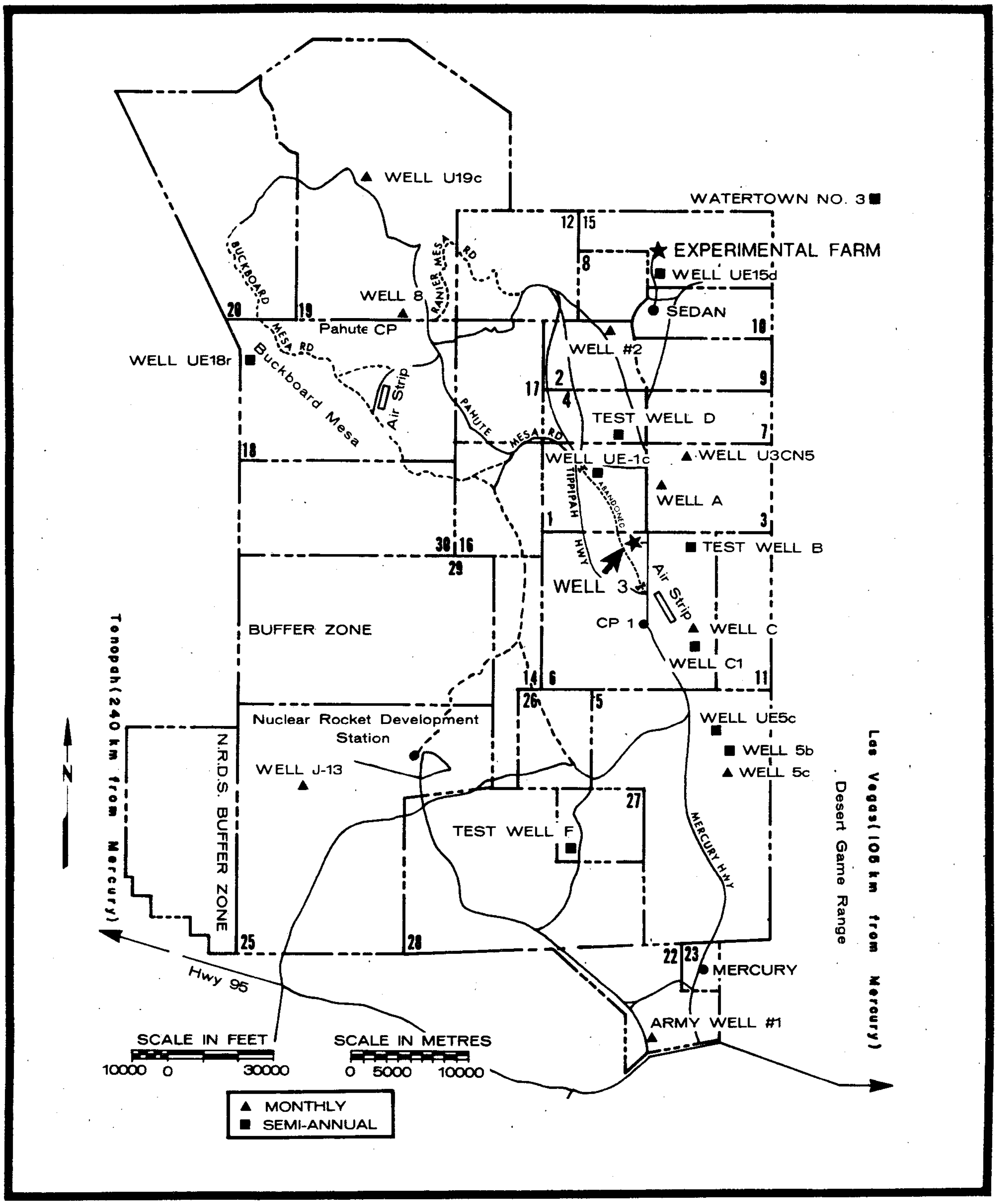

Figure 14. On-Site Long-Term Hydrological Monitoring Program, Nevada Test Site

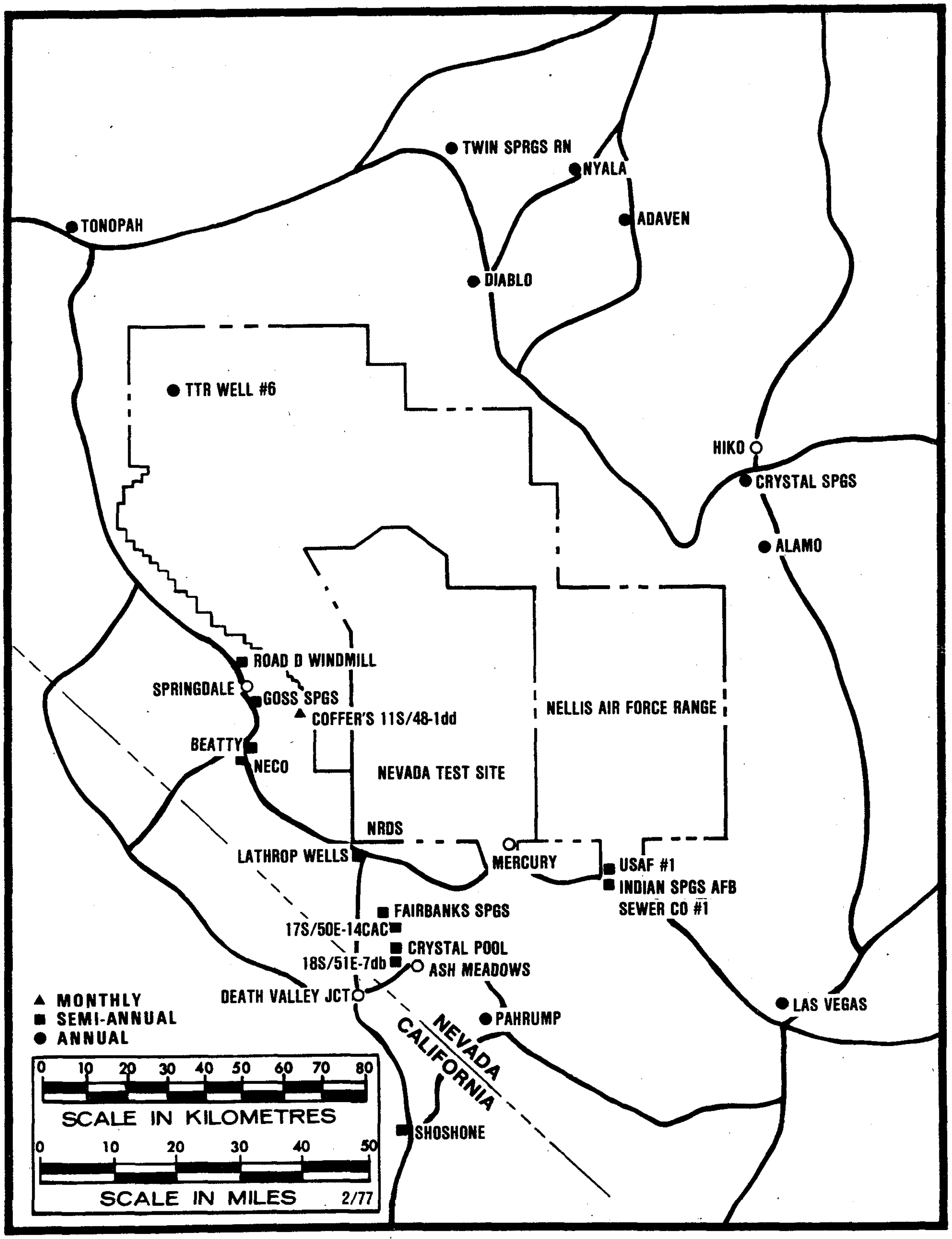

Figure 15. Off-Site Long-Term Hydrological Monitoring Program, Nevada Test Site

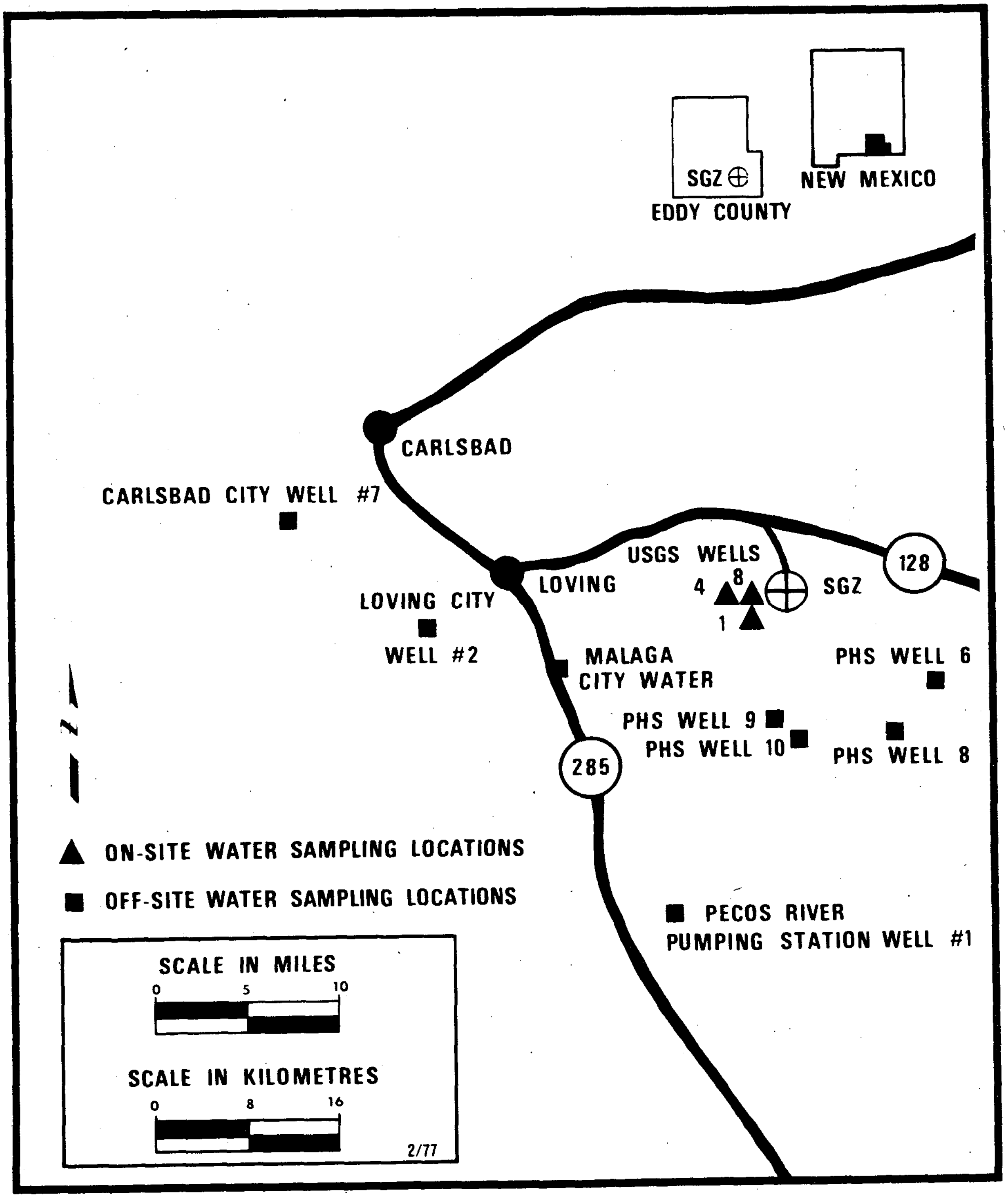

Figure 16. Long-Term Hydrological Monitoring Locations, Carlsbad, New Mexico, Project Gnome/Coach

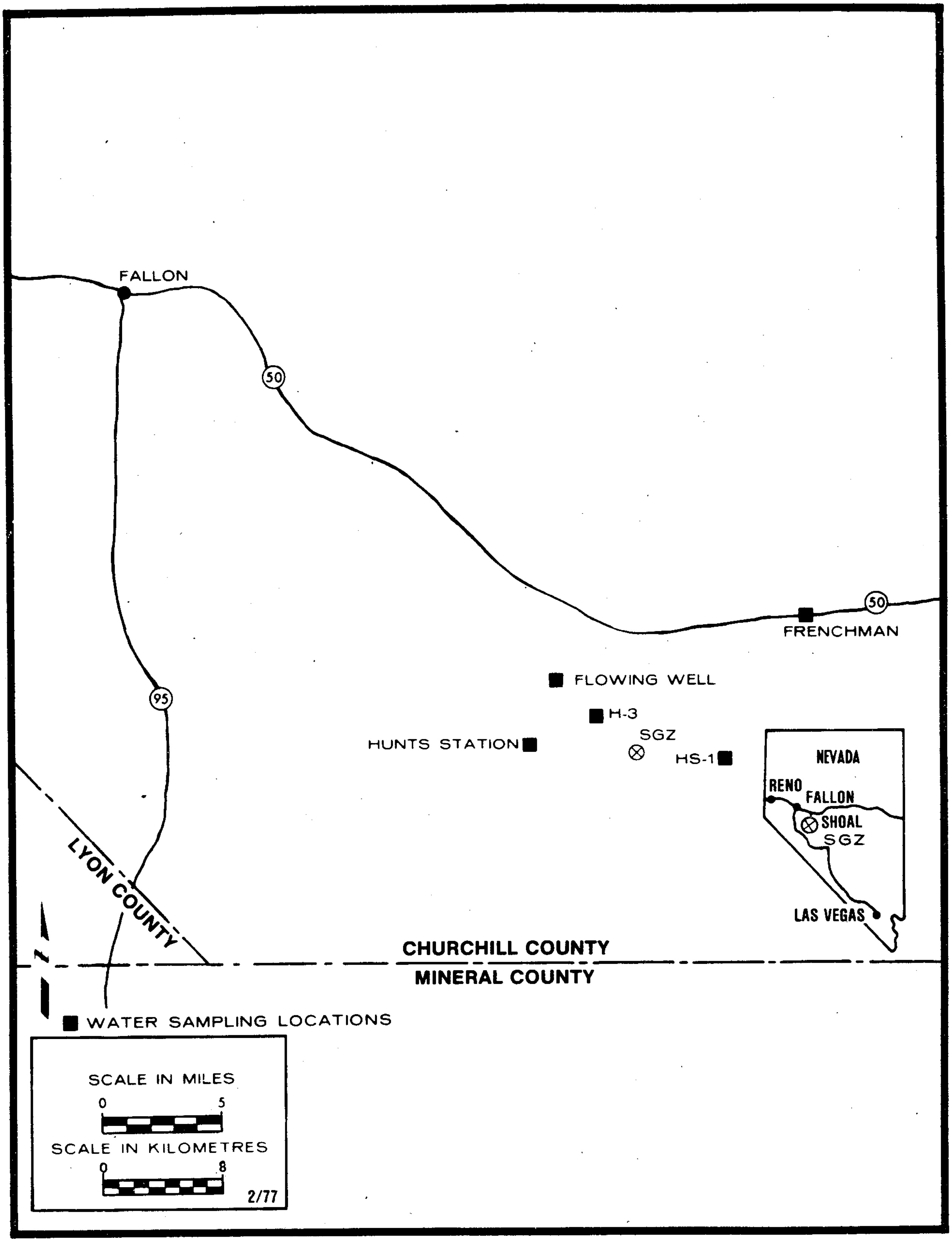

Figure 17. Long-Term Hydrological Monitoring Locations, Fallon, Nevada, Project Shoal

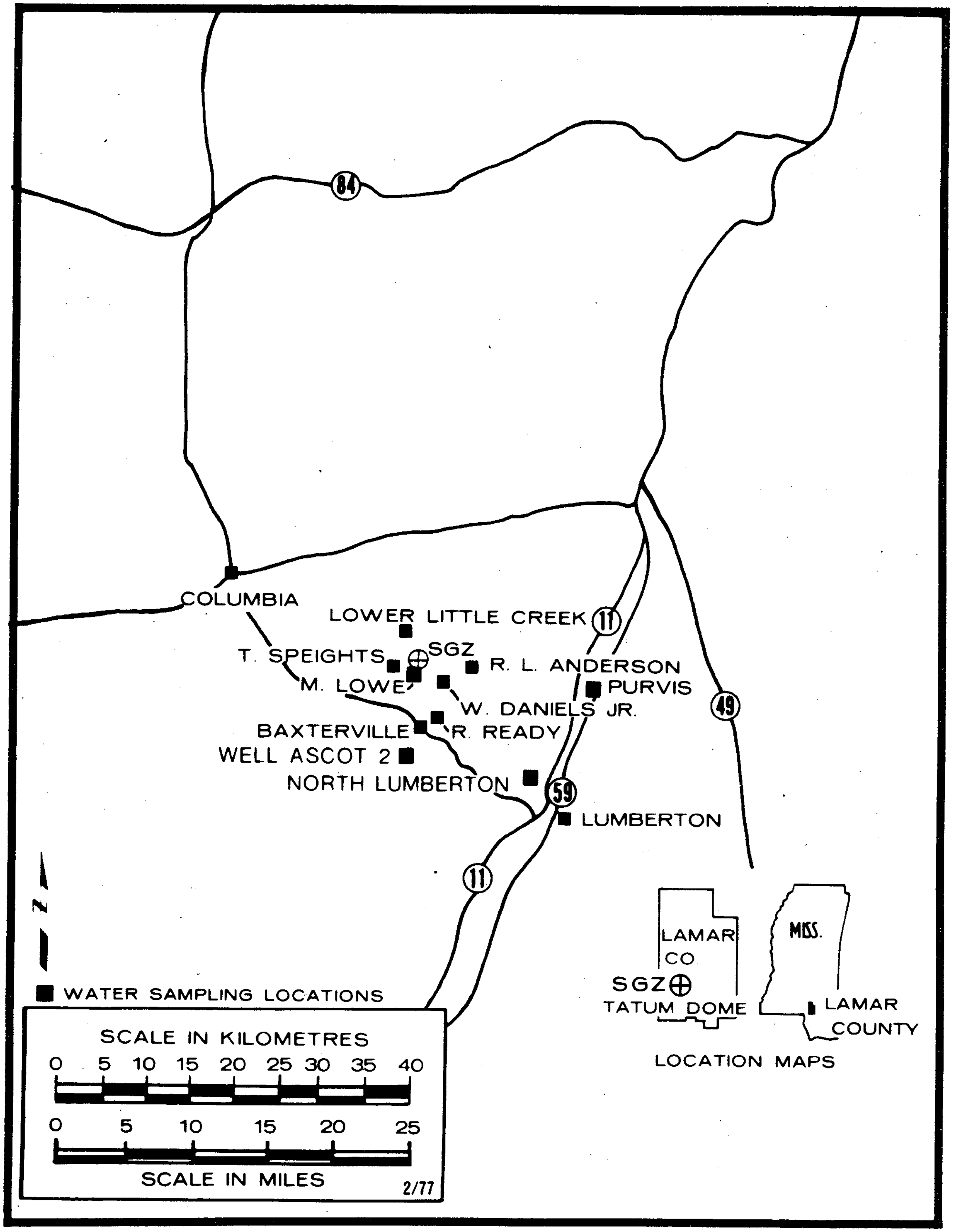

Figure 18. Long-Term Hydrological Monitoring Locations, Project Dribble/Miracle Play (vicinity of Tatum Salt Dome, Mississippi)

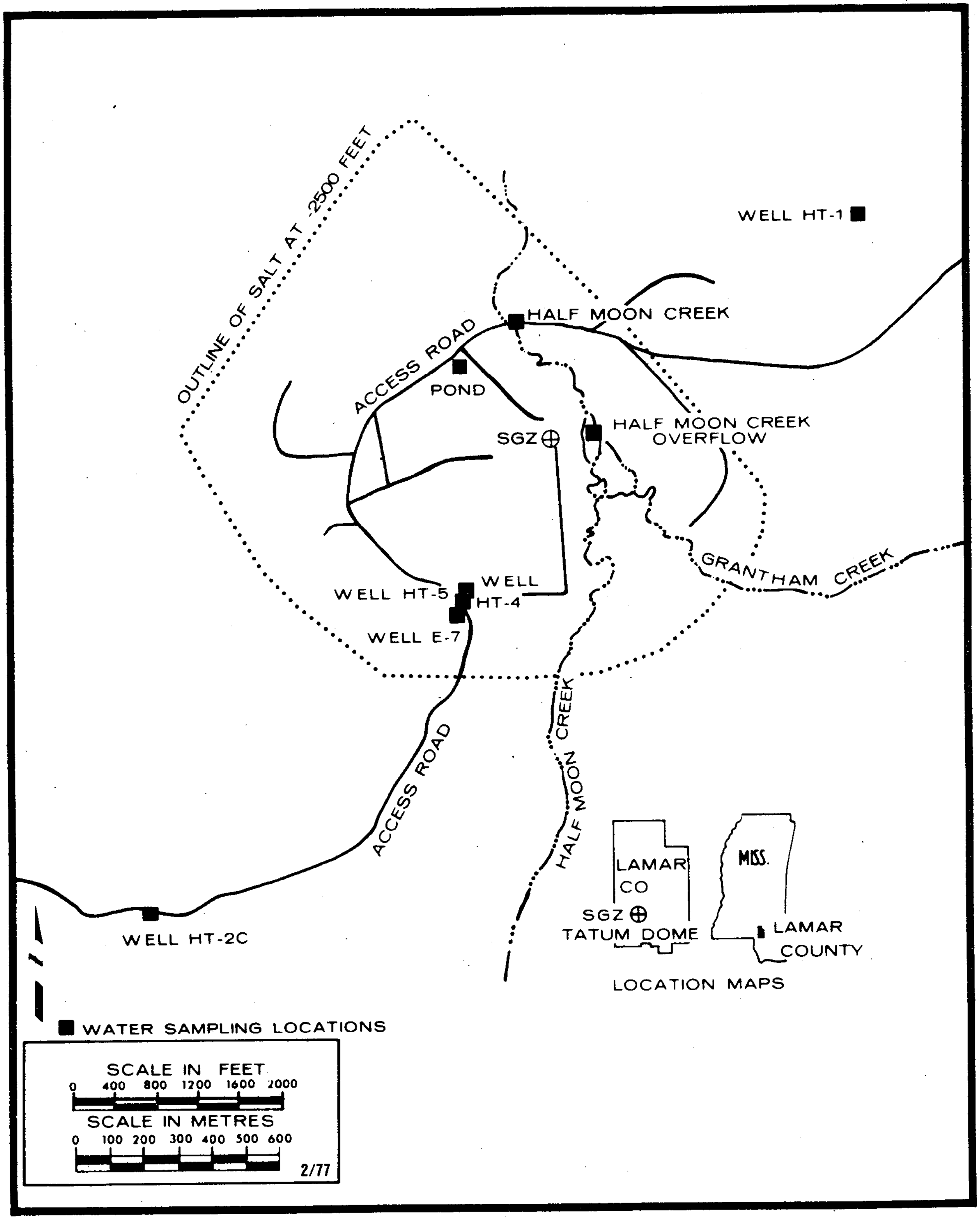

Figure 19. Long-Term Hydrological Monitoring Locations, Project Dribble/Miracle Play (Tatum Salt Dome, Mississippi)

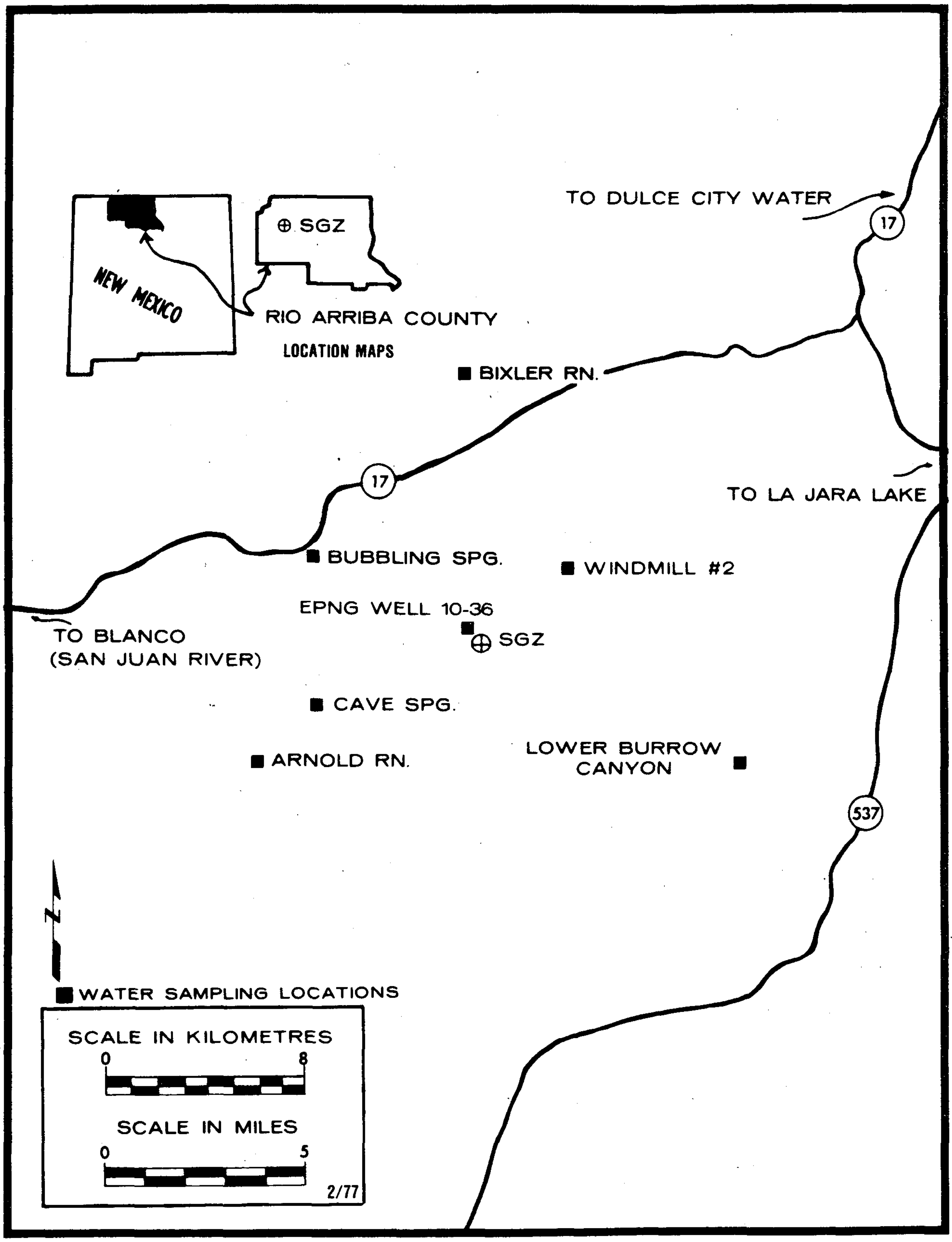

Figure 20. Long-Term Hydrological Monitoring Locations, Rio Arriba County, New Mexico, Project Gasbuggy

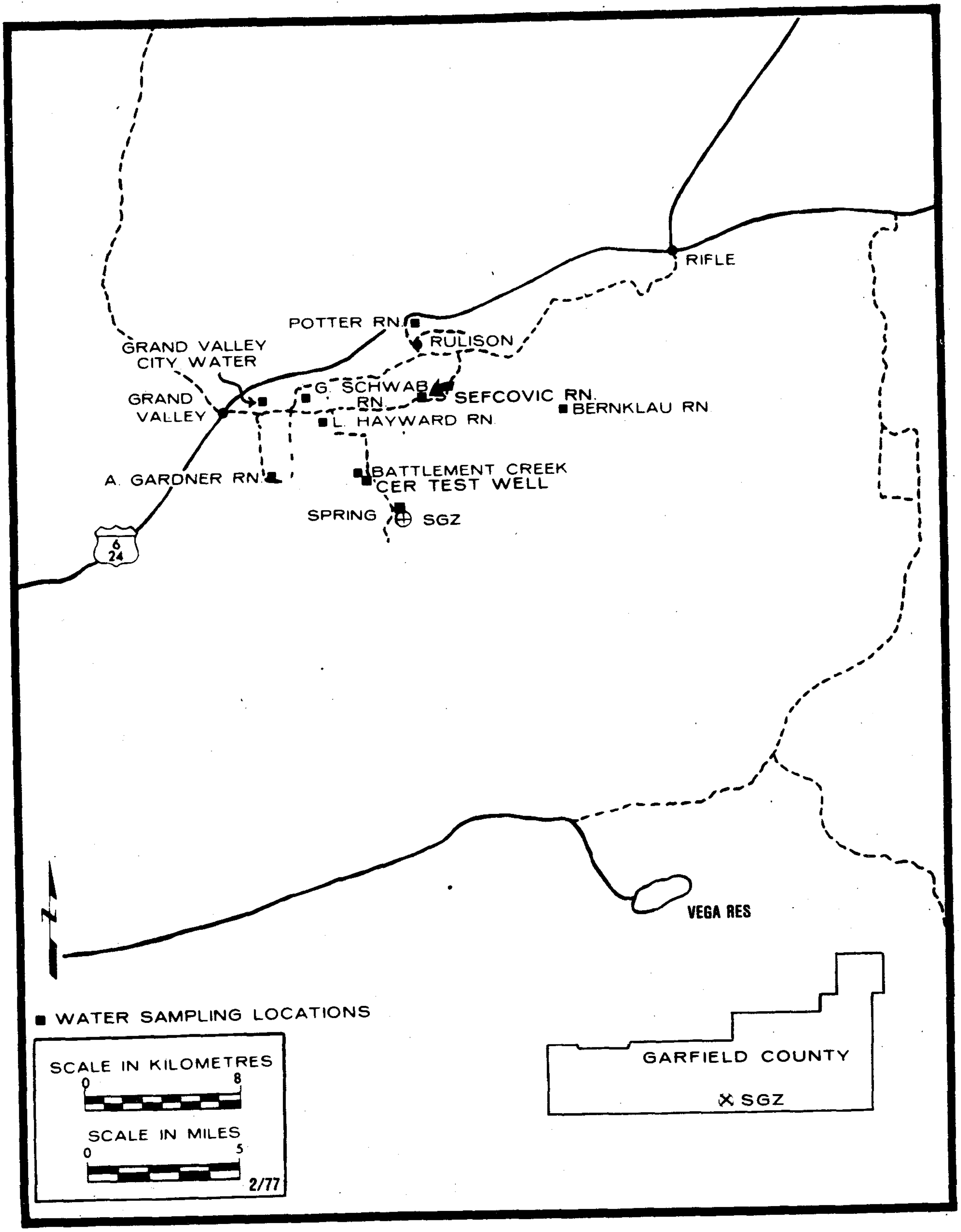

Figure 21. Long-Term Hydrological Monitoring Locations, Rulison, Colorado, Project Rulison

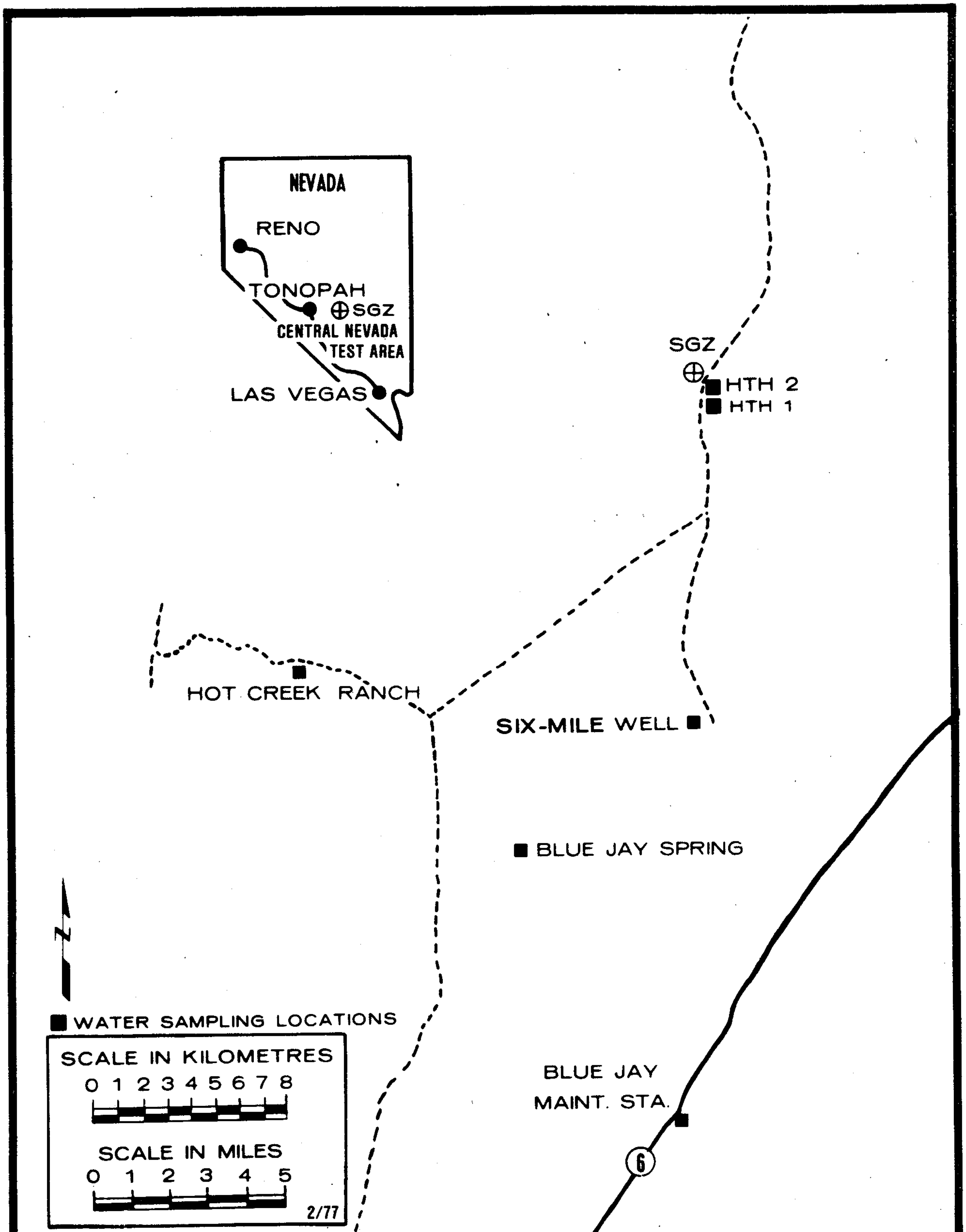

Figure 22. Long-Term Hydrological Monitoring Locations, Central Nevada Test Area, Faultless Event

APPENDIX A. TABLES

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

Name of Test, Operation or Project	Date	Location	Yield[a] (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[4]	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 missle.
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.

(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 (Litre)	Approximate Detection Limit[2]
Gamma Spectroscopy[1]	Gamma spectrometer with 10-cm-thick by 10-cm-diameter NaI (Tl-activated) crystal with input to 200 channels (0-2 MeV) of 400-channel, pulse-height analyzer.	100 min for milk, water, Long-Term Hydro. suspended solids, and air filters; 10 min for air charcoal cartridges.	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 litre for Long-Term Hydro. Water suspended solids.	For routine milk and water generally, $5x10^{-9}$ $\mu Ci/ml$ for most common fallout radionuclides in a simple spectrum. For air filters, $2x10^{-14}$ $\mu Ci/ml$. For Long-Term Hydro. suspended solids, $3.0x10^{-9}$ $\mu Ci/ml$.
$^{89-90}Sr$[3]	Low-background thin-window, gas-flow proportional counter with a 5.7-cm diameter window (80 $\mu g/cm^2$).	50	Chemical separation by ion exchange. Separated sample counted successively; activity calculated by simultaneous equations.	1.0	$^{89}Sr = 2x10^{-9}$ $\mu Ci/ml$ $^{90}Sr = 1x10^{-9}$ $\mu Ci/ml$.
^{3}H[3]	Automatic liquid scintillation counter with output printer.	200	Sample prepared by distillation.	0.005	$2x10^{-7}$ $\mu Ci/ml$
^{3}H Enrichment (Long-Term Hydrological Samples)[3]	Automatic scintillation counter with output printer.	200	Sample concentrated by electrolysis followed by distillation.	0.25	$6x10^{-9}$ $\mu Ci/ml$
$^{238,239}Pu$ ^{234,235} ^{238}U[3]	Alpha spectrometer with 45 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	$^{238}Pu = 4x10^{-11}$ $\mu Ci/ml$ ^{239}Pu, ^{234}U, ^{235}U $^{238}U = 2x10^{-11}$ $\mu Ci/ml$
^{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	$1x10^{-10}$ $\mu Ci/ml$

Table A-2. (continued)

Type of Analysis	Analytical Equipment	Counting Period (Min)	Analytical Procedures	Sample Size (Litre)	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/cm^2).	50	Sample evaporated; residue weighed and counted; corrected for self-attenuation.	0.2	α = 3×10^{-9} µCi/ml β = 2×10^{-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/cm^2).	20	Filters counted upon receipt and at 5 and 12 days after collection; last two counts 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 800-1200m^3.	2×10^{-15} µCi/ml
^{85}Kr Xe 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 = 2×10^{-12} µCi/ml Xe = 2×10^{-12} µCi/ml CH_3T = 2×10^{-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. 1976 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[1]
Death	357.5	^{85}Kr	$10^{-12}\mu Ci/ml$ air	25	12	20	0.02
Valley	357.5	Total Xe	$10^{-12}\mu Ci/ml$ air	< 7	< 4	< 5	<0.01
Jct.,	321.7	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	4.2	< 0.2	< 0.5	-
Calif.	357.5	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	7.0	< 2	< 3	
	321.7	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	29	< 0.2	< 3	<0.01
	328.6	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	5.3	< 0.4	< 2	
Beatty,	363.3	^{85}Kr	$10^{-12}\mu Ci/ml$ air	24	15	20	0.02
Nev.	363.3	Total Xe	$10^{-12}\mu Ci/ml$ air	< 7	< 4	< 5	<0.01
	328.5	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	1.6	< 0.2	< 0.4	-
	363.3	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	11	< 2	< 3	
	328.5	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	21	< 0.2	< 2	<0.01
	328.5	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	5.0	< 0.2	< 2	
Diablo,	341.4	^{85}Kr	$10^{-12}\mu Ci/ml$ air	25	12	19	0.02
Nev.	341.4	Total Xe	$10^{-12}\mu Ci/ml$ air	< 8	< 4	< 5	<0.01
	320.6	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	1.2	< 0.2	< 0.4	-
	335.4	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	< 3	< 2	< 2	
	320.6	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	5.8	< 0.4	< 2	<0.01
	320.6	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	2.7	< 0.3	< 0.8	
Hiko,	349.4	^{85}Kr	$10^{-12}\mu Ci/ml$ air	25	11	17	0.02
Nev.	349.4	Total Xe	$10^{-12}\mu Ci/ml$ air	< 8	< 4	< 5	<0.01
	321.5	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	1.4	< 0.2	< 0.4	-
	349.4	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	6.1	< 2	< 3	
	321.5	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	3.4	< 0.3	< 2	<0.01
	321.5	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	1.3	< 0.2	< 0.6	
Indian	350.6	^{85}Kr	$10^{-12}\mu Ci/ml$ air	26	12	20	0.02
Springs,	357.6	Total Xe	$10^{-12}\mu Ci/ml$ air	< 8	< 4	< 4	<0.01
Nev.	335.7	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	2.4	< 0.2	< 0.5	-
	363.6	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	18	< 2	< 3	
	335.7	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	12	< 0.2	< 2	<0.01
	328.7	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	7.6	< 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[1]
Las Vegas, Nev.	340.5	^{85}Kr	$10^{-12}\mu Ci/ml$ air	29	12	18	0.02
	340.5	Total Xe	$10^{-12}\mu Ci/ml$ air	< 7	< 3	< 5	<0.01
	342.4	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	1.1	< 0.2	< 0.4	-
	340.5	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	7.0	< 2	< 3	
	342.4	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	17	< 0.4	< 2	<0.01
	342.4	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	1.8	< 0.2	< 0.6	
NTS, Nev. Mercury	363.2	^{85}Kr	$10^{-12}\mu Ci/ml$ air	26	12	19	<0.01
	363.2	Total Xe	$10^{-12}\mu Ci/ml$ air	< 6	< 4	< 5	<0.01
	320.4	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	3.6	< 0.2	< 0.5	-
	363.2	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	11	< 2	< 3	
	320.4	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	19	< 0.2	< 2	<0.01
	320.4	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	3.9	< 0.2	< 0.7	
NTS, Nev. Area 51[2]	336.7	^{85}Kr	$10^{-12}\mu Ci/ml$ air	25	12	20	<0.01
	349.7	Total Xe	$10^{-12}\mu Ci/ml$ air	< 6	< 4	< 4	<0.01
	336.6	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	15	< 0.3	< 0.9	-
	349.7	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	7.0	< 2	< 3	
	336.6	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	35	< 0.3	< 3	<0.01
	329.6	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	< 5	< 0.2	< 0.9	
NTS, Nev. BJY	356.4	^{85}Kr	$10^{-12}\mu Ci/ml$ air	27	13	20	<0.01
	355.4	Total Xe	$10^{-12}\mu Ci/ml$ air	< 6	< 4	< 5	<0.01
	356.6	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	6.9	< 0.3	< 2	-
	363.4	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	4.0	< 2	< 3	
	356.6	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	51	< 0.6	< 7	<0.01
	356.6	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	< 8	< 0.2	< 2	
NTS, Nev. Area 12	342.4	^{85}Kr	$10^{-12}\mu Ci/ml$ air	24	13	20	<0.01
	349.4	Total Xe	$10^{-12}\mu Ci/ml$ air	< 6	< 4	< 5	<0.01
	341.6	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	71	< 0.3	< 9	-
	349.4	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	4.0	< 2	< 3	
	341.6	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	230	< 0.5	<33	<0.01
	341.6	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	75	< 0.3	< 3	

Table A-3. (continued)

Sampling Location	No. Days Sampled	Radio-nuclide	Units	Radioactivity Concentrations C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide[1]
Tonopah, Nev.	363.3	^{85}Kr	$10^{-12}\mu Ci/ml$ air	25	13	19	0.02
	363.3	Total Xe	$10^{-12}\mu Ci/ml$ air	< 7	< 5	< 5	<0.01
	363.5	^{3}H as HTO	$10^{-6}\mu Ci/ml$ H_2O	1.3	< 0.2	< 0.4	-
	363.3	^{3}H as CH_3T	$10^{-12}\mu Ci/ml$ air	4.0	< 2	< 2	
	363.5	^{3}H as HTO	$10^{-12}\mu Ci/ml$ air	13	< 0.3	< 2	<0.01
	357.5	^{3}H as HT	$10^{-12}\mu Ci/ml$ air	4.3	< 0.2	< 0.8	

(1) 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.

(2) Also known as Groom Lake.

Table A-4. 1976 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.	1/21/76 - 1/10/77	0.42	0.34	0.37	140
Alamo, Nev.	1/13/76 - 1/04/77	0.29	0.25	0.28	100
Baker, Calif.	1/12/76 - 1/10/77	0.24	0.21	0.23	84
Barstow, Calif.	1/12/76 - 1/10/77	0.28	0.25	0.27	99
Beatty, Nev.	1/20/76 - 1/04/77	0.30	0.28	0.29	110
Bishop, Calif.	1/14/76 - 1/11/77	0.28	0.24	0.26	95
Blue Eagle Ranch, Nev.	1/22/76 - 1/13/77	0.18	0.16	0.17	62
Blue Jay, Nev.	1/21/76 - 1/13/77	0.33	0.29	0.31	110
Cactus Springs, Nev.	1/19/76 - 1/03/77	0.16	0.14	0.15	55
Caliente, Nev.	1/14/76 - 1/06/77	0.36	0.28	0.33	120
Casey's Ranch, Nev.	1/21/76 - 1/10/77	0.21	0.18	0.20	73
Cedar City, Utah	1/21/76 - 1/11/77	0.24	0.20	0.22	81
Clark Station, Nev.	1/21/76 - 1/13/77	0.33	0.28	0.32	120
Coyote Summit, Nev.	1/20/76 - 1/10/77	0.34	0.31	0.33	120
Currant, Nev.	1/22/76 - 1/12/77	0.28	0.23	0.26	95
Death Valley Jct., Calif.	1/15/76 - 1/13/77	0.22	0.21	0.22	81
Desert Game Range, Nev.	1/19/76 - 1/03/77	0.16	0.15	0.15	55
Desert Oasis, Nev.	1/19/76 - 1/10/77	0.18	0.16	0.17	62
Diablo Maint. Sta., Nev.	1/20/76 - 1/10/77	0.37	0.32	0.34	120
Duckwater, Nev.	1/22/76 - 1/12/77	0.33	0.27	0.30	110
Elgin, Nev.	1/14/76 - 1/05/77	0.36	0.31	0.34	120
Ely, Nev.	1/20/76 - 1/13/77	0.25	0.21	0.23	84

Table A-4. (continued)

Station Location	Measurement Period	Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Dose Equivalent (mrem/y)
Enterprise, Utah	1/21/76 - 1/11/77	0.30	0.25	0.28	100
Furnace Creek, Calif.	1/15/76 - 1/13/77	0.19	0.17	0.18	66
Geyser Maint. Sta., Nev.	1/20/76 - 1/11/77	0.29	0.25	0.27	99
Goldfield, Nev.	1/20/76 - 1/10/77	0.29	0.24	0.27	99
Groom Lake, Nev.	1/20/76 - 1/10/77	0.20	0.17	0.19	70
Hancock Summit, Nev.	1/20/76 - 1/10/77	0.42	0.35	0.39	140
Hiko, Nev.	1/13/76 - 1/04/77	0.23	0.20	0.22	81
Hot Creek Ranch, Nev.	1/21/76 - 1/13/77	0.26	0.22	0.25	92
Independence, Calif.	1/14/76 - 1/11/77	0.29	0.25	0.27	99
Indian Springs, Nev.	1/19/76 - 1/03/77	0.18	0.15	0.17	62
Kirkeby Ranch, Nev.	1/20/76 - 1/11/77	0.22	0.20	0.22	81
Koynes, Nev.	1/20/76 - 1/10/77	0.28	0.22	0.25	92
Las Vegas (Airport), Nev.	1/08/76 - 1/03/77	0.16	0.12	0.14	51
Las Vegas (Placak), Nev.	1/08/76 - 1/05/77	0.16	0.14	0.15	55
Las Vegas (USDI), Nev.	1/08/76 - 1/03/77	0.18	0.16	0.17	62
Lathrop Wells, Nev.	1/20/76 - 1/04/77	0.26	0.23	0.25	92
Lida, Nev.	1/19/76 - 1/10/77	0.31	0.27	0.30	110
Lone Pine, Calif.	1/13/76 - 1/11/77	0.28	0.25	0.26	95
Lund, Nev.	1/21/76 - 1/10/77	0.25	0.20	0.23	84
Mammoth Mtn., Calif.	1/14/76 - 1/12/77	0.36	0.23	0.31	110
Manhattan, Nev.	1/21/76 - 1/11/77	0.37	0.31	0.35	130
Mesquite, Nev.	1/19/76 - 1/10/77	0.19	0.17	0.18	66

Table A-4. (continued)

Station Location	Measurement Period	Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Dose Equivalent (mrem/y)
Nevada Farms, Nev.	1/20/76 - 1/10/77	0.35	0.30	0.32	120
Nuclear Eng. Co., Nev.	1/20/76 - 1/05/77	0.35	0.26	0.31	110
Nyala, Nev.	1/21/76 - 1/10/77	0.25	0.21	0.23	84
Olancha, Calif.	1/13/76 - 1/11/77	0.25	0.23	0.24	88
Pahrump, Nev.	1/22/76 - 1/06/77	0.18	0.17	0.18	66
Pine Creek Ranch, Nev.	1/21/76 - 1/10/77	0.35	0.29	0.33	120
Pioche, Nev.	1/14/76 - 1/05/77	0.25	0.23	0.24	88
Queen City Summit, Nev.	1/20/76 - 1/10/77	0.40	0.34	0.37	140
Reed Ranch, Nev.	1/20/76 - 1/10/77	0.30	0.27	0.29	110
Ridgecrest, Calif.	1/13/76 - 1/11/77	0.24	0.22	0.23	84
Round Mountain, Nev.	1/21/76 - 1/11/77	0.34	0.29	0.32	120
Scotty's Junction, Nev.	1/19/76 - 1/10/77	0.34	0.29	0.31	110
Selbach Ranch, Nev.	1/21/76 - 1/05/77	0.31	0.27	0.29	110
Sherri's Bar, Nev.	1/13/76 - 1/04/77	0.22	0.18	0.20	73
Shoshone, Calif.	1/15/76 - 1/13/77	0.32	0.28	0.30	110
Spring Meadows, Nev.	1/21/76 - 1/04/77	0.18	0.16	0.16	59
Springdale, Nev.	1/21/76 - 1/04/77	0.34	0.29	0.32	120
St. George, Utah	1/22/76 - 1/12/77	0.18	0.17	0.18	66
Sunnyside, Nev.	1/21/76 - 1/10/77	0.20	0.17	0.19	70
Tempiute, Nev.	1/20/76 - 1/10/77	0.30	0.26	0.28	100
Tenneco, Nev.	1/21/76 - 1/04/77	0.29	0.26	0.28	100
Tonopah Test Range, Nev.	1/20/76 - 1/11/77	0.34	0.28	0.32	120

Table A-4. (continued)

Station Location	Measurement Period	Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Dose Equivalent (mrem/y)
Tonopah, Nev.	1/20/76 - 1/10/77	0.31	0.26	0.29	110
Twin Springs Ranch, Nev.	1/21/76 - 1/10/77	0.32	0.27	0.30	110
Warm Springs, Nev.	1/21/76 - 1/13/77	0.31	0.27	0.29	110
Young's Ranch, Nev.	1/21/76 - 1/11/77	0.26	0.24	0.25	92

Table A-5. 1976 Summary of Analytical Results for the Milk Surveillance Network

Sampling Location	Sample Type(1)	No. of Samples	Radio-nuclide	C_{Max} (Radioactivity Conc. 10^{-9} µCi/ml)	C_{Min}	C_{Avg}
Hinkley, Calif. Bill Nelson Dairy	12	4	^{137}Cs	<5	<4	<4
		4	^{89}Sr	<3	<1	<2
		4	^{90}Sr	2.1	<0.8	<2
Keough Hot Spgs., Calif. Yribarren Ranch	13	4	^{137}Cs	<4	<3	<4
		4	^{89}Sr	<3	<1	<2
		4	^{90}Sr	<2	<1	<2
Olancha, Calif. J. Riley Ranch	13	4	^{137}Cs	<4	<4	<4
		4	^{89}Sr	<2	<1	<2
		4	^{90}Sr	1.4	<0.7	<1
Alamo, Nev.(2) Alamo Dairy	14	1	^{137}Cs	4.0	4.0	4.0
		1	^{89}Sr	<2	<2	<2
		1	^{90}Sr	1.3	1.3	1.3
Austin, Nev. Young's Ranch	13	4	^{137}Cs	<4	<4	<4
		4	^{89}Sr	<2	<1	<2
		4	^{90}Sr	2.7	1.3	1.8
		4	^{3}H	550	<300	<400
Caliente, Nev. June Cox Ranch	13	4	^{137}Cs	<5	<4	<4
		4	^{89}Sr	<3	<0.8	<2
		4	^{90}Sr	2.4	<0.6	<2

Table A-5. (continued)

Sampling Location	Sample Type[1]	No. of Samples	Radio-nuclide	Radioactivity Conc. (10^{-9} $\mu Ci/ml$) C Max	C Min	C Avg
Currant, Nev. Blue Eagle Ranch	13	3[3]	^{137}Cs	<6	<4	<5
		4	^{89}Sr	<7	<1	<3
		4	^{90}Sr	4.0	1.4	2.5
Currant, Nev. Manzonie Ranch	13	4	^{137}Cs	<4	<4	<4
		4	^{89}Sr	<3	<1	<2
		4	^{90}Sr	1.4	1.1	<2
Hiko, Nev. Schofield Dairy[4]	12	3	^{137}Cs	<4	<4	<4
		3	^{89}Sr	<3	<2	<2
		3	^{90}Sr	3.1	1.4	2.2
		3	^{3}H	650	<300	<400
Hiko, Nev. Darrel Hansen Ranch	13	1	^{137}Cs	<4	<4	<4
		1	^{89}Sr	<0.8	<0.8	<0.8
		1	^{90}Sr	<0.6	<0.6	<0.6
Las Vegas, Nev. LDS Dairy Farm	12	4	^{137}Cs	<5	<4	<4
		4	^{89}Sr	<2	<1	<1
		4	^{90}Sr	<0.9	<0.6	<0.8
		4	^{3}H	<300	<300	<300
Lathrop Wells, Nev. Kirker Ranch	13	4	^{137}Cs	4.6	<4	<4
		4	^{89}Sr	<2	<0.8	<1
		4	^{90}Sr	1.3	0.93	1.1

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}
Lida, Nev. Lida Livestock Co.	13	4	^{137}Cs	<4	<4	<4
		3[5]	^{89}Sr	<2	<2	<2
		3[5]	^{90}Sr	3.3	<1	<3
Logandale, Nev. Vegas Valley Dairy	12	4	^{137}Cs	<5	<4	<4
		4	^{89}Sr	<2	<0.9	<1
		4	^{90}Sr	1.3	<0.73	<1
Lund, Nev. McKenzie Dairy	12	4	^{137}Cs	<5	<4	<4
		4	^{89}Sr	<4	<0.9	<2
		4	^{90}Sr	4.7	<0.9	<2
		4	^{3}H	<300	<300	<300
Mesquite, Nev. Hughes Bros. Dairy	12	4	^{137}Cs	<5	<4	<4
		4	^{89}Sr	<2	<0.9	<2
		4	^{90}Sr	1.1	<0.7	<0.9
		4	^{3}H	1500	<300	<700
Moapa, Nev. Agman Seventy-Five, Inc.	12	4	^{137}Cs	<4	<4	<4
		4	^{89}Sr	<2	<0.9	<2
		4	^{90}Sr	1.3	1.0	<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
Nyala, Nev. Sharp's Ranch	13	3	^{137}Cs	<10	<4	<6
		4	^{89}Sr	<3	<0.8	<2
		4	^{90}Sr	<1	<0.6	<0.8
		4	^{3}H	1200	<300	<500
Pahrump, Nev. Burson Ranch	13	4	^{137}Cs	<5	<4	<4
		4	^{89}Sr	<2	<1	<2
		4	^{90}Sr	<2	<0.8	<0.9
Round Mountain, Nev. Berg Ranch	13	4	^{137}Cs	<7	<2	<4
		4	^{89}Sr	<4	<2	<3
		4	^{90}Sr	6.5	1.5	3.7
Shoshone, Nev. Kirkeby Ranch	13	4	^{137}Cs	<5	<4	<5
		4	^{89}Sr	<3	<2	<2
		4	^{90}Sr	2.7	1.0	2.0
Springdale, Nev. Siedentopf Ranch	13	4	^{137}Cs	<5	<4	<4
		4	^{89}Sr	<3	<0.9	<2
		4	^{90}Sr	<1	<0.7	<0.8
Cedar City, Utah Western Gold Dairy	12	4	^{137}Cs	<4	<4	<4
		4	^{89}Sr	<3	<1	<2
		4	^{90}Sr	2.0	<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	<4	<4	<4
		4	^{89}Sr	<2	<0.8	<2
		4	^{90}Sr	2.6	<0.8	<2

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

(2) Alamo Dairy went out of business. No other sampling location was available.

(3) One sample was of insufficient size for analysis.

(4) Schofield Dairy went out of business. Darrel Hansen Ranch replaces sampling location.

(5) One sample went sour and could not be analyzed.

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

	Monthly Samples	Semi-Annual Samples	Annual Samples
Gross alpha	All samples	All samples	All Samples
Gross beta	All samples	All samples	All samples
Gamma scan	All samples	All samples	All samples
^{3}H(1)	All samples	All samples	All samples
$^{89,90}Sr$	Jan. and July samples. Any other sample if gross beta exceeds 1×10^{-8} µCi/ml.	Jan. sample only. July sample if gross beta exceeds 1×10^{-8} µCi/ml.	All samples collected at locations for the first time within CY76. Subsequent samples if gross beta exceeds 1×10^{-8} µCi/ml.
^{226}Ra	Any sample if gross alpha exceeds 3×10^{-9} µCi/ml.	Any sample if gross alpha exceeds 3×10^{-9} µCi/ml.	Any sample if gross alpha exceeds 3×10^{-9} µCi/ml.
U	Jan. and July samples in CY76.	Jan. sample only in CY76.	Only samples collected at locations for the first time during CY76.
$^{238,239}Pu$	Jan. and July samples in CY76.	Jan. sample only in CY76	Only samples collected at locations for the first time during CY76.

(1) All samples were first analyzed by the more rapid conventional technique (MDC of about 2×10^{-7} µCi/ml) and then by the enrichment technique (MDC of about 6×10^{-9} µCi/ml).

Table A-7. 1976 Summary of Analytical Results for the NTS Monthly Long-Term Hydrological Monitoring Program

Sampling Location	(1) No. Samples Collected	No. Samples Analyzed	Radionuclide	Radioactivity Conc. (10^{-9} μCi/ml) Max	Min	Avg	% of Conc. Guide(2)
NTS Well 8	12	12	^{3}H	13	<7	<9	<0.01
		2	^{89}Sr	<4	<2	<3	<0.1
		2	^{90}Sr	<1	<0.6	<0.8	<0.3
		2	^{226}Ra	0.12	<0.05	<0.09	<0.3
		2	^{234}U	0.62	0.52	0.57	<0.01
		2	^{235}U	0.09	0.009	0.050	<0.01
		2	^{238}U	0.27	0.14	0.21	<0.01
		2	^{238}Pu	<0.3	<0.02	<0.2	<0.01
		2	^{239}Pu	<0.2	<0.008	<0.1	<0.01
NTS Well U3CN-5	10	10	^{3}H	330	<6	<50	<0.01
		9	^{89}Sr	<4	<1	<2	<0.07
		9	^{90}Sr	<3	<0.6	<2	<0.7
		9	^{226}Ra	2.7	1.2	<2	<7
		2	^{234}U	3.8	2.0	2.9	0.01
		2	^{235}U	<0.8	<0.05	<0.5	<0.01
		2	^{238}U	1.0	0.66	0.83	<0.01
		2	^{238}Pu	<0.2	<0.04	<0.2	<0.01
		2	^{239}Pu	<0.1	<0.06	<0.08	<0.01
NTS Well A	12	12	^{3}H	<9	<6	<8	<0.01
		3	^{89}Sr	<4	<1	<3	<0.1
		3	^{90}Sr	<2	<0.7	<2	<0.7
		10	^{226}Ra	0.28	0.033	0.11	0.4
		2	^{234}U	5.3	5.2	5.3	0.02
		2	^{225}U	<0.07	0.066	<0.07	<0.01
		2	^{238}U	1.6	1.4	1.5	<0.01
		2	^{238}Pu	<0.03	<0.03	<0.03	<0.01
		2	^{239}Pu	<0.08	<0.04	<0.06	<0.01
NTS Well C	12	12	^{3}H	73	<40	<60	<0.01
		6	^{89}Sr	<4	<1	<2	<0.07
		6	^{90}Sr	<2	<1	<2	<0.07
		12	^{226}Ra	1.2	0.50	0.89	3
		2	^{234}U	8.4	8.3	8.4	0.03
		2	^{235}U	0.067	0.067	0.067	<0.01
		2	^{238}U	2.3	2.2	2.3	<0.01
		2	^{238}Pu	<0.04	<0.02	<0.03	<0.01
		2	^{239}Pu	<0.03	<0.009	<0.02	<0.01

Table A-7. (continued)

Sampling Location	[1] No. Samples Collected	No. Samples Analyzed	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml) Max	Min	Avg	% of Conc. Guide[2]
NTS Well 5c	12	12	^{3}H	<20	<6	<9	<0.01
		2	^{89}Sr	<4	<2	<3	<0.1
		2	^{90}Sr	<1	<0.7	<0.9	<0.3
		9	^{226}Ra	0.56	0.082	0.25	0.8
		2	^{234}U	4.6	4.2	4.4	0.02
		2	^{235}U	<0.1	0.087	<0.1	<0.01
		2	^{238}U	2.5	2.3	2.4	<0.01
		2	^{238}Pu	<0.03	<0.009	<0.02	<0.01
		2	^{239}Pu	<0.02	<0.02	<0.02	<0.01
NTS Well Army No. 1	8	8	^{3}H	12	<7	<9	<0.01
		2	^{89}Sr	<7	<4	<5	<0.2
		2	^{90}Sr	<6	<0.6	<4	<1
		6	^{226}Ra	0.71	0.24	0.37	1
		2	^{234}U	2.4	2.2	2.3	<0.01
		2	^{235}U	0.044	0.037	0.041	<0.01
		2	^{238}U	0.88	0.78	0.83	<0.01
		2	^{238}Pu	<0.2	<0.03	<0.2	<0.01
		2	^{239}Pu	<0.2	<0.02	<0.2	<0.01
Beatty, Nev. Well 11S/48-1dd	10	10	^{3}H	15	<7	<9	<0.01
		2	^{89}Sr	<4	<3	<3	<0.1
		2	^{90}Sr	<2	<0.7	<1	<0.3
		9	^{226}Ra	0.26	<0.04	<0.2	<0.7
		2	^{234}U	8.5	8.3	8.4	0.03
		2	^{235}U	0.091	0.071	0.081	<0.01
		2	^{238}U	2.0	2.0	2.0	<0.01
		2	^{238}Pu	<0.05	<0.02	<0.04	<0.01
		2	^{239}Pu	<0.04	<0.03	<0.04	<0.01
NTS Well 2	8	8	^{3}H	13	<5	<9	<0.01
		2	^{89}Sr	<4	<2	<3	<0.1
		2	^{90}Sr	<3	<2	<3	<1
		2	^{234}U	2.0	1.8	1.9	<0.01
		2	^{235}U	<0.04	0.018	<0.03	<0.01
		2	^{238}U	0.55	0.48	0.52	<0.01
		2	^{238}Pu	<0.2	<0.02	<0.02	<0.01
		2	^{239}Pu	<0.2	<0.009	<0.1	<0.01

Table A-7. (continued)

Sampling Location	[1]No. Samples Collected	No. Samples Analyzed	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml) Max	Min	Avg	% of Conc. Guide[2]
NTS Well J-13	12	12	^{3}H	77	<6	<20	<0.01
		2	^{89}Sr	<3	<2	<2	<0.07
		2	^{90}Sr	<1	<0.6	<0.8	<0.3
		3	^{226}Ra	0.43	0.12	0.22	0.7
		2	^{234}U	1.9	1.6	1.8	<0.01
		2	^{235}U	<0.03	<0.02	<0.03	<0.01
		2	^{238}U	.30	.22	.26	<0.01
		2	^{238}Pu	<0.03	<0.03	<0.03	<0.01
		2	^{239}Pu	<0.02	<0.02	<0.02	<0.01
NTS Well U19c	6	6	^{3}H	<9	<7	<8	<0.01
		2	^{89}Sr	<4	<3	<3	<0.1
		2	^{90}Sr	<2	<0.7	<2	<0.7
		2	^{226}Ra	0.23	0.056	0.14	0.5
		2	^{234}U	4.7	0.67	2.7	<0.01
		2	^{235}U	<0.06	<0.02	<0.04	<0.01
		2	^{238}U	0.78	0.11	0.45	<0.01
		2	^{238}Pu	<0.2	<0.02	<0.2	<0.01
		2	^{239}Pu	<0.4	<0.03	<0.3	<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. 1976 Analytical Results for the NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(3)
NTS Well UE15d	1/08		23	^{3}H	<7	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<2	<0.7
				^{226}Ra	1.5	5
				^{234}U	4.9	0.02
				^{235}U	0.038	<0.01
				^{238}U	1.3	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.01	<0.01
NTS Well UE15d	7/12		23	^{3}H	<8	<0.01
				^{89}Sr	<4	<0.1
				^{90}Sr	<0.6	<0.2
				^{226}Ra	1.5	5
NTS Test Well D	2/03	571	23	^{3}H	11	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<2	<0.7
				^{234}U	0.26	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	0.11	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.01	<0.01
NTS Test Well D	8/05	571	23	^{3}H	11	<0.01
NTS Well UE1c	2/03	500	23	^{3}H	<8	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<2	<0.7
				^{226}Ra	<0.08	0.3
				^{234}U	3.6	0.01
				^{235}U	0.042	<0.01
				^{238}U	1.0	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01
NTS Well UE1c	8/04	500	23	^{3}H	<9	<0.01
				^{226}Ra	0.13	0.4

Table A-8. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(3)
NTS Test Well B	2/03	503	23	^{3}H	260	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<2	<0.7
				^{226}Ra	0.18	0.6
				^{234}U	0.21	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	<0.02	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01
NTS Test Well B	8/05	504	23	^{3}H	250	<0.01
NTS Well C-1	1/08		23	^{3}H	40	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	1.2	4
				^{234}U	7.7	0.03
				^{235}U	0.091	<0.01
				^{238}U	2.2	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01
NTS Well C-1	7/13		23	^{3}H	30	<0.01
				^{226}Ra	1.1	4
NTS Well UE5C	8/04		23	^{3}H	<9	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	3.4	0.01
				^{235}U	<0.08	<0.01
				^{238}U	1.9	<0.01
				^{238}Pu	0.19	<0.01
				^{239}Pu	<0.05	<0.01

Table A-8. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide(3)
NTS Well UE18r	8/03	507	23	^{3}H	<8	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	1.5	0.5
				^{226}Ra	0.11	0.4
				^{234}U	2.5	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	0.40	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.03	<0.01
NTS Well 5B	1/07		23	^{3}H	10	<0.01
				^{89}Sr	<1	<0.03
				^{90}Sr	<1	<0.3
				^{226}Ra	0.33	1
				^{234}U	3.0	0.01
				^{235}U	0.067	<0.01
				^{238}U	2.0	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.008	<0.01
NTS Well 5B	7/14		23	^{3}H	<8	<0.01
NTS Test Well F	2/02	1006	23	^{3}H	<9	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<2	<0.7
				^{226}Ra	2.0	7
				^{234}U	0.72	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.16	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.03	<0.01
NTS Test Well F	8/02	1006	23	^{3}H	<8	<0.01

Table A-8. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(3)
NTS Watertown No. 3	1/14		23	^{3}H	<8	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	1.4	<0.01
				^{235}U	0.023	<0.01
				^{238}U	0.65	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.01	<0.01
NTS Watertown No. 3	7/12		23	^{3}H	<8	<0.01
Ash Meadows, Nev. Crystal Pool	1/13		27	^{3}H	<8	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<2	<0.7
				^{226}Ra	0.45	2
				^{234}U	14	0.05
				^{235}U	0.27	<0.01
				^{238}U	4.8	0.01
				^{238}Pu	<0.05	<0.01
				^{239}Pu	<0.03	<0.01
Ash Meadows, Nev. Crystal Pool	7/19		27	^{3}H	<8	<0.01
				^{226}Ra	0.14	0.5
Ash Meadows, Nev. Well 18S/51E-7DB	1/13		23	^{3}H	<8	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<2	<0.7
				^{226}Ra	0.45	2
				^{234}U	3.0	0.01
				^{235}U	0.041	<0.01
				^{238}U	1.1	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.01	<0.01
Ash Meadows, Nev. Well 18S/51E-7DB	7/19		23	^{3}H	<8	<0.01

Table A-8. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[3]
Ash Meadows, Nev. Well 17S/50E-14CAC	1/13		23	^{3}H	<8	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<2	<0.7
				^{226}Ra	0.76	3
				^{234}U	2.7	<0.01
				^{235}U	0.043	<0.01
				^{238}U	1.0	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.03	<0.01
Ash Meadows, Nev. Well 17S/50E-14CAC	7/19		23	^{3}H	<8	<0.01
				^{226}Ra	0.66	2
Ash Meadows, Nev. Fairbanks Springs	1/13		27	^{3}H	<8	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<2	<0.7
				^{226}Ra	0.31	1
				^{234}U	2.3	<0.01
				^{235}U	0.045	<0.01
				^{238}U	0.92	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.02	<0.01
Ash Meadows, Nev. Fairbanks Springs	7/19		27	^{3}H	<7	<0.01
Beatty, Nev. City Supply	1/12		23	^{3}H	<8	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.13	0.4
				^{234}U	8.2	0.3
				^{235}U	0.12	<0.01
				^{238}Pu	2.6	<0.01
				^{238}Pu	<0.05	<0.01
				^{239}Pu	0.062	<0.01

Table A-8. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radionuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[3]
Beatty, Nev. City Supply	7/15		23	^{3}H	7.4	<0.01
				^{226}Ra	0.044	0.2
Beatty, Nev. Nuclear Engineering Co.	1/12		23	^{3}H	11	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.084	0.3
				^{234}U	5.9	0.02
				^{235}U	0.061	<0.01
				^{238}U	1.9	<0.01
				^{238}Pu	<0.05	<0.01
				^{239}Pu	<0.03	<0.01
Beatty, Nev. Nuclear Engineering Co.	7/20		23	^{3}H	45	<0.01
				^{226}Ra	0.19	0.6
Indian Springs, Nev. USAF No. 2	1/12		23	^{3}H	17	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.22	0.7
				^{234}U	5.1	0.02
				^{235}U	0.039	<0.01
				^{238}U	0.80	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01
Indian Springs, Nev. USAF No. 2	7/14		23	^{3}H	<8	<0.01
				^{226}Ra	0.12	0.4

Table A-8. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[3]
Indian Springs, Nev. Sewer Co. Inc. Well No. 1	1/12		23	^{3}H	<8	<0.01
				^{89}Sr	<1	<0.03
				^{90}Sr	<1	<0.3
				^{226}Ra	0.10	0.3
				^{234}U	3.4	0.01
				^{235}U	0.041	<0.01
				^{238}U	0.66	<0.01
				^{238}Pu	<0.04	<0.01
				^{239}Pu	<0.03	<0.01
Indian Springs, Nev. Sewer Co. Inc. Well No. 1	7/14		23	^{3}H	<8	<0.01
				^{226}Ra	0.078	0.3
Lathrop Wells, Nev. City Supply	1/12		23	^{3}H	<8	<0.01
				^{89}Sr	<1	<0.03
				^{90}Sr	<1	<0.3
				^{226}Ra	0.084	0.3
				^{234}U	1.1	<0.01
				^{235}U	<0.01	<0.01
				^{238}U	<0.02	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	0.032	<0.01
Lathrop Wells, Nev. City Supply	7/19		23	^{3}H	<8	<0.01
Springdale, Nev. Goss Springs	1/14		27	^{3}H	<11	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<2	<0.7
				^{226}Ra	0.16	0.5
				^{234}U	4.2	0.01
				^{235}U	0.055	<0.01
				^{238}U	1.1	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.01	<0.01

Table A-8. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide[3]
Springdale, Nev. Goss Springs	7/15		27	^{3}H	<7	<0.01
				^{226}Ra	0.072	0.2
Springdale, Nev. Road D Windmill	2/05		23	^{3}H	<8	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<2	<0.7
				^{226}Ra	0.37	1.2
				^{234}U	2.0	<0.01
				^{235}U	<0.04	<0.01
				^{238}U	1.0	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01
Springdale, Nev. Road D Windmill	7/15		23	^{3}H	<7	<0.01
Shoshone, Calif. Shoshone Spring	1/13		27	^{3}H	<30	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<2	<0.7
				^{226}Ra	0.24	0.8
				^{234}U	4.2	0.01
				^{235}U	0.042	<0.01
				^{238}U	1.4	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.02	<0.01
Shoshone, Calif. Shoshone Spring	7/19		27	^{3}H	<10	<0.01
				^{226}Ra	0.36	1

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

(2) 23 - Well
27 - Spring

(3) 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-9. 1976 Analytical Results for the NTS Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type(1)	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(2)
Hiko, Nev. Crystal Springs	7/06	27	^{3}H	<8	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	<0.8	<0.3
			^{226}Ra	0.54	2
			^{234}U	4.4	0.02
			^{235}U	0.052	<0.01
			^{238}U	1.6	<0.01
			^{238}Pu	<0.04	<0.01
			^{239}Pu	<0.04	<0.01
Alamo, Nev. City Supply	7/06	23	^{3}H	<8	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	<0.7	<0.2
			^{234}U	4.3	0.01
			^{235}U	0.048	<0.01
			^{238}U	1.9	<0.01
			^{238}Pu	<0.06	<0.01
			^{239}Pu	<0.03	<0.01
Warm Springs, Nev. Twin springs Ranch	7/07	27	^{3}H	<8	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	<0.8	<0.3
			^{226}Ra	0.40	1
			^{234}U	4.2	0.01
			^{235}U	0.042	<0.01
			^{238}U	2.0	<0.01
			^{238}Pu	<0.02	<0.01
			^{239}Pu	0.024	<0.01
Diablo, Nev. Highway Maint. Station	7/06	23	^{3}H	<8	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	<0.8	<0.3
			^{234}U	1.9	<0.01
			^{235}U	0.050	<0.01
			^{238}U	0.82	<0.01
			^{238}Pu	<0.008	<0.01
			^{239}Pu	<0.02	<0.01

Table A-9. (continued)

Sampling Location	Date	Sample Type[1]	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[2]
Nyala, Nev. Sharp Ranch	7/07	23	^{3}H	<8	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	<0.7	<0.2
			^{234}U	1.7	<0.01
			^{235}U	<0.03	<0.01
			^{238}U	0.65	<0.01
			^{238}Pu	<0.02	<0.01
			^{239}Pu	<0.03	<0.01
Adaven, Nev. Adaven Spring	7/07	27	^{3}H	130	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	<0.6	<0.2
			^{226}Ra	0.078	0.3
			^{234}U	3.1	0.01
			^{235}U	0.054	<0.01
			^{238}U	1.1	<0.01
			^{238}Pu	<0.03	<0.01
			^{239}Pu	<0.03	<0.01
Pahrump, Nev. Calvada Well 3	7/19	23	^{3}H	<10	<0.01
			^{89}Sr	<4	<0.1
			^{90}Sr	<0.7	<0.2
			^{226}Ra	0.13	0.4
			^{234}U	8.4	0.03
			^{235}U	0.13	<0.01
			^{238}U	2.6	<0.01
			^{238}Pu	<0.03	<0.01
			^{239}Pu	<0.02	<0.01
Tonopah, Nev. City Supply	7/07	23	^{3}H	<8	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	<0.8	<0.3
			^{226}Ra	0.18	0.6
			^{234}U	3.2	0.01
			^{235}U	<0.06	<0.01
			^{238}U	0.92	<0.01
			^{238}Pu	0.027	<0.01
			^{239}Pu	0.020	<0.01

Table A-9. (continued)

Sampling Location	Date	Sample Type[1]	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[2]
Clark Station, Nev. Tonopah Test Range Well No. 6	7/09	23	^{3}H	<10	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	<0.6	<0.2
			^{234}U	4.3	0.01
			^{235}U	0.15	<0.01
			^{238}U	2.3	<0.01
			^{238}Pu	<0.02	<0.01
			^{239}Pu	<0.02	<0.01
Las Vegas, Nev. Well No. 28	7/19	23	^{3}H	<9	<0.01
			^{89}Sr	<3	<0.1
			^{90}Sr	1.1	0.4
			^{234}U	2.1	<0.01
			^{235}U	0.039	<0.01
			^{238}U	0.69	<0.01
			^{238}Pu	<0.02	<0.01
			^{239}Pu	<0.02	<0.01

(1) 23 - Well
27 - Spring

(2) See Appendix B for Concentration Guides.

Table A-10. 1976 Analytical Results for the Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(3)
			PROJECT GNOME			
Malaga, N. Mex. USGS Well No. 1	5/01	161	23	^{3}H	8.6	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	5.0	17
				^{234}U	5.9	0.02
				^{235}U	0.062	<0.01
				^{238}U	1.8	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.007	<0.01
Malaga, N. Mex. USGS Well No. 4	5/01	148	23	^{3}H	870,000	29
				^{89}Sr	<600	<20
				^{90}Sr	8700	2900
				^{226}Ra	3.9	13
				^{234}U	2.3	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.56	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.0067	<0.01
Malaga, N. Mex. USGS Well No. 8	5/01	144	23	^{3}H	980,000	33
				^{89}Sr	<200	<7
				^{90}Sr	12,000	4000
				^{137}Cs	170	0.9
				^{226}Ra	3.1	10
				^{234}U	0.27	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.083	<0.01
				^{238}Pu	<0.05	<0.01
				^{239}Pu	<0.03	<0.01
Malaga, N. Mex. PHS Well No. 6	5/01		23	^{3}H	140	<0.01
				^{89}Sr	<5	<0.2
				^{90}Sr	<3	<1
				^{234}U	0.94	<0.01
				^{235}U	0.064	<0.01
				^{238}U	0.71	<0.01
				^{238}Pu	<0.05	<0.01
				^{239}Pu	<0.04	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide(3)
Malaga, N. Mex. PHS Well No. 8	4/30		23	^{3}H	6.7	<0.01
				^{89}Sr	<7	<0.3
				^{90}Sr	2.1	0.7
				^{226}Ra	0.069	0.2
				^{234}U	7.3	0.02
				^{235}U	0.13	<0.01
				^{238}U	2.3	<0.01
				^{238}Pu	<0.003	<0.01
				^{239}Pu	<0.009	<0.01
Malaga, N. Mex. PHS Well No. 9	4/30		23	^{3}H	11	<0.01
				^{89}Sr	<6	<0.2
				^{90}Sr	<3	<0.1
				^{234}U	1.7	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.60	<0.01
				^{238}Pu	<0.05	<0.01
				^{239}Pu	<0.03	<0.01
Malaga, N. Mex. PHS Well No. 10	4/30		23	^{3}H	<7	<0.01
				^{89}Sr	<6	<0.2
				^{90}Sr	<3	<1
				^{226}Ra	0.33	0.1
				^{234}U	10	0.03
				^{235}U	0.045	<0.01
				^{238}U	1.7	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.008	<0.01
Malaga, N. Mex. City Water	4/29		23	^{3}H	19	<0.01
				^{89}Sr	<5	<0.2
				^{90}Sr	<3	<1
				^{234}U	1.9	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.62	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide(3)
Malaga, N. Mex. Pecos River Pumping Station	4/29		23	^{3}H	<9	<0.01
				^{89}Sr	<5	<0.2
				^{90}Sr	<3	<1
				^{226}Ra	0.15	0.5
				^{234}U	0.027	<0.01
				^{235}U	<0.01	<0.01
				^{238}U	0.024	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.008	<0.01
Loving, N. Mex. City Well No. 2	4/29		23	^{3}H	18	<0.01
				^{89}Sr	<5	<0.2
				^{90}Sr	<3	<1
				^{234}U	1.9	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.65	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01
Carlsbad, N. Mex. City Well No. 7	4/29		23	^{3}H	17	<0.01
				^{89}Sr	<5	<0.2
				^{90}Sr	<3	<1
				^{234}U	0.69	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.28	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.02	<0.01
PROJECT SHOAL						
Frenchman, Nev. Frenchman Station	4/07		23	^{3}H	<20	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.089	0.3
				^{234}U	22	0.07
				^{235}U	0.39	<0.01
				^{238}U	11	0.03
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.05	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide(3)
Frenchman, Nev. Well HS-1	4/07		23	^{3}H	<9	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	1.1	4
				^{234}U	0.34	<0.01
				^{235}U	<0.01	<0.01
				^{238}U	0.39	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.03	<0.01
Frenchman, Nev. Well H-3	4/08		23	^{3}H	<9	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.18	0.6
				^{234}U	3.5	0.01
				^{235}U	0.038	<0.01
				^{238}U	2.1	<0.01
				^{238}Pu	<0.04	<0.01
				^{239}Pu	<0.03	<0.01
Frenchman, Nev. Flowing Well	4/07		23	^{3}H	<8	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.12	0.4
				^{234}U	0.39	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.24	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.03	<0.01
Frenchman, Nev. Hunts Station	4/07		23	^{3}H	<9	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	0.88	<0.01
				^{235}U	<0.01	<0.01
				^{238}U	0.49	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.04	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radionuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide[3]
			PROJECT DRIBBLE			
Baxterville, Miss.	1/12		23	^{3}H	86	<0.01
City Supply	4/20		23	^{3}H	83	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<2	<0.7
				^{234}U	<0.04	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	<0.03	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.04	<0.01
	7/12		23	^{3}H	54	<0.01
Baxterville, Miss.	1/14		22	^{3}H	96	<0.01
Lower Little Creek	4/25		22	^{3}H	240	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	0.050	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.053	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.02	<0.01
	7/12		22	^{3}H	35	<0.01
Baxterville, Miss.	1/13	381	23	^{3}H	60	<0.01
Well HT-1	4/21	378	23	^{3}H	40	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	0.020	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.023	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.06	<0.01
	7/13	378	23	^{3}H	24	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[3]
Baxterville, Miss.	1/15	108	23	^{3}H	<8	<0.01
Well HT-2c	4/24	108	23	^{3}H	40	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	0.045	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.029	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.02	<0.01
	7/14	108	23	^{3}H	18	<0.01
Baxterville, Miss.	1/15	122	23	^{3}H	16	<0.01
Well HT-4	4/24	122	23	^{3}H	26	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	2.9	0.01
				^{235}U	<0.03	<0.01
				^{238}U	0.85	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.01	<0.01
	7/14	122	23	^{3}H	<7	<0.01
Baxterville, Miss.	1/15	183	23	^{3}H	<8	<0.01
Well HT-5	4/24	183	23	^{3}H	14	<0.01
				^{89}Sr	<7	<0.3
				^{90}Sr	<2	<0.7
				^{234}U	<0.05	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	<0.05	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.02	<0.01
	7/14	183	23	^{3}H	<9	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide(3)
Baxterville, Miss.	1/15	282	23	^{3}H	13	<0.01
Well E-7	4/24	282	23	^{3}H	16	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	<0.02	<0.01
				^{235}U	<0.01	<0.01
				^{238}U	<0.02	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.01	<0.01
	7/14	282	23	^{3}H	<8	<0.01
Baxterville, Miss.	1/14		23	^{3}H	<9	<0.01
				^{226}Ra	0.094	0.3
Well Ascot No. 2	4/20		23	^{3}H	26	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	12	40
				^{234}U	0.040	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	<0.03	<0.01
				^{238}Pu	<0.07	<0.01
				^{239}Pu	<0.04	<0.01
	7/15		23	^{3}H	<8	<0.01
				^{226}Ra	7.8	26
Baxterville, Miss.	1/11		22	^{3}H	74	<0.01
Half Moon Creek	4/21		22	^{3}H	<7	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	0.044	<0.01
				^{235}U	<0.009	<0.01
				^{238}U	<0.02	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.06	<0.01
	7/11		22	^{3}H	40	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide(3)
Baxterville, Miss.	1/16		22	^{3}H	770	0.03
Half Moon Creek Overflow	4/23		22	^{3}H	2400	0.08
				^{89}Sr	<3	<0.1
				^{90}Sr	<1	<3
				^{234}U	0.18	<0.01
				^{235}U	<0.08	<0.01
				^{238}U	0.12	<0.01
				^{238}Pu	<0.07	<0.01
				^{239}Pu	<0.03	<0.01
	7/11		22	^{3}H	3000	0.1
				^{89}Sr	<4	<0.1
				^{90}Sr	<1	<0.3
Baxterville, Miss. T. Speights Residence	4/19		23	^{3}H	110	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	<0.03	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	<0.03	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.04	<0.01
	7/12		23	^{3}H	90	<0.01
Baxterville, Miss.	1/16		23	^{3}H	120	<0.01
R. L. Anderson Residence	4/22		23	^{3}H	120	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	<0.03	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	0.024	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.05	<0.01
	7/14		23	^{3}H	40	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide[3]
Baxterville, Miss.	1/12		23	^{3}H	160	<0.01
Mark Lowe Residence	4/22		23	^{3}H	150	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	0.027	<0.01
				^{235}U	<0.008	<0.01
				^{238}U	<0.02	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.02	<0.01
	7/12		23	^{3}H	80	<0.01
				^{89}Sr	<4	<0.2
				^{90}Sr	<0.7	<0.3
Baxterville, Miss.	1/16		23	^{3}H	70	<0.01
R. Ready Residence	4/22		23	^{3}H	100	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	0.12	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	0.046	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.008	<0.01
	7/15		23	^{3}H	30	<0.01
Baxterville, Miss.	1/16		23	^{3}H	90	<0.01
W. Daniels, Jr. Residence	4/22		23	^{3}H	70	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	<0.02	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	<0.02	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.01	<0.01
	7/12		23	^{3}H	<8	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[3]
Lumberton, Miss.	1/12		23	^{3}H	<8	<0.01
City Supply Well No. 2	4/19		23	^{3}H	<7	<0.01
				^{89}Sr	<8	<0.3
				^{90}Sr	<1	<0.3
				^{234}U	0.26	<0.01
				^{235}U	<0.06	<0.01
				^{238}U	0.11	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.01	<0.01
	7/13		23	^{3}H	<7	<0.01
Purvis, Miss.	1/12		23	^{3}H	<8	<0.01
City Supply	4/22		23	^{3}H	<8	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	<0.04	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	<0.04	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.05	<0.01
	7/15		23	^{3}H	<9	<0.01
Columbia, Miss.	1/12		23	^{3}H	19	<0.01
City Supply	4/22		23	^{3}H	25	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	<0.03	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	<0.03	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.007	<0.01
	7/12		23	^{3}H	<7	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide[3]
Lumberton, Miss.	1/12		23	^{3}H	<7	<0.01
North Lumberton City Supply	4/19		23	^{3}H	16	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	<0.05	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	<0.04	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.04	<0.01
	7/13		23	^{3}H	7.4	<0.01
				^{226}Ra	0.16	0.5
Baxterville, Miss.	1/16		21	^{3}H	54	<0.01
Pond W of GZ	4/23		21	^{3}H	61	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<1	<0.3
				^{234}U	0.042	<0.01
				^{235}U	<0.009	<0.01
				^{238}U	<0.02	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.008	<0.01
	7/11		21	^{3}H	31	<0.01
PROJECT GASBUGGY						
Gobernador, N. Mex. Arnold Ranch	5/23		27	^{3}H	<8	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.17	0.6
				^{234}U	2.1	<0.01
				^{235}U	0.041	<0.01
				^{238}U	0.74	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.03	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[3]
Gobernador, N. Mex. Lower Burro Canyon	5/23		23	^{3}H	5.8	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.26	0.9
				^{234}U	0.16	<0.01
				^{235}U	<0.02	<0.01
				^{238}U	<0.02	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.04	<0.01
Gobernador, N. Mex. Fred Bixler Ranch	5/23		23	^{3}H	7.7	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	0.25	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	0.062	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.04	<0.01
Blanco, N. Mex. San Juan River	5/23		22	^{3}H	270	<0.01
				^{89}Sr	<5	<0.2
				^{90}Sr	<1	<0.3
				^{234}U	2.2	<0.01
				^{235}U	<0.06	<0.01
				^{238}U	1.3	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.008	<0.01
Gobernador, N. Mex. Cave Springs	5/23		27	^{3}H	11	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.089	0.3
				^{234}U	2.6	<0.01
				^{235}U	0.052	<0.01
				^{238}U	1.5	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.05	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide[3]
Gobernador, N. Mex. Windmill No. 2	5/23		23	^{3}H	<7	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.083	0.3
				^{234}U	0.44	<0.01
				^{235}U	<0.040	<0.01
				^{238}U	0.20	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.04	<0.01
Gobernador, N. Mex. Bubbling Springs	5/23		27	^{3}H	138	<0.01
				^{89}Sr	<1	<0.03
				^{90}Sr	<1	<0.3
				^{226}Ra	0.16	0.5
				^{234}U	2.6	<0.01
				^{235}U	0.047	<0.01
				^{238}U	1.3	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.03	<0.01
Dulce, N. Mex. City Water Supply	5/23		21	^{3}H	230	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<9	<0.3
				^{234}U	0.62	<0.01
				^{235}U	<0.09	<0.01
				^{238}U	0.63	<0.01
				^{238}Pu	<0.9[4]	<0.02
				^{239}Pu	<0.6[4]	<0.02
Dulce, N. Mex. La Jara Lake	5/23		21	^{3}H	220	<0.01
				^{89}Sr	<3	<0.1
				^{90}Sr	<2	<0.2
				^{226}Ra	0.28	0.9
				^{234}U	6.7	0.22
				^{235}U	0.12	<0.01
				^{238}U	3.6	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.008	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(3)
Gobernador, N. Mex. EPNG Well 10-36	5/22	1097	23	^{3}H	<7	<0.01
				^{89}Sr	<5	<0.2
				^{90}Sr	<1	<0.3
				^{226}Ra	0.36	1.2
				^{234}U	0.23	<0.01
				^{235}U	<0.05	<0.01
				^{238}U	0.091	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.009	<0.01
PROJECT RULISON						
Rulison, Colo. Lee L. Hayward Ranch	5/19		23	^{3}H	470	0.02
				^{89}Sr	<2	<0.07
				^{90}Sr	<0.8	<0.3
				^{226}Ra	0.18	0.6
				^{234}U	8.3	0.03
				^{235}U	0.13	<0.01
				^{238}U	4.5	0.04
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.04	<0.01
Rulison, Colo. Glen Schwab Ranch	5/19		23	^{3}H	750	0.03
				^{89}Sr	<2	<0.07
				^{90}Sr	<0.8	<0.3
				^{226}Ra	0.18	0.6
				^{234}U	8.4	0.03
				^{235}U	0.16	<0.01
				^{238}U	4.9	0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.03	<0.01
Grand Valley, Colo. Albert Gardner Ranch	5/19		23	^{3}H	610	0.02
				^{89}Sr	<2	<0.07
				^{90}Sr	<0.9	<0.3
				^{234}U	2.0	<0.01
				^{235}U	0.14	<0.01
				^{238}U	1.4	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.04	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radionuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(3)
Grand Valley, Colo. City Water Supply	5/19		27	^{3}H	<6	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<0.8	<0.3
				^{234}U	1.8	<0.01
				^{235}U	0.045	<0.01
				^{238}U	0.72	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01
Grand Valley, Colo. Spring 300 Yds. NW of GZ	5/20		27	^{3}H	270	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<0.8	<0.3
				^{234}U	1.5	<0.01
				^{235}U	0.037	<0.01
				^{238}U	0.71	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.06	<0.01
Rulison, Colo. Felix Sefcovic Ranch	5/19		23	^{3}H	420	0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<0.8	<0.3
				^{234}U	0.47	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	0.24	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.03	<0.01
Anvil Points, Colo. Bernklau Ranch	5/19		27	^{3}H	350	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<0.8	<0.3
				^{234}U	2.8	<0.01
				^{235}U	<0.03	<0.01
				^{238}U	1.4	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.03	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)[1]	Sample Type[2]	Radio-nuclide	Radioactivity Conc. (10^{-9} µCi/ml)	% of Conc. Guide[3]
Grand Valley, Colo. Battlement Creek	5/20		22	^{3}H	250	<0.01
				^{89}Sr	<6	0.2
				^{90}Sr	1.6	0.5
				^{234}U	1.1	<0.01
				^{235}U	<0.1	<0.01
				^{238}U	0.54	<0.01
				^{238}Pu	<0.009	<0.01
				^{239}Pu	<0.007	<0.01
Grand Valley, Colo. CER Well	5/20	13.6	23	^{3}H	350	0.01
				^{89}Sr	<6	<0.2
				^{90}Sr	<0.9	<0.3
				^{234}U	0.60	<0.01
				^{235}U	<0.07	<0.01
				^{238}U	0.40	<0.01
				^{238}Pu	<0.01	<0.01
				^{239}Pu	<0.06	<0.01
Rulison, Colo. Potter Ranch	5/19		27	^{3}H	350	0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.11	0.4
				^{234}U	5.4	0.02
				^{235}U	0.16	<0.01
				^{238}U	3.0	0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.05	<0.01
PROJECT FAULTLESS						
Blue Jay, Nev. Highway Maint. Station	5/05		23	^{3}H	<7	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<8	<3
				^{226}Ra	0.12	0.4
				^{234}U	3.5	0.01
				^{235}U	0.049	<0.01
				^{238}U	1.4	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.01	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(3)
Warm Springs, Nev. Hot Creek Ranch	5/05		27	^{3}H	77	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.072	0.2
				^{234}U	1.6	<0.01
				^{235}U	<0.04	<0.01
				^{238}U	0.93	<0.01
				^{238}Pu	<0.04	<0.01
				^{239}Pu	<0.03	<0.01
Blue Jay, Nev. Blue Jay Spring	5/05		27	^{3}H	22	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<9	<3
				^{226}Ra	0.15	0.5
				^{234}U	3.9	0.01
				^{235}U	0.049	<0.01
				^{238}U	1.7	<0.01
				^{238}Pu	<0.02	<0.01
				^{239}Pu	<0.02	<0.01
Blue Jay, Nev. Sixmile Well	5/05		23	^{3}H	<7	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	1.7	<0.01
				^{235}U	0.025	<0.01
				^{238}U	0.68	<0.01
				^{238}Pu	<0.030	<0.01
				^{239}Pu	<0.040	<0.01
Blue Jay, Nev. Well HTH-1	5/06	259	23	^{3}H	19	<0.01
				^{89}Sr	<6	<0.2
				^{90}Sr	<2	<0.7
				^{234}U	1.9	<0.01
				^{235}U	<0.05	<0.01
				^{238}U	0.95	<0.01
				^{238}Pu	<0.03	<0.01
				^{239}Pu	<0.02	<0.01
	5/06	305	23	^{3}H	6.4	<0.01
	5/06	855	23	^{3}H	14	<0.01

Table A-10. (continued)

Sampling Location	Date	Depth (m)(1)	Sample Type(2)	Radio-nuclide	Radioactivity Conc. (10^{-9} μCi/ml)	% of Conc. Guide(3)
Blue Jay, Nev. Well HTH-2	5/06	184	23	^{3}H	<6	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{234}U	2.7	<0.01
				^{235}U	0.033	<0.01
				^{238}U	0.76	<0.01
				^{238}Pu	<0.04	<0.01
				^{239}Pu	<0.02	<0.01
Blue Jay, Nev.	5/06	213	23	^{3}H	14	<0.01
Well HTH-2	5/06	300	23	^{3}H	26	<0.01
				^{89}Sr	<2	<0.07
				^{90}Sr	<1	<0.3
				^{226}Ra	0.056	2
				^{234}U	2.7	<0.01
				^{235}U	<0.04	<0.01
				^{238}U	0.76	<0.01
				^{238}Pu	<0.04	<0.01
				^{239}Pu	<0.03	<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
27 - Spring

(3) Concentration Guides for drinking water at on-site locations are the same as those for off-site locations. See Appendix B for Concentration Guides.

(4) Chemical yield of sample was only 40% resulting in higher than normal MDC.

APPENDIX B. RADIATION PROTECTION STANDARDS FOR EXTERNAL AND INTERNAL EXPOSURE

ERDA 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

ERDA CONCENTRATION GUIDES (CG's)[1]

Network or Program	Sampling Medium	Radionuclide	CG (μCi/ml)	Basis of Exposure
Air Surveillance Network	air	^{7}Be	1.1×10^{-8}	Suitable sample of the exposed population in uncontrolled area.
		^{95}Zr	3.3×10^{-10}	
		^{103}Ru	1.0×10^{-9}	
		^{131}I	3.3×10^{-11}	
		^{132}Te	1.0×10^{-9}	
		^{140}Ba	3.3×10^{-10}	
Noble Gas and Tritium Surveillance Network, On-NTS	air	^{85}Kr	1.0×10^{-5}	Individual in controlled area.
		^{3}H	5.0×10^{-6}	
		^{133}Xe	1.0×10^{-5}	
Noble Gas and Tritium Surveillance Network, Off-NTS	air	^{85}Kr	1.0×10^{-7}	Suitable sample of the exposed population in uncontrolled area.
		^{3}H	6.7×10^{-8}	
		^{133}Xe	1.0×10^{-7}	

Network or Program	Sampling Medium	Radionuclide	CG (μCi/ml)	Basis of Exposure
Long-Term Hydrological Program	water	^{3}H	3.0×10^{-3}	Individual in a controlled or an uncontrolled area.
		^{89}Sr	3.0×10^{-6}	
		^{90}Sr	3.0×10^{-7}	
		^{137}Cs	2.0×10^{-5}	
		^{226}Ra	3.0×10^{-8}	
		^{234}U	3.0×10^{-5}	
		^{235}U	3.0×10^{-5}	
		^{238}U	4.0×10^{-5}	
		^{238}Pu	5.0×10^{-6}	
		^{239}Pu	5.0×10^{-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 litre 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 litre
Tritium	Total body	20,000
Strontium-90	Bone marrow	8

(1)"Radiation Protection Standards," ERDA 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 reguarly serves an average of 25 individuals daily at least 3 months out of the year.

APPENDIX C. REPLICATE SAMPLING PROGRAM

Purpose

The program was initiated for the purpose of routinely assessing the errors due to sampling replication error and analytical/counting errors associated with the collection and analysis of samples obtained from the surveillance networks maintained around the Nevada Test Site and other sites designated by the Nevada Operations Office, Energy Research and Development Administration.

Procedure

The program involved the collection and analysis of replicate samples from the Air Surveillance Network (ASN), the Noble Gas and Tritium Surveillance Network (NG&TSN), the Dosimetry Network and the Standby Milk Surveillance Network (SMSN). Due to difficulties anticipated in obtaining sufficient quantities of milk for duplicate samples from the Milk Surveillance Network, duplicate samples were collected during the annual activation of the SMSN.

At least 40 duplicate samples from each network were collected and analyzed over the report period. Since three thermoluminescent (TLD) cards consisting of two TLD chips each are used at each station of the Dosimetry Network, no additional samples were necessary. The following table summarizes the sampling information for each surveillance network.

TABLE C-1. SAMPLES AND ANALYSES FOR REPLICATE SAMPLING PROGRAM

Surveillance Network	Number of Sampling Locations	Samples Collected Per Year	Total No. of Replicate Samples	Replicate Sample Size	Sample Analysis
ASN	121	8,300	131	2	Gross β
NG&TSN	11	572	40	2	^{85}Kr
	11	572	12	2	^{3}H
	11	572	12	2	HTO
	11	572	8	2	HT
	11	572	44	2	H_2O
Dosimetry	70	289	289	4-6	External γ

Surveillance Network	Number of Sampling Locations	Samples Collected Per Year	Total No. of Replicate Samples	Replicate Sample Size	Sample Analysis
SMSN	185	185	96	2	^{40}K
LTHMP (surface)	8	16	11	2	^{238}U
LTHMP (wellhead)	62	187	22	2	^{238}U
LTHMP (deep well)	18	36	11	2	^{238}U

There were other analyses for air, milk and water samples that could not be included in this evaluation due to the fact that there were not a sufficient number of analytical results available at the time of this report. Since the sampling distributions of each sample type appeared to be log-normal from the review of cumulative frequency plots of the results, the variance of each set of replicate sample results was estimated from the logarithms of the results in each set.

The variance, s^2, of each set of replicate TLD results (n=6) was estimated from the logarithms of the results by the standard expression,

$$s^2 = \sum_{i=1}^{n} (x_i - \bar{x})^2/(n-1)$$

Since duplicate samples were collected for all other sample types, the variances (s^2) for these types were calculated from $s^2 = (0.886R)^2$, where R is the absolute difference between the logarithms of the duplicate sample results. For small sample sizes, this estimate of the variance is statistically efficient[1] and certainly more convenient in calculating than the standard expression.

The principle that the variances of random samples collected from a normal population follow a chi-square distribution (χ^2) was then used to estimate the confidence interval of the expected population geometric variance for each type of sample analysis. The expressions used are as follows:[2]

$$\tilde{s}^2 = \sum_{i=1}^{n}(n_i-1)s_i^2 / \sum_{i=1}^{n}(n_i-1)$$

$$\text{Lower Confidence Limit (LCL)} = \sum_{i=1}^{n}(n_i-1)(\tilde{s}^2)/\chi^2\{0.995, \sum_{i=1}^{n}(n_i-1)\}$$

$$\text{Upper Confidence Limit (UCL)} = \sum_{i=1}^{n}(n_i-1)(\tilde{s}^2)/\chi^2\{0.005, \sum_{i=1}^{n}(n_i-1)\}$$

LCL $\leq \sigma^2 \leq$ UCL

where σ^2 = the true value of the population geometric variance.

$n_i - 1$ = the degrees of freedom for n samples collected for the ith replicate sample.

s^2 = the expected geometric variance of the ith replicate sample.

$\tilde{s}^2$ = the best estimate of sample geometric variance derived from the variance estimates of all replicate samples (the expected value of $\tilde{s}^2$ is σ^2).

The 99% upper confidence limit for the total error (sampling + analytical/counting errors) of the geometric mean of any group of samples collected from a given network was then determined as the geometric mean $+2.57\tilde{s}$.

The following table summarizes the antilogarithm of the results for the 99% confidence limits on the expected geometric standard deviation of the total error, compares the confidence limits of the total error with the ranges in geometric standard deviations observed from the data of each network, and lists the 99% upper confidence limit (UCL) expected from the sampling/analytical/counting errors for the geometric mean of any Network samples.

TABLE C-2. UPPER CONFIDENCE LIMITS OF SAMPLING AND ANALYTICAL/ COUNTING ERRORS

		From Evaluation of Replicate Samples				Observed Geometric Std Dev From Network Data		
		No. of Replicate Samples	99% Confidence Limits For Expected Geometric Standard Deviation					99% UCL of Total Error
Surveillance Network	Analysis		$LCL_{0.995}$	$\tilde{s}$	$UCL_{0.005}$	Min	Max	
ASN	Gross β	131	1.83	2.03	2.33	1.3	5.8	6.2
NG&TSN	^{85}Kr	40	1.20	1.26	1.38	1.2	1.2	1.8
	^{3}H	12	1.41	1.69	1.81	1.4	5.1	3.8
	HTO	12	1.52	1.90	3.56	1.8	5.2	5.2
	HT	8	1.20	1.34	1.98	1.7	2.6	2.2
Dosimetry	γ (TLD)	289	1.050	1.053	1.056	1.1	1.3(3)	1.1

Surveillance Network	Analysis	From Evaluation of Replicate Samples: No. of Replicate Samples	99% Confidence Limits For Expected Geometric Standard Deviation: $LCL_{0.995}$	$\tilde{s}$	$UCL_{0.005}$	Observed Geometric Std Dev From Network Data: Min	Max	99% UCL of Total Error
SMSN	^{40}K	96	1.08	1.09	1.11	1.0	1.2	1.3
LTHMP								
(Surface)	^{238}U	11	1.77	2.44	6.25	-		9.9
(Wellhead)	^{238}U	22	1.46	1.69	2.32	1.1	7.4	3.9
(Deep Well)	^{238}U	11	1.72	2.34	5.74	-		8.9

From a comparison of the observed geometric standard deviation with the expected geometric standard deviation from sampling and analytical/counting errors, one can see that the observed variations in surveillance data exceed the variance attributable to the sampling and analytical/counting errors except for the ^{85}Kr data and the environmental radiation TLD measurements. Apparently, the majority of variations in ^{85}Kr concentrations are the result of the sampling and analytical/counting errors. As there are not sufficient TLD data per station and year, the actual variation in TLD exposures under environmental conditions could not be determined. However, the variation in TLD data for the Hanford environs can be used as a reasonable substitute.

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(1) Snedecor, G. W. and W. G. Cochran. Statistical Methods. The Iowa State University Press, Ames, Iowa. 6th ed. 1967. pp 39-47.

(2) Freud, J. E. Mathematical Statistics. Prentice Hall, N. J. Engelwood, 1962. pp 189-197, 235.

(3) Not based on EMSL-LV data. Fix, J. J. and P. J. Blumer. "Thermoluminescent Dosimeter (CaF_2Dy) Measurement of Hanford Environs, 1971-1975." BNWL-2140, UC-41. Battelle Northwest Laboratories. Richland, Washington. Jan. 1977. pp A-2 to A-7.

APPENDIX D. AIRBORNE RADIOACTIVITY FROM ATMOSPHERIC NUCLEAR TESTS BY PEOPLE'S REPUBLIC OF CHINA

Airborne radioactivity from the first atmospheric test by the People's Republic of China on September 25 at 2200 hours, PDT, was detected throughout the Network beginning with samples collected over a 3-day period (weekend) that ended October 4. The airborne concentration of gross beta radioactivity estimated from the analysis of filters collected at those stations operated throughout October was observed to reach its peak during the period October 15-25 and to generally decrease throughout the remainder of the year, except for a slight increase in November from the second Chinese test. Typical time series plots of the gross beta concentrations in air are shown in Figures D-1 and D-2 for Duckwater, Nevada, and Lone Pine, California, where the maximum individual concentration of gross beta radioactivity (6.2×10^{-12} µCi/ml in a sample collected October 13-15) and the maximum quarterly average concentration of gross beta radioactivity ($<8.0\times10^{-13}$ µCi/ml) occurred, respectively. The increase in gross beta radioactivity concentrations from the second Chinese test (November 16 at 2200 hours, PST) shown by the small peaks shown on November 24 for these two stations and during the week of November 21 for 33 of the other active stations. The highest concentration measured following the second test was 2.1×10^{-12} µCi/ml for a sample collected at Boise, Idaho, during the period November 22-23.

The fission products ^{95}Zr, ^{103}Ru, ^{106}Ru, ^{141}Ce, ^{144}Ce, ^{131}I, ^{132}Te, ^{140}Ba, and naturally occurring ^{7}Be were detected in various combinations on many of the particulate filters collected during the 4th calendar quarter and analyzed by gamma spectrometry. Due to gamma peak interferences and the large number of filters to be analyzed, the concentrations for the radionuclides ^{106}Ru, ^{141}Ce, and ^{144}Ce could not be quantitated. The fresh fission products ^{131}I, ^{132}Te, and ^{140}Ba were detected on air filters collected only during the month of October, whereas the longer-lived fission products ^{95}Zr, ^{103}Ru, ^{106}Ru, ^{141}Ce, and ^{144}Ce were detected throughout the 4th quarter. No radionuclides were detected on any of the charcoal cartridges. The following table shows the locations where the samples having the maximum concentration of each radionuclide were collected.

TABLE D-1. LOCATIONS OF MAXIMUM RADIONUCLIDE CONCENTRATIONS IN AIR

Location	Radio-nuclide	Half-Life (days)	Collection Period	Max. Conc. (10^{-12} μCi/ml)	%CG
Barstow, Calif.	^{7}Be	53	10/13-10/15	0.84	<0.01
Barstow, Calif.	^{95}Zr	65	10/22-10/25	3.9	1
Barstow, Calif.	^{103}Ru	40	10/22-10/25	2.6	0.3
Nyala, Nev.	^{131}I	8.0	10/28-10/30	1.0	3
Lida, Nev.	^{132}Te	3.3	10/04-10/06	0.17	0.02
Barstow, Calif.	^{140}Ba	13	10/22-10/25	4.6	1

Although the CG's of the ERDA, as specified in the ERDA Manual, Chapter 0524 (Appendix B), are not applicable to foreign nuclear tests, the percentages of the relevant CG's are shown as a means of interpreting the potential radiological hazard from the observed concentrations of radioactivity. Except for ^{131}I, these CG's are the same as 1/10 of the maximum permissible concentrations in air recommended by the National Committee of Radiation Protection (NCRP) for continuous occupational exposures. The CG for ^{131}I is 1/30 of the NCRP value.

From the gamma spectrometry results of all samples, the highest total thyroid inhalation dose from radioiodines was calculated from the samples collected at Nyala, Nevada, over the period October 2-30. The doses estimated for that location were 0.15 mrem for a hypothetical infant receptor and 0.081 mrem for a hypothetical adult receptor.

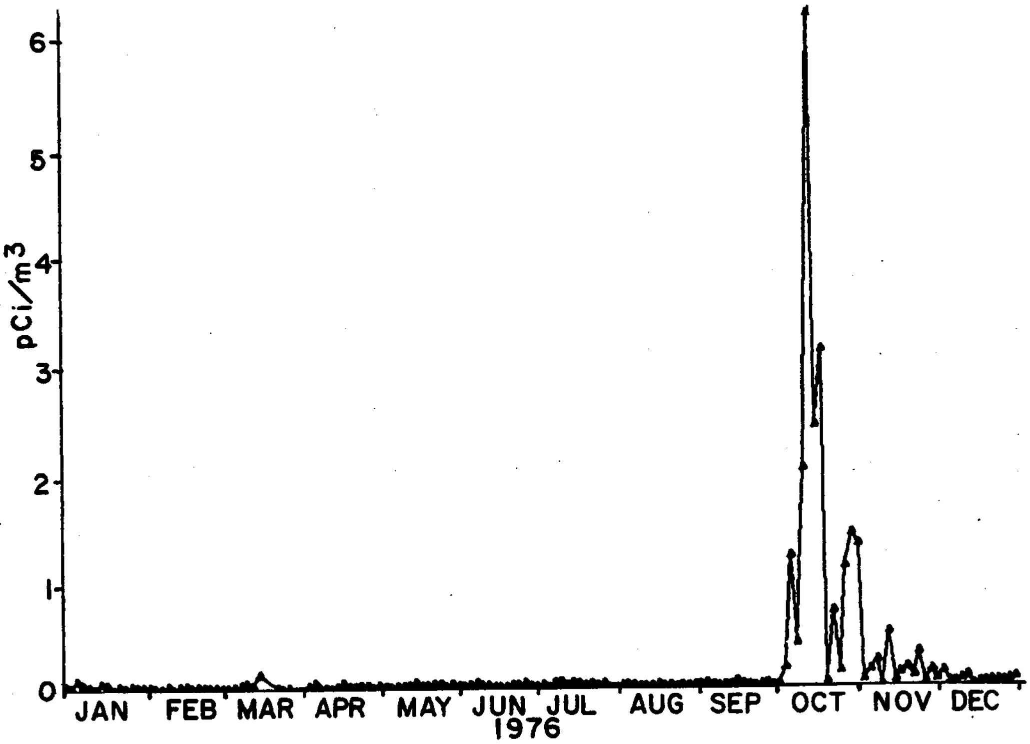

Figure D-1. Gross Beta Radioactivity Concentrations in Air at Duckwater, Nevada

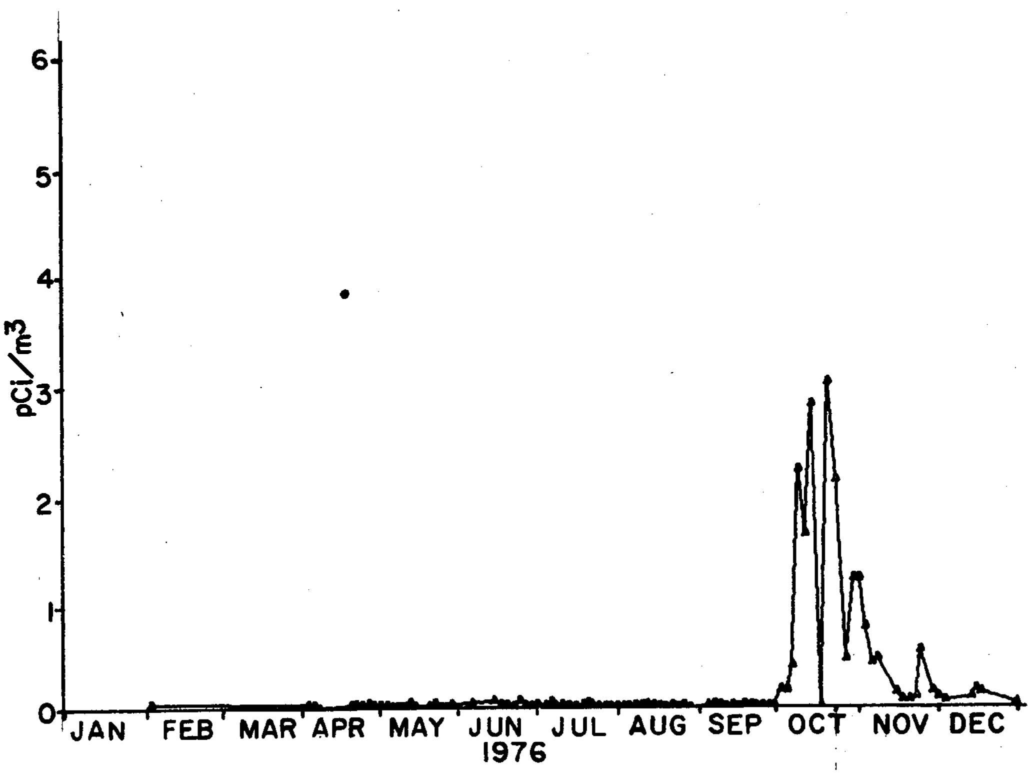

Figure D-2. Gross Beta Radioactivity Concentrations in Air at Lone Pine, California

Table D-2. 1976 Summary of Analytical Results for Air Surveillance Network Active Stations

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9} μCi/ml) Max	Min	Avg
Kingman, Ariz.	10.0	^{7}Be	0.43	0.20	0.0088
	40.0	^{95}Zr	0.43	0.20	0.015
	4.0	^{103}Ru	0.12	0.052	0.00094
	12.0	^{131}I	0.16	0.035	0.0025
	.0	^{132}Te	-	-	-
	28.0	^{140}Ba	0.54	0.048	0.015
Seligman, Ariz.	7.0	^{7}Be	0.44	0.23	0.0056
	43.8	^{95}Zr	0.50	0.022	0.018
	10.0	^{103}Ru	0.31	0.056	0.0053
	14.0	^{131}I	0.27	0.046	0.0054
	.0	^{132}Te	-	-	-
	32.2	^{140}Ba	0.58	0.038	0.021
Baker, Calif.	8.9	^{7}Be	0.45	0.15	0.0075
	38.6	^{95}Zr	0.50	0.012	0.018
	4.9	^{103}Ru	0.10	0.080	0.0013
	13.7	^{131}I	0.21	0.030	0.0044
	.0	^{132}Te	-	-	-
	28.6	^{140}Ba	0.60	0.028	0.018
Barstow, Calif.	8.0	^{7}Be	0.84	0.20	0.0087
	49.0	^{95}Zr	3.9	0.018	0.049
	5.0	^{103}Ru	2.6	0.11	0.022
	10.0	^{131}I	0.20	0.063	0.0034
	.0	^{132}Te	-	-	-
	26.0	^{140}Ba	4.6	0.029	0.053
Bishop, Calif.	.0	^{7}Be	-	-	-
	41.0	^{95}Zr	0.63	0.021	0.023
	10.0	^{103}Ru	0.29	0.077	0.0049
	14.0	^{131}I	0.22	0.028	0.0046
	.0	^{132}Te	-	-	-
	29.0	^{140}Ba	0.59	0.075	0.024
Death Valley Jct., Calif.	5.0	^{7}Be	0.34	0.26	0.0041
	42.3	^{95}Zr	0.66	0.021	0.020
	5.0	^{103}Ru	0.097	0.081	0.0013
	3.1	^{131}I	0.022	0.022	0.00020
	.0	^{132}Te	-	-	-
	20.1	^{140}Ba	0.54	0.037	0.014

Table D-2. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9} μCi/ml) Max	Min	Avg
Furnace Creek, Calif.	3.0	^{7}Be	0.35	0.35	0.0031
	46.0	^{95}Zr	0.71	0.017	0.017
	10.0	^{103}Ru	0.33	0.058	0.0045
	9.9	^{131}I	0.18	0.035	0.0034
	.0	^{132}Te	-	-	-
	27.0	^{140}Ba	1.6	0.049	0.022
Lone Pine, Calif.	9.0	^{7}Be	0.45	0.28	0.014
	48.1	^{95}Zr	0.70	0.015	0.038
	12.9	^{103}Ru	0.25	0.044	0.0089
	16.9	^{131}I	0.26	0.033	0.0099
	.0	^{132}Te	-	-	-
	30.9	^{140}Ba	0.62	0.056	0.040
Needles, Calif.	.0	^{7}Be	-	-	-
	35.0	^{95}Zr	0.66	0.014	0.012
	2.0	^{103}Ru	0.52	0.52	0.0044
	8.8	^{131}I	0.10	0.023	0.0028
	.0	^{132}Te	-	-	-
	18.8	^{140}Ba	1.0	0.034	0.016
Ridgecrest, Calif.	5.0	^{7}Be	0.35	0.20	0.0036
	40.0	^{95}Zr	0.50	0.014	0.016
	10.0	^{103}Ru	0.19	0.041	0.0028
	4.0	^{131}I	0.17	0.12	0.0016
	2.0	^{132}Te	0.16	0.16	0.00087
	25.0	^{140}Ba	0.41	0.035	0.016
Shoshone, Calif.	6.9	^{7}Be	0.29	0.22	0.0047
	39.0	^{95}Zr	0.69	0.012	0.019
	5.0	^{103}Ru	0.22	0.10	0.0024
	13.0	^{131}I	0.30	0.029	0.0044
	5.0	^{132}Te	0.15	0.032	0.0011
	27.0	^{140}Ba	0.69	0.031	0.018
Alamo, Nev.	10.9	^{7}Be	0.39	0.18	0.0079
	40.8	^{95}Zr	0.58	0.015	0.020
	8.9	^{103}Ru	0.30	0.083	0.0044
	9.8	^{131}I	0.25	0.032	0.0038
	.0	^{132}Te	-	-	-
	29.7	^{140}Ba	0.57	0.018	0.020

Table D-2. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9} µCi/ml) Max	Min	Avg
Austin, Nev.	4.2	^{7}Be	0.22	0.15	0.0026
	35.9	^{95}Zr	0.69	0.020	0.026
	10.8	^{103}Ru	0.34	0.058	0.0080
	7.9	^{131}I	0.24	0.042	0.0019
	.0	^{132}Te	-	-	-
	22.7	^{140}Ba	0.67	0.052	0.025
Beatty, Nev.	6.0	^{7}Be	0.31	0.27	0.0051
	31.9	^{95}Zr	0.78	0.028	0.025
	1.9	^{103}Ru	0.056	0.056	0.00031
	4.0	^{131}I	0.25	0.12	0.0022
	.0	^{132}Te	-	-	-
	22.0	^{140}Ba	0.65	0.047	0.020
Blue Eagle Ranch, Nev.	9.9	^{7}Be	0.27	0.16	0.0062
	35.8	^{95}Zr	0.49	0.016	0.013
	3.0	^{103}Ru	0.14	0.14	0.0012
	7.0	^{131}I	0.20	0.13	0.0033
	.0	^{132}Te	-	-	-
	22.9	^{140}Ba	0.48	0.032	0.012
Blue Jay, Nev.	15.0	^{7}Be	0.33	0.15	0.0092
	42.0	^{95}Zr	0.48	0.015	0.016
	3.0	^{103}Ru	0.24	0.24	0.0020
	6.9	^{131}I	0.16	0.061	0.0021
	.0	^{132}Te	-	-	-
	28.0	^{140}Ba	0.53	0.015	0.017
Caliente, Nev.	.0	^{7}Be	-	-	-
	48.7	^{95}Zr	0.59	0.013	0.017
	2.1	^{103}Ru	0.23	0.23	0.0013
	7.7	^{131}I	0.31	0.020	0.0030
	.0	^{132}Te	-	-	-
	27.0	^{140}Ba	0.56	0.020	0.017
Currant Ranch, Nev.	4.0	^{7}Be	0.45	0.40	0.0048
	49.1	^{95}Zr	0.59	0.014	0.020
	1.9	^{103}Ru	0.058	0.058	0.00032
	7.2	^{131}I	0.23	0.12	0.0033
	.0	^{132}Te	-	-	-
	24.0	^{140}Ba	0.57	0.028	0.019

Table D-2. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9} μCi/ml) Max	Min	Avg
Diablo, Nev.	6.0	^{7}Be	0.25	0.23	0.0040
	29.8	^{95}Zr	0.59	0.014	0.015
	.0	^{103}Ru	-	-	-
	4.0	^{131}I	0.13	0.10	0.0013
	.0	^{132}Te	-	-	-
	21.8	^{140}Ba	0.62	0.013	0.014
Duckwater, Nev.	5.0	^{7}Be	0.23	0.20	0.0030
	31.0	^{95}Zr	0.66	0.035	0.015
	5.0	^{103}Ru	0.19	0.18	0.0026
	14.0	^{131}I	0.22	0.036	0.0047
	.0	^{132}Te	-	-	-
	19.0	^{140}Ba	0.56	0.062	0.013
Ely, Nev.	12.1	^{7}Be	0.61	0.30	0.013
	42.2	^{95}Zr	0.60	0.013	0.020
	5.0	^{103}Ru	0.31	0.12	0.0035
	5.8	^{131}I	0.21	0.094	0.0029
	.0	^{132}Te	-	-	-
	25.0	^{140}Ba	0.64	0.017	0.021
Eureka, Nev.	9.0	^{7}Be	0.32	0.25	0.0068
	44.0	^{95}Zr	0.58	0.014	0.016
	10.0	^{103}Ru	0.30	0.020	0.0042
	11.0	^{131}I	0.34	0.058	0.0052
	.0	^{132}Te	-	-	-
	28.0	^{140}Ba	0.66	0.022	0.016
Fallini's Ranch, Nev.	11.1	^{7}Be	0.44	0.10	0.0068
	49.5	^{95}Zr	0.54	0.0086	0.021
	5.1	^{103}Ru	0.28	0.073	0.0027
	13.2	^{131}I	0.18	0.032	0.0038
	2.0	^{132}Te	0.10	0.10	0.00055
	28.3	^{140}Ba	0.56	0.026	0.019
Geyser Ranch, Nev.	9.0	^{7}Be	0.44	0.15	0.0067
	39.0	^{95}Zr	0.48	0.016	0.020
	9.0	^{103}Ru	0.17	0.059	0.0031
	11.0	^{131}I	0.22	0.028	0.0037
	.0	^{132}Te	-	-	-
	26.0	^{140}Ba	0.53	0.056	0.020

Table D-2. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9} μCi/ml) Max	Min	Avg
Goldfield, Nev.	2.7	^{7}Be	0.14	0.14	0.0012
	47.7	^{95}Zr	0.58	0.015	0.023
	5.0	^{103}Ru	0.14	0.037	0.0014
	9.0	^{131}I	0.23	0.013	0.0028
	.0	^{132}Te	-	-	-
	24.0	^{140}Ba	0.55	0.024	0.020
Groom Lake, Nev.(1)	7.0	^{7}Be	0.55	0.23	0.0066
	35.1	^{95}Zr	0.74	0.016	0.019
	6.0	^{103}Ru	0.18	0.031	0.0025
	8.0	^{131}I	0.23	0.031	0.0025
	.0	^{132}Te	-	-	-
	30.2	^{140}Ba	0.63	0.029	0.019
Hiko, Nev.	6.0	^{7}Be	0.41	0.14	0.0045
	42.0	^{95}Zr	0.70	0.015	0.019
	3.9	^{103}Ru	0.062	0.050	0.00060
	4.0	^{131}I	0.064	0.035	0.00054
	.0	^{132}Te	-	-	-
	26.0	^{140}Ba	0.69	0.020	0.021
Indian Springs, Nev.	2.0	^{7}Be	0.22	0.22	0.0012
	40.0	^{95}Zr	0.33	0.011	0.012
	6.0	^{103}Ru	0.16	0.076	0.0020
	10.0	^{131}I	0.16	0.059	0.0028
	.0	^{132}Te	-	-	-
	28.0	^{140}Ba	0.34	0.049	0.013
Las Vegas, Nev.	3.0	^{7}Be	0.14	0.14	0.0013
	36.1	^{95}Zr	0.93	0.028	0.022
	10.0	^{103}Ru	0.22	0.058	0.0043
	5.0	^{131}I	0.060	0.052	0.00087
	.0	^{132}Te	-	-	-
	28.0	^{140}Ba	0.56	0.027	0.019
Lathrop Wells, Nev.	2.0	^{7}Be	0.79	0.79	0.0045
	31.0	^{95}Zr	0.66	0.027	0.018
	5.0	^{103}Ru	0.092	0.043	0.0010
	14.0	^{131}I	0.23	0.077	0.0068
	.0	^{132}Te	-	-	-
	24.0	^{140}Ba	0.69	0.039	0.018

Table D-2. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9} μCi/ml) Max	Min	Avg
Lida, Nev.	9.0	^{7}Be	0.33	0.12	0.0063
	33.9	^{95}Zr	0.70	0.014	0.024
	7.0	^{103}Ru	0.20	0.048	0.0025
	12.0	^{131}I	0.32	0.095	0.0062
	2.0	^{132}Te	0.17	0.17	0.00094
	28.0	^{140}Ba	0.59	0.017	0.023
Lund, Nev.	7.8	^{7}Be	0.36	0.27	0.0064
	50.8	^{95}Zr	0.80	0.014	0.027
	7.0	^{103}Ru	0.34	0.063	0.0039
	11.8	^{131}I	0.24	0.021	0.0034
	2.8	^{132}Te	0.042	0.042	0.00032
	30.8	^{140}Ba	0.80	0.034	0.025
Mesquite, Nev.	10.0	^{7}Be	0.41	0.15	0.0084
	43.0	^{95}Zr	0.50	0.015	0.015
	8.0	^{103}Ru	0.16	0.079	0.0026
	5.0	^{131}I	0.14	0.044	0.0011
	.0	^{132}Te	-	-	-
	29.0	^{140}Ba	0.56	0.015	0.016
Moapa, Nev.	6.0	^{7}Be	0.40	0.32	0.0082
	36.4	^{95}Zr	0.66	0.020	0.020
	5.1	^{103}Ru	0.26	0.073	0.0035
	7.9	^{131}I	0.14	0.022	0.0023
	.0	^{132}Te	-	-	-
	20.8	^{140}Ba	0.54	0.075	0.019
Nyala, Nev.	7.0	^{7}Be	0.38	0.31	0.0069
	44.0	^{95}Zr	0.85	0.017	0.027
	5.0	^{103}Ru	0.44	0.29	0.0050
	9.0	^{131}I	1.0	0.033	0.0085
	.0	^{132}Te	-	-	-
	26.0	^{140}Ba	1.5	0.031	0.030
Pahrump, Nev.	3.9	^{7}Be	0.23	0.22	0.0024
	33.9	^{95}Zr	0.39	0.0090	0.015
	5.0	^{103}Ru	0.22	0.077	0.0022
	7.9	^{131}I	0.25	0.017	0.0019
	.0	^{132}Te	-	-	-
	27.8	^{140}Ba	0.43	0.014	0.012

Table D-2. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9} μCi/ml) Max	Min	Avg
Pioche, Nev.	7.0	^{7}Be	0.36	0.24	0.0057
	30.9	^{95}Zr	0.22	0.017	0.0062
	5.0	^{103}Ru	0.17	0.042	0.0017
	7.0	^{131}I	0.076	0.028	0.00092
	.0	^{132}Te	-	-	-
	19.0	^{140}Ba	0.22	0.032	0.0057
Round Mountain, Nev.	7.0	^{7}Be	0.49	0.33	0.0072
	38.0	^{95}Zr	0.64	0.021	0.022
	7.0	^{103}Ru	0.23	0.028	0.0024
	15.0	^{131}I	0.23	0.029	0.0045
	.0	^{132}Te	-	-	-
	29.0	^{140}Ba	0.49	0.044	0.018
Scotty's Junction, Nev.	9.0	^{7}Be	0.57	0.25	0.0097
	38.0	^{95}Zr	1.2	0.019	0.024
	3.0	^{103}Ru	0.11	0.11	0.00096
	9.0	^{131}I	0.48	0.025	0.0039
	.0	^{132}Te	-	-	-
	26.0	^{140}Ba	0.97	0.034	0.023
Stone Cabin Ranch, Nev.	6.0	^{7}Be	0.36	0.19	0.0047
	43.8	^{95}Zr	0.77	0.013	0.021
	9.9	^{103}Ru	0.30	0.16	0.0064
	10.9	^{131}I	0.56	0.069	0.0066
	.0	^{132}Te	-	-	-
	28.9	^{140}Ba	0.94	0.020	0.022
Sunnyside, Nev.	5.1	^{7}Be	0.62	0.43	0.0074
	38.4	^{95}Zr	0.76	0.011	0.019
	2.7	^{103}Ru	0.27	0.27	0.0020
	11.3	^{131}I	0.20	0.027	0.0036
	.0	^{132}Te	-	-	-
	24.0	^{140}Ba	0.67	0.045	0.018
Tonopah, Nev.	6.0	^{7}Be	0.34	0.30	0.0053
	36.0	^{95}Zr	0.75	0.018	0.025
	.0	^{103}Ru	-	-	-
	13.0	^{131}I	0.26	0.031	0.0055
	.0	^{132}Te	-	-	-
	29.0	^{140}Ba	0.66	0.024	0.022

Table D-2. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9} μCi/ml) Max	Min	Avg
Tonopah Test Range, Nev.	5.9	^{7}Be	0.20	0.19	0.0040
	29.3	^{95}Zr	0.71	0.023	0.025
	6.7	^{103}Ru	0.27	0.043	0.0039
	7.0	^{131}I	0.23	0.13	0.0049
	.0	^{132}Te	-	-	-
	18.9	^{140}Ba	0.71	0.060	0.027
Cedar City, Utah	.0	^{7}Be	-	-	-
	23.7	^{95}Zr	0.42	0.027	0.0091
	6.9	^{103}Ru	0.21	0.074	0.0028
	8.8	^{131}I	0.11	0.037	0.0021
	.0	^{132}Te	-	-	-
	19.7	^{140}Ba	0.46	0.040	0.010
Delta, Utah	5.9	^{7}Be	0.44	0.28	0.0098
	35.8	^{95}Zr	0.38	0.016	0.021
	5.0	^{103}Ru	0.19	0.15	0.0037
	7.0	^{131}I	0.14	0.053	0.0030
	.0	^{132}Te	-	-	-
	18.9	^{140}Ba	0.41	0.054	0.017
Garrison, Utah	4.0	^{7}Be	0.40	0.33	0.0041
	35.0	^{95}Zr	0.95	0.019	0.015
	2.0	^{103}Ru	0.19	0.19	0.0011
	7.0	^{131}I	0.12	0.036	0.0015
	.0	^{132}Te	-	-	-
	19.0	^{140}Ba	0.89	0.023	0.014
Milford, Utah	.0	^{7}Be	-	-	-
	21.7	^{95}Zr	0.18	0.019	0.0060
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	4.8	^{140}Ba	0.16	0.13	0.0025
St. George, Utah	3.0	^{7}Be	0.16	0.16	0.0013
	32.6	^{95}Zr	0.42	0.015	0.016
	11.1	^{103}Ru	0.29	0.027	0.0042
	17.8	^{131}I	0.15	0.022	0.0044
	.0	^{132}Te	-	-	-
	25.8	^{140}Ba	0.53	0.039	0.017

(1) Also known as Area 51.

Table D-3. 1976 Summary of Analytical Results for Air Surveillance Network Standby Stations

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-}µCi/ml) Max	Min	Avg
Phoenix, Ariz.	4.3	^{7}Be	0.44	0.15	0.018
	16.3	^{95}Zr	0.21	0.022	0.020
	.0	^{103}Ru	–	–	–
	5.8	^{131}I	0.043	0.035	0.0040
	.0	^{132}Te	–	–	–
	10.8	^{140}Ba	0.24	0.016	0.020
Winslow, Ariz.	6.0	^{7}Be	0.46	0.19	0.037
	16.0	^{95}Zr	0.092	0.012	0.011
	2.0	^{103}Ru	0.055	0.055	0.0021
	3.0	^{131}I	0.013	0.013	0.0073
	3.0	^{132}Te	0.019	0.019	0.0011
	14.0	^{140}Ba	0.18	0.014	0.019
Little Rock, Ark.	2.0	^{7}Be	0.17	0.17	0.068
	9.0	^{95}Zr	0.052	0.022	0.078
	.0	^{103}Ru	–	–	–
	.0	^{131}I	–	–	–
	.0	^{132}Te	–	–	–
	2.0	^{140}Ba	0.052	0.052	0.0021
Indio, Calif.	3.0	^{7}Be	0.50	0.50	0.021
	16.0	^{95}Zr	0.45	0.024	0.033
	.0	^{103}Ru	–	–	–
	6.0	^{131}I	0.095	0.079	0.0073
	.0	^{132}Te	–	–	–
	14.0	^{140}Ba	0.37	0.020	0.034
Denver, Colo.	.0	^{7}Be	–	–	–
	14.8	^{95}Zr	0.12	0.032	0.017
	.0	^{103}Ru	–	–	–
	7.0	^{131}I	0.081	0.037	0.0093
	.0	^{132}Te	–	–	–
	7.0	^{140}Ba	0.19	0.11	0.022
Durango, Colo.	.0	^{7}Be	–	–	–
	12.4	^{95}Zr	0.19	0.017	0.012
	.0	^{103}Ru	–	–	–
	.0	^{131}I	–	–	–
	.0	^{132}Te	–	–	–
	5.4	^{140}Ba	0.21	0.032	0.012

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Grand Junction, Colo.	.0	^{7}Be	–	–	–
	14.9	^{95}Zr	0.30	0.019	0.022
	.0	^{103}Ru	–	–	–
	6.0	^{131}I	0.094	0.035	0.0065
	.0	^{132}Te	–	–	–
	7.0	^{140}Ba	0.20	0.087	0.018
Pueblo, Colo.	4.0	^{7}Be	0.71	0.30	0.045
	13.9	^{95}Zr	0.20	0.040	0.023
	.0	^{103}Ru	–	–	–
	4.9	^{131}I	0.090	0.034	0.0062
	.0	^{132}Te	–	–	–
	6.9	^{140}Ba	0.21	0.088	0.020
Boise, Idaho	7.0	^{7}Be	0.67	0.20	0.052
	10.0	^{95}Zr	0.094	0.029	0.013
	.0	^{103}Ru	–	–	–
	2.0	^{131}I	0.068	0.068	0.0028
	2.0	^{132}Te	0.12	0.12	0.0049
	6.0	^{140}Ba	0.25	0.033	0.016
Idaho Falls, Idaho	1.3	^{7}Be	0.23	0.23	0.0060
	13.2	^{95}Zr	0.13	0.022	0.020
	.0	^{103}Ru	–	–	–
	3.3	^{131}I	0.062	0.026	0.0027
	.0	^{132}Te	–	–	–
	7.2	^{140}Ba	0.11	0.055	0.013
Mountain Home, Idaho	4.0	^{7}Be	0.63	0.25	0.033
	12.0	^{95}Zr	0.12	0.021	0.012
	.0	^{103}Ru	–	–	–
	5.0	^{131}I	0.065	0.022	0.0036
	.0	^{132}Te	–	–	–
	7.0	^{140}Ba	0.11	0.078	0.012
Pocatello, Idaho	2.0	^{7}Be	0.24	0.24	0.0096
	13.7	^{95}Zr	0.12	0.029	0.019
	.0	^{103}Ru	–	–	–
	.0	^{131}I	–	–	–
	.0	^{132}Te	–	–	–
	7.0	^{140}Ba	0.16	0.055	0.012

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Preston, Idaho	3.0	^{7}Be	0.51	0.51	0.031
	10.9	^{95}Zr	0.068	0.018	0.011
	.0	^{103}Ru	-	-	-
	5.0	^{131}I	0.041	0.028	0.0036
	.0	^{132}Te	-	-	-
	5.0	^{140}Ba	0.086	0.054	0.0074
Twin Falls, Idaho	4.7	^{7}Be	0.40	0.25	0.029
	14.0	^{95}Zr	0.37	0.031	0.024
	.0	^{103}Ru	-	-	-
	5.0	^{131}I	0.10	0.038	0.0049
	.0	^{132}Te	-	-	-
	10.0	^{140}Ba	0.19	0.049	0.019
Iowa City, Iowa	7.0	^{7}Be	0.44	0.26	0.055
	7.7	^{95}Zr	0.041	0.028	0.0061
	.0	^{103}Ru	-	-	-
	2.0	^{131}I	0.038	0.038	0.0018
	.0	^{132}Te	-	-	-
	4.0	^{140}Ba	0.058	0.026	0.0040
Sioux City, Iowa	6.0	^{7}Be	0.17	0.10	0.015
	10.9	^{95}Zr	0.13	0.015	0.012
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	10.0	^{140}Ba	0.14	0.018	0.011
Dodge City, Kans.	7.0	^{7}Be	0.16	0.11	0.018
	16.6	^{95}Zr	0.073	0.023	0.013
	.0	^{103}Ru	-	-	-
	5.0	^{131}I	0.030	0.028	0.0029
	3.0	^{132}Te	0.028	0.028	0.0017
	7.0	^{140}Ba	0.087	0.071	0.011
Lake Charles, La.	.0	^{7}Be	-	-	-
	3.8	^{95}Zr	0.019	0.019	0.0014
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	2.0	^{140}Ba	0.033	0.033	0.0013

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radioactivity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Monroe, La.	3.0	^{7}Be	0.15	0.15	0.010
	10.7	^{95}Zr	0.061	0.018	0.0088
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	4.9	^{140}Ba	0.11	0.022	0.0065
New Orleans, La.	.0	^{7}Be	-	-	-
	5.9	^{95}Zr	0.040	0.033	0.0049
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	3.9	^{140}Ba	0.057	0.046	0.0044
Minneapolis, Minn.	4.9	^{7}Be	0.34	0.13	0.020
	6.1	^{95}Zr	0.13	0.020	0.0066
	.0	^{103}Ru	-	-	-
	2.0	^{131}I	0.077	0.077	0.0030
	.0	^{132}Te	-	-	-
	7.0	^{140}Ba	0.10	0.045	0.0081
Clayton, Mo.	5.0	^{7}Be	0.26	0.19	0.022
	7.9	^{95}Zr	0.087	0.030	0.0083
	.0	^{103}Ru	-	-	-
	2.0	^{131}I	0.037	0.037	0.0014
	.0	^{132}Te	-	-	-
	4.0	^{140}Ba	0.088	0.077	0.0063
Joplin, Mo.	.0	^{7}Be	-	-	-
	6.0	^{95}Zr	0.042	0.030	0.0051
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	.0	^{140}Ba	-	-	-
St. Joseph, Mo.	5.7	^{7}Be	0.29	0.16	0.025
	12.7	^{95}Zr	0.15	0.023	0.014
	.0	^{103}Ru	-	-	-
	4.0	^{131}I	0.066	0.048	0.0046
	.0	^{132}Te	-	-	-
	7.0	^{140}Ba	0.23	0.026	0.018

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Billings, Mont.	9.0	^{7}Be	0.34	0.12	0.042
	12.1	^{95}Zr	0.087	0.025	0.015
	.0	^{103}Ru	-	-	-
	6.0	^{131}I	0.058	0.026	0.0070
	4.0	^{132}Te	0.041	0.041	0.0041
	9.0	^{140}Ba	0.13	0.026	0.019
Bozeman, Mont.	5.0	^{7}Be	0.21	0.21	0.020
	14.7	^{95}Zr	0.092	0.029	0.014
	.0	^{103}Ru	-	-	-
	5.0	^{131}I	0.038	0.027	0.0032
	.0	^{132}Te	-	-	-
	7.0	^{140}Ba	0.12	0.050	0.012
Missoula, Mont.	5.0	^{7}Be	0.15	0.13	0.014
	10.7	^{95}Zr	0.093	0.041	0.013
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	8.0	^{140}Ba	0.045	0.011	0.0149
North Platte, Nebr.	2.9	^{7}Be	0.36	0.36	0.022
	14.8	^{95}Zr	0.10	0.037	0.020
	.0	^{103}Ru	-	-	-
	6.8	^{131}I	0.067	0.054	0.0082
	.0	^{132}Te	-	-	-
	6.8	^{140}Ba	0.13	0.11	0.018
Battle Mountain, Nev.	.0	^{7}Be	-	-	-
	5.3	^{95}Zr	0.034	0.020	0.0047
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	.0	^{140}Ba	-	-	-
Currant Maint. Sta., Nev.	5.1	^{7}Be	0.68	0.33	0.59
	14.6	^{95}Zr	0.17	0.015	0.021
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	7.2	^{140}Ba	0.34	0.025	0.026

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Currie, Nev.	3.0	^{7}Be	0.15	0.15	0.010
	17.9	^{95}Zr	0.17	0.020	0.026
	.0	^{103}Ru	-	-	-
	7.9	^{131}I	0.11	0.032	0.011
	.0	^{132}Te	-	-	-
	9.0	^{140}Ba	0.24	0.044	0.021
Elko, Nev.	4.0	^{7}Be	0.45	0.32	0.031
	11.8	^{95}Zr	0.11	0.023	0.012
	2.0	^{103}Ru	0.063	0.063	0.0057
	4.0	^{131}I	0.089	0.046	0.0056
	.0	^{132}Te	-	-	-
	7.0	^{140}Ba	0.10	0.052	0.011
Fallon, Nev.	.0	^{7}Be	-	-	-
	5.7	^{95}Zr	0.040	0.023	0.0045
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	.0	^{140}Ba	-	-	-
Frenchman Sta., Nev.	4.9	^{7}Be	0.59	0.50	0.52
	18.4	^{95}Zr	0.41	0.022	0.034
	.0	^{103}Ru	-	-	-
	7.8	^{131}I	0.15	0.026	0.013
	.0	^{132}Te	-	-	-
	10.8	^{140}Ba	0.39	0.044	0.035
Lovelock, Nev.	.0	^{7}Be	-	-	-
	13.1	^{95}Zr	0.31	0.014	0.061
	.0	^{103}Ru	-	-	-
	7.1	^{131}I	0.13	0.053	0.023
	.0	^{132}Te	-	-	-
	9.1	^{140}Ba	0.24	0.064	0.059
Reno, Nev.	.0	^{7}Be	-	-	-
	14.9	^{95}Zr	0.21	0.019	0.026
	.0	^{103}Ru	-	-	-
	7.2	^{131}I	0.12	0.10	0.016
	2.1	^{132}Te	0.12	0.12	0.0050
	7.2	^{140}Ba	0.31	0.18	0.038

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Warm Springs, Nev.	.0	^{7}Be	–	–	–
	10.1	^{95}Zr	0.32	0.026	0.023
	.0	^{103}Ru	–	–	–
	4.0	^{131}I	0.10	0.086	0.0073
	.0	^{132}Te	–	–	–
	4.0	^{140}Ba	0.22	0.19	0.017
Wells, Nev.	3.0	^{7}Be	0.24	0.24	0.013
	14.0	^{95}Zr	0.097	0.024	0.014
	.0	^{103}Ru	–	–	–
	.0	^{131}I	–	–	–
	.0	^{132}Te	–	–	–
	10.0	^{140}Ba	0.088	0.049	0.013
Winnemucca, Nev.	.0	^{7}Be	–	–	–
	13.0	^{95}Zr	0.14	0.040	0.023
	3.0	^{103}Ru	0.066	0.066	0.0042
	7.0	^{131}I	0.091	0.056	0.010
	.0	^{132}Te	–	–	–
	7.0	^{140}Ba	0.19	0.13	0.021
Albuquerque, N. Mex.	7.0	^{7}Be	0.26	0.22	0.031
	17.0	^{95}Zr	0.17	0.029	0.018
	.0	^{103}Ru	–	–	–
	11.0	^{131}I	0.12	0.011	0.0081
	3.0	^{132}Te	0.023	0.023	0.0013
	12.0	^{140}Ba	0.27	0.012	0.020
Carlsbad, N. Mex.	1.0	^{7}Be	0.52	0.52	0.013
	8.4	^{95}Zr	0.17	0.018	0.015
	.0	^{103}Ru	–	–	–
	2.7	^{131}I	0.081	0.081	0.052
	.0	^{132}Te	–	–	–
	4.7	^{140}Ba	0.20	0.027	0.014
Muskogee, Okla.	3.0	^{7}Be	0.19	0.19	0.011
	12.9	^{95}Zr	0.48	0.028	0.034
	.0	^{103}Ru	–	–	–
	5.0	^{131}I	0.13	0.040	0.0087
	.0	^{132}Te	–	–	–
	5.0	^{140}Ba	0.32	0.068	0.020

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Norman, Okla.	.0	^{7}Be	-	-	-
	11.1	^{95}Zr	0.12	0.021	0.014
	2.0	^{103}Ru	0.084	0.084	0.0038
	2.0	^{131}I	0.078	0.078	0.0036
	.0	^{132}Te	-	-	-
	8.9	^{140}Ba	0.18	0.023	0.021
Burns, Oreg.	4.9	^{7}Be	0.23	0.17	0.017
	19.1	^{95}Zr	0.12	0.035	0.026
	.0	^{103}Ru	-	-	-
	7.1	^{131}I	0.076	0.033	0.0082
	5.1	^{132}Te	0.049	0.047	0.0046
	9.1	^{140}Ba	0.21	0.058	0.024
Medford, Oreg.	.0	^{7}Be	-	-	-
	4.0	^{95}Zr	0.049	0.049	0.0049
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	.0	^{140}Ba	-	-	-
Aberdeen, S. Dak.	9.0	^{7}Be	0.26	0.12	0.038
	9.0	^{95}Zr	0.053	0.024	0.0068
	2.0	^{103}Ru	0.053	0.053	0.0021
	3.0	^{131}I	0.029	0.029	0.0017
	3.0	^{132}Te	0.048	0.048	0.0029
	7.0	^{140}Ba	0.085	0.046	0.0097
Rapid City, S. Dak.	6.8	^{7}Be	0.34	0.23	0.035
	11.0	^{95}Zr	1.2	0.049	0.032
	.0	^{103}Ru	-	-	-
	2.0	^{131}I	0.063	0.063	0.0024
	.0	^{132}Te	-	-	-
	4.2	^{140}Ba	1.3	0.074	0.012
Abilene, Tex.	5.0	^{7}Be	0.23	0.21	0.022
	13.1	^{95}Zr	0.42	0.016	0.029
	.0	^{103}Ru	-	-	-
	3.0	^{131}I	0.053	0.053	0.0031
	.0	^{132}Te	-	-	-
	7.3	^{140}Ba	0.55	0.13	0.039

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Amarillo, Tex.	.0	^{7}Be	-	-	-
	17.7	^{95}Zr	0.32	0.024	0.025
	.0	^{103}Ru	-	-	-
	8.0	^{131}I	0.073	0.059	0.0089
	.0	^{132}Te	-	-	-
	10.0	^{140}Ba	0.20	0.061	0.022
Austin, Tex.	2.8	^{7}Be	0.45	0.45	0.029
	18.0	^{95}Zr	0.33	0.025	0.038
	.0	^{103}Ru	-	-	-
	5.8	^{131}I	0.16	0.032	0.013
	.0	^{132}Te	-	-	-
	10.0	^{140}Ba	0.28	0.058	0.031
Fort Worth, Tex.	3.0	^{7}Be	0.40	0.40	0.023
	11.0	^{95}Zr	0.071	0.034	0.010
	.0	^{103}Ru	-	-	-
	5.0	^{131}I	0.045	0.026	0.0032
	.0	^{132}Te	-	-	-
	7.0	^{140}Ba	0.084	0.048	0.0086
Bryce Canyon, Utah	.0	^{7}Be	-	-	-
	3.9	^{95}Zr	0.031	0.031	0.027
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	.0	^{140}Ba	-	-	-
Capitol Reef, Utah	.0	^{7}Be	-	-	-
	16.5	^{95}Zr	0.25	0.022	0.024
	.0	^{103}Ru	-	-	-
	4.0	^{131}I	0.13	0.025	0.0064
	.0	^{132}Te	-	-	-
	9.0	^{140}Ba	0.30	0.013	0.020
Dugway, Utah	8.0	^{7}Be	0.30	0.14	0.032
	19.0	^{95}Zr	0.12	0.012	0.015
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	11.0	^{140}Ba	0.099	0.017	0.013

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Enterprise, Utah	2.0	^{7}Be	0.25	0.25	0.015
	14.9	^{95}Zr	0.17	0.023	0.024
	.0	^{103}Ru	-	-	-
	3.0	^{131}I	0.025	0.025	0.0022
	.0	^{132}Te	-	-	-
	10.9	^{140}Ba	0.16	0.024	0.028
Logan, Utah	2.1	^{7}Be	0.25	0.25	0.016
	8.4	^{95}Zr	0.047	0.037	0.010
	.0	^{103}Ru	-	-	-
	3.3	^{131}I	0.060	0.043	0.0047
	.0	^{132}Te	-	-	-
	3.3	^{140}Ba	0.16	0.029	0.071
Monticello, Utah	.0	^{7}Be	-	-	-
	15.0	^{95}Zr	0.13	0.019	0.014
	.0	^{103}Ru	-	-	-
	6.0	^{131}I	0.10	0.031	0.0055
	.0	^{132}Te	-	-	-
	10.0	^{140}Ba	0.21	0.060	0.023
Parowan, Utah	.0	^{7}Be	-	-	-
	13.1	^{95}Zr	0.11	0.026	0.011
	.0	^{103}Ru	-	-	-
	3.0	^{131}I	0.031	0.031	0.0018
	.0	^{132}Te	-	-	-
	7.1	^{140}Ba	0.14	0.058	0.012
Provo, Utah	2.0	^{7}Be	0.33	0.33	0.012
	15.9	^{95}Zr	0.11	0.030	0.016
	.0	^{103}Ru	-	-	-
	9.0	^{131}I	0.050	0.025	0.059
	.0	^{132}Te	-	-	-
	9.0	^{140}Ba	0.13	0.077	0.019
Salt Lake City, Utah	.0	^{7}Be	-	-	-
	16.6	^{95}Zr	1.3	0.036	0.080
	3.0	^{103}Ru	0.34	0.28	0.014
	3.0	^{131}I	0.61	0.17	0.017
	.0	^{132}Te	-	-	-
	8.7	^{140}Ba	1.4	0.090	0.074

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration (10^{-9}µCi/ml) Max	Min	Avg
Vernal, Utah	5.0	^{7}Be	0.26	0.14	0.022
	11.1	^{95}Zr	0.12	0.030	0.022
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	7.0	^{140}Ba	0.17	0.055	0.017
Wendover, Utah	6.0	^{7}Be	0.44	0.26	0.034
	13.0	^{95}Zr	0.080	0.011	0.010
	2.0	^{103}Ru	0.062	0.062	0.0024
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	7.0	^{140}Ba	0.078	0.018	0.0069
Seattle, Wash.	.0	^{7}Be	-	-	-
	10.0	^{95}Zr	0.19	0.017	0.011
	.0	^{103}Ru	-	-	-
	5.9	^{131}I	0.036	0.016	0.0025
	.0	^{132}Te	-	-	-
	7.9	^{140}Ba	0.10	0.039	0.0082
Spokane, Wash.	2.0	^{7}Be	0.20	0.20	0.0083
	4.0	^{95}Zr	0.11	0.013	0.0031
	.0	^{103}Ru	-	-	-
	.0	^{131}I	-	-	-
	.0	^{132}Te	-	-	-
	.0	^{140}Ba	-	-	-
Casper, Wyo.	5.0	^{7}Be	0.43	0.20	0.028
	15.8	^{95}Zr	0.057	0.020	0.011
	.0	^{103}Ru	-	-	-
	5.0	^{131}I	0.048	0.037	0.0041
	.0	^{132}Te	-	-	-
	8.0	^{140}Ba	0.063	0.054	0.0087
Rock Springs, Wyo.	2.0	^{7}Be	0.35	0.35	0.014
	9.8	^{95}Zr	0.077	0.015	0.0087
	.0	^{103}Ru	-	-	-
	2.0	^{131}I	0.046	0.046	0.0019
	.0	^{132}Te	-	-	-
	6.0	^{140}Ba	0.098	0.056	0.0088

Table D-3. (continued)

Sampling Location	No. Days Sampled	Type of Radio-activity	Radioactivity Concentration ($10^{-9}\mu Ci/ml$) Max	Min	Avg
Worland, Wyo.	8.0	^{7}Be	0.36	0.20	0.037
	16.0	^{95}Zr	0.12	0.041	0.018
	.0	^{103}Ru	-	-	-
	3.0	^{131}I	0.052	0.052	0.0030
	.0	^{132}Te	-	-	-
	7.0	^{140}Ba	0.11	0.033	0.011

APPENDIX E. LIST OF ABBREVIATIONS AND SYMBOLS

μrem	Micro-roentgen-equivalent-man.
μCi/g	Microcurie per gram.
μCi/ml	Microcurie per millilitre.
AEC	Atomic Energy Commission.
ASN	Air Surveillance Network.
C	Temperature in Celsius.
CG	Concentration Guide.
Ci	Curie.
cm	Centimetre.
CP-1	Control Point One.
CY	Calendar Year.
D.E.	Dose Equivalent.
EMSL-LV	Environmental Monitoring and Support Laboratory-Las Vegas.
EPA	Environmental Protection Agency.
ERDA	Energy Research and Development Administration.
ERDA/NV	Energy Research and Development Administration/ Nevada Operations Office.
ft	Feet.
kg	Kilogram.
kt	Kiloton.
LCL	Lower confidence limit.
LLL	Lawrence Livermore Laboratory.
LTHMP	Long-Term Hydrological Monitoring Program
m	Metre.
MDC	Minimum detectable concentration.
mrem/y	Milli-roentgen-equivalent-man per year.
mrem/d	Milli-roentgen-equivalent-man per day.
mR	Milli-roentgen.
mR/h	Milli-roentgen per hour.
MSL	Mean sea level.
MSM	Milk Surveillance Network.
nCi	Nanocurie.
NG&TSN	Noble Gas and Tritium Surveillance Network.
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 Society.
WSN	Water Surveillance Network.
^3H	Tritium or Hydrogen-3.
HT	Tritiated Hydrogen.

HTO	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.
χ^2	Chi-square.
σ	Geometric standard deviation.
σ^2	Population geometric variance.
$\tilde{s}^2$	Best estimate of sample geometric variance.
$\tilde{s}$	Best estimate of sample geometric standard deviation.
s^2	Expected geometric variance of replicate sample.

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99 George E. Tucker, Sandia Laboratories, Albuquerque, NM

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