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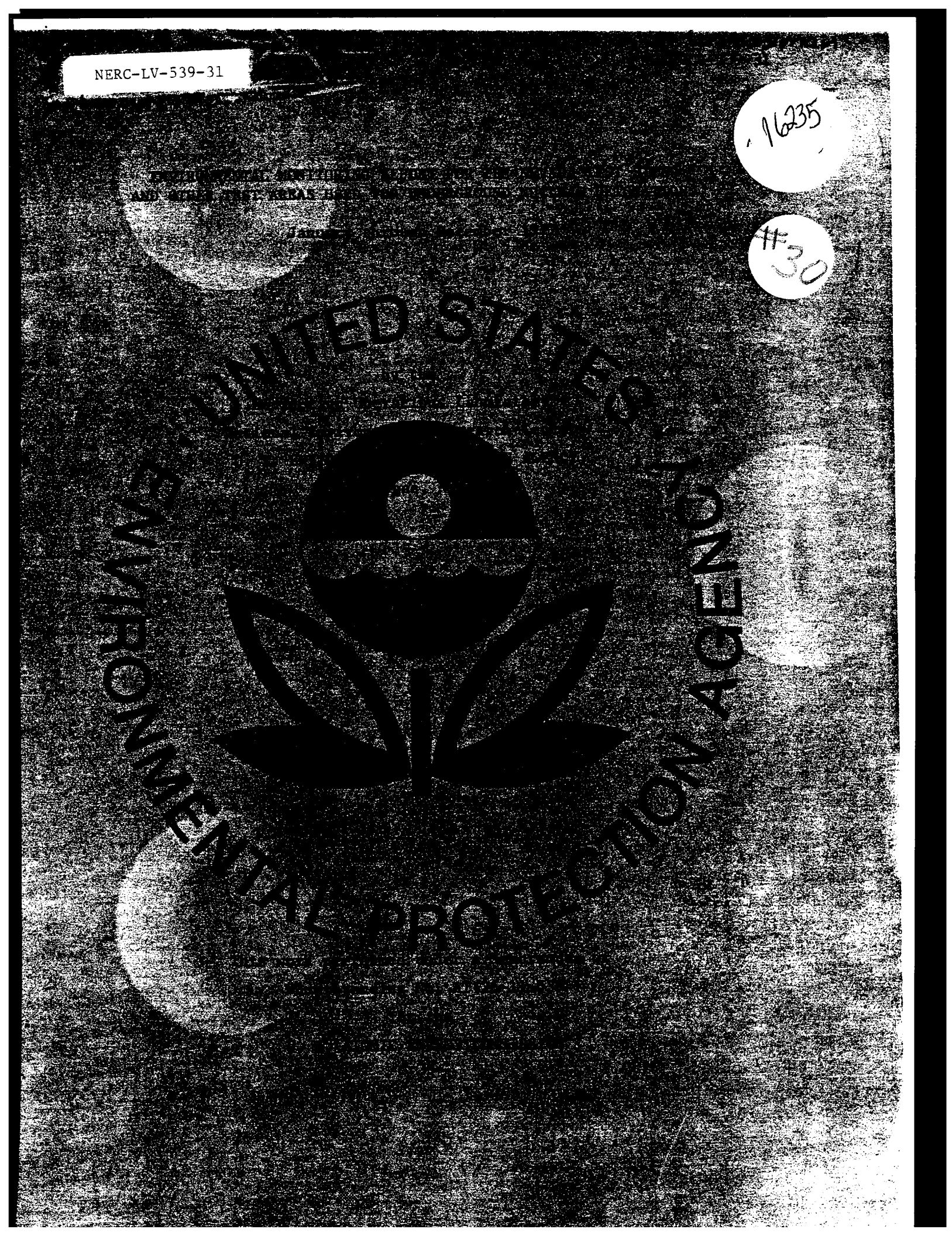

NERC-LV-539-31

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

January through December 1973

by the

Monitoring Operations Laboratory

National Environmental Research Center

U. S. ENVIRONMENTAL PROTECTION AGENCY

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PREFACE

The Atomic Energy Commission (AEC) has used the Nevada Test Site (NTS) since January 1951 as an area for conducting nuclear detonations, nuclear rocket-engine development, nuclear medicine studies, and miscellaneous nuclear and non-nuclear experiments. With the exception of a test moratorium from October 30, 1958, to September 1, 1961, atmospheric nuclear tests were conducted periodically from 1951 through July 17, 1962. Since July 17, 1962, in accordance with the limited test ban treaty, all nuclear detonations have been conducted underground with the expectation of containment except for five nuclear earth-cratering experiments conducted under the Plowshare program.

Under the U. S. Public Health Service (PHS) from 1959 through 1970, and since 1970, under the U. S. Environmental Protection Agency (EPA), facilities have been maintained in Las Vegas, NV, for the purpose of providing an Off-Site Radiological Surveillance Program for the AEC. Prior to that time, surveillance was performed by the Los Alamos Scientific Laboratory and by U. S. Army personnel. Although off-site surveillance has been provided by the Las Vegas facility for nuclear explosive tests at places other than the NTS, the primary surveillance effort has been centered around the NTS.

The objective of the Program from the beginning 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.

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 CY 1959 for reactor tests, and in CY 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 six months with the analytical results for all routine or special milk samples.

In CY 1971, the AEC implemented a requirement (AEC Manual, Chapter 0513)[1] 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 on-going environmental impact data from AEC sponsored activities. To provide more rapid dissemination of data, the monthly reports of analytical results of all air data collected since July 1971, and all milk and water samples collected since January 1972, are submitted to the appropriate state health departments involved, and are also published in Radiation Data and Reports a monthly publication of the EPA.

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 monitors, and the results of cloud sampling are used to quantitate the inventories of the radionuclides released. Beginning with CY 1971, all monitoring and sampling results of aircraft are reported in effluent monitoring data reports in accordance with AEC Manual, Chapter 0513.

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INTRODUCTION

Under a Memorandum of Understanding, No. AT(26-1)-539, with the U. S. Atomic Energy Commission (AEC), the U. S. Environmental Protection Agency (EPA), National Environmental Research Center-Las Vegas (NERC-LV), continued a program of routine and special radiological surveillance of various media in the environment surrounding the Nevada Test Site (NTS) and at other sites designated by the AEC during 1973. This report, prepared in accordance with the AEC Manual, Chapter 0513, contains summaries of NERC-LV sampling methodologies, analytical procedures, and the results of all environmental samples collected in support of AEC nuclear testing activities. Where applicable, sampling data are also compared to appropriate guides for external and internal exposures to ionizing radiation. In addition, a brief summary of pertinent ecological 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), nuclear rocket development (Project 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 Rover, which was terminated in January 1973. No Plowshare tests were conducted at the NTS during this period, the only test being conducted off-NTS. All nuclear testing was conducted underground to minimize the possible release of fission products to the atmosphere.

Site Location

The Nevada Test Site (Figures 1 and 2) is located in Nye County, NV, with its southeast corner about 100 km (65 mi) northwest of Las Vegas. The NTS has an area of about 3500 km^2 (1350 square mi) and varies from 40-56 km (25-35 mi) in width (east-west) and from 64-88 km (40-55 mi) in length (north-south). This area consists of large basins or flats about 900-1200 m (3000-4000 ft) above mean sea level (MSL) surrounded by mountain ranges 1800-2100 m (6000-7000 ft) 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 (15 to 65 mi) between the test area and land that is open to the public. Depending upon wind speed and direction, this provides a delay of one half hour to more than 6 hours before any inadvertent release of airborne radioactivity could pass over public lands.

Ecology and Climate

The climate of the NTS is variable, primarily due to altitude and the rugged terrain. Generally, the climate is referred to as Continental Arid. The average annual precipitation ranges from about 10 cm (4 in) at the 900-m (3000-ft) altitude to around 25 cm (10 in) 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 pleateaus 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 prevailing direction from which winds blow, as measured on a 30-m (100-ft) 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.[2]

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 published in 1968 as Memoir 110 by the Geological Society of America, entitled "Nevada Test Site."

There are two hydrologic systems on the NTS (Figure 3). Groundwater in the Pahute Mesa system travels at a rate of from 2.1 - 76 m (7-250 ft) per year to the south and southwest toward the Amargosa Desert. Groundwater in the Ash Meadows system moves beneath the NTS from north to south at a rate of from 2.1 - 222 m (7-730 ft) per year. Carbon-14 analyses of water from formations underlying the NTS 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.

Depths to water on the NTS vary from about 100 m (a few hundred feet) beneath the valleys in the southeastern part of the site to more than 600 m (2000 ft) beneath the 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.[3]

NEVADA TEST SITE ENVIRONS

It is difficult to generalize on the ecology, land use and climate of the NTS environs with the exception of the very close-in areas. As an example, within a 320-km (200-mi) radius west of the NTS, elevations range from below sea level in Death Valley, to 4420 m (14,495 ft) 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 comprises most of this portion of Nevada, California, and Arizona. The areas east of the NTS are primarily Basin Range Desert with some of the older river valleys, such as the Virgin River Valley, supporting small scale, but intensive farming and

production of a surprising variety of crops. Grazing is also common in this area, particularly to the northeast. The area north of the NTS is also Basin Range Desert where the major agricultural-related activity is grazing of both cattle and sheep. Only areas of minor agricultural importance, primarily alfalfa hay, are found in this portion of the state within a distance of 320 km (200 mi).

The only major body of water close to the NTS is Lake Mead, a man-made lake supplied by water from the Colorado River. Lake Mead is the source of water for almost all domestic, recreational, and industrial purposes in the Las Vegas Valley. Smaller reservoirs and lakes are located in the area; however, they are of limited use, primarily for irrigation and for stock water. 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.

Except for the higher elevations, the summers are hot with relatively mild winters. In the close-in areas, precipitation rarely exceeds 25 cm (10 in) even at higher elevations and the relative humidity is low. Prevailing winds are from the south-southwest in the summer months, while north-northeast winds are often found during the winter months. Because of the terrain and elevation, any generalization of temperature and wind direction must be qualified in terms of specific locality.

Dairy farming is not extensive in the 320-km (200-mi) radius area under discussion. There are, however, several Grade A dairies located in the Moapa River Valley in Nevada and in the areas around St. George and Cedar City, UT. Two small dairies are located in the Alamo, NV area. Other dairies exist in the Owens Valley in CA. It is also fairly common for remote ranches to keep one or two family milk cows. Within 160 km (100 mi) of the site there are about 3000 dairy cows. The majority of these cows is located at dairy farms southeast of the NTS, one in the Moapa Valley, several in the Virgin Valley, and one near Las Vegas.

Population Distribution

With the exception of Las Vegas and vicinity, there are no major population centers within 320 km (200 mi) of the site. There are only about 500,000 people

living in this total area, about one-half of whom live in the Las Vegas greater metropolitan area. If the City of Las Vegas is not considered in determining population density, there are about 0.8 people per km^2 (2 people per mi^2) within the 320-km (200-mi) radius of the NTS Control Point. For comparison, the United States (50 states) has a population density of 21 people per km^2 (57.5 people per mi^2) and the overall Nevada average is 1.7 people per km^2 (4.4 people per mi^2).

The off-site areas within about 80 km (50 mi) of NTS are predominantly rural. Several small communities are located in the area, the largest being in the Pahrump Valley. This rural community, with an estimated population of about 2000, is located about 72 km (45 mi) south of the NTS. The Amargosa Farm area has a population of about 200 and is located about 50 km (30 mi) southwest of the center of the NTS. The Spring Meadows Farm area is a relatively new development consisting of approximately 10,000 acres with a population of somewhat more than 100. This area is about 55 km (35 mi) south-southwest of the NTS. The largest town in the near off-site area is Beatty with a population of more than 500 and is located about 65 km (40 mi) 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 2000 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 (165 mi) south-southwest of the NTS, with a population of over 12,000. The Owens Valley, where numerous small towns are located, lies about 50 km (30 mi) west of Death Valley. The largest town in Owens Valley is Bishop, located 225 km (140 mi) west-northwest of the NTS, with a population of about 3000.

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

of approximately 9,000, is located 282 km (175 mi) east-northeast of the NTS. The next largest community is St. George, located 217 km (135 mi) east of the NTS, with a population of somewhat more than 7,000.

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 (175 mi) southeast of the NTS, with a population of about 6,000.

Figure 4 shows a generalized schematic of human population and milk cow distribution by 30° sectors from the NTS out to a distance of about 320 km (200 mi).[4] Figure 5 shows the locations and general land use of the areas mentioned above.

OTHER TEST SITES

Table 1 lists the name, date, location, yield, depth, and purpose of all underground nuclear tests conducted at locations other than the NTS since the beginning of testing through December 1973. The only test conducted during this report period was Project Rio Blanco. CER Geonuclear Corporation was the contractor responsible for the off-site radiological safety program for this test, and they will report their results separately.

During CY 1973, the NERC-LV provided radiological surveillance for a production test of the nuclear-stimulated Gasbuggy natural gas well located near Farmington, NM. This surveillance consisted of aerial and ground environmental sampling at scheduled intervals before, during, and after the production flaring.

SUMMARY AND DOSE ASSESSMENT

During 1973 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 various environmental media were continuously monitored by permanently established networks of air, milk, and water sampling stations. Before each underground nuclear detonation, mobile radiation monitors, equipped with radiation monitoring instruments and sampling equipment, were on standby in off-site locations to respond to an accidental release of airborne radioactivity.

During this reporting period, a total of 322 Ci of gaseous radioactivity, primarily radioxenon, was released into the atmosphere at the NTS. Due to the relatively low quantity, the varying location of release and the discontinuous release rate of the radioactivity, an estimate of the radiation dose to off-NTS populations in accordance with the AEC Manual, Chapter 0513, was not made. However, the concentration of each specific radionuclide detected and attributable to test operations was compared to the appropriate Concentration Guide of the AEC Manual, Chapter 0524.

The only off-NTS indication of radioactivity that was attributable to test operations was found in the Noble Gas and Tritium Surveillance Network. Concentrations of radioxenon greater than the minimum detectable concentration (MDC) of 2×10^{-12} μCi/ml were detected during the year at all noble gas and tritium air sampling locations except Beatty, and Tonopah, NV. The radioxenon, identified as ^{133}Xe, was detected off-NTS on a few occasions with concentrations as high as 3.0×10^{-11} μCi/ml at Diablo, NV. The highest ^{133}Xe concentrations, which were detected in October, are considered to be anomalies since there was no known release of radioactivity in the quantity that would have been required to cause the magnitude of ^{133}Xe concentrations which were detected in the off-NTS area. At each location the ^{133}Xe concentration, when averaged over the total sampling times for the year, was less than 0.003% of the Concentration Guide for this nuclide, which is 1×10^{-7} μCi/ml for a suitable sample of a population in an uncontrolled area and 1×10^{-5} μCi/ml for radiation workers, as specified by the AEC Manual, Chapter 0524.[5] No ^{3}H in the forms HT and HTO above expected background was detected in off-NTS areas; however,

CH_3T was detected, on occasions, at all stations except Death Valley Junction, CA. The total of the average ^3H concentrations (HTO +HT +CH_3T) for each location was less than 0.02% of the Concentration Guide for a suitable sample of a population in an uncontrolled area or to a radiation worker. These Concentration Guides are 6.7×10^{-8} μCi/ml, and 6×10^{-6} μCi/ml, respectively. No connection between NTS activities and the presence of CH_3T could be established.

The Long-Term Hydrological Monitoring Program, used for the monitoring of radionuclide concentrations in surface and ground waters which are downgradient from sites of past underground nuclear detonations, was begun for the NTS. Nine stations were selected for monthly sampling near nuclear test areas, at domestic supplies, and at points where ground water exits the NTS. In addition, 18 sites were selected for semi-annual sampling to represent industrial supplies, domestic supplies off-NTS, and points in possible but less probable NTS exit flow patterns. Several of these wells were selected as controls for the total NTS program. The nine monthly stations and 18 of the semi-annual stations were sampled in 1973. No radioactivity related to NTS nuclear testing was detected in any of the samples. Tritium was detected in samples from two NTS wells which were contaminated by previous radionuclide experiments using ^3H as a tracer. However, the ^3H concentration in these wells was so low as to be detectable only by special analytical techniques.

Soil sampling for ^{239}Pu was continued in the areas surrounding the NTS. Concentrations of ^{239}Pu above the levels expected from world-wide fallout were found in the first few centimeters of the soil at several locations around the NTS. A retrospective study of ^{239}Pu on filters collected from air samplers operated near the NTS and on filters collected from air samplers at eight distant locations in the western United States, showed no significant difference in ^{239}Pu concentrations.

As part of a routine program started in 1971, 87 people from areas adjacent to the NTS were brought to the NERC-LV for whole-body counting

and urinalysis during CY 1973. The radionuclides evaluated were ^{137}Cs, ^{3}H, and $^{238-239}Pu$. The average ^{137}Cs concentration in the residents was 1.8×10^{-9} μCi/g of body weight. The average concentration of ^{3}H in urine was 5.2×10^{-7} μCi/ml. No $^{238-239}Pu$ was detected.

At other locations in the Continental United States where underground nuclear tests had been conducted in previous years, the Long-Term Hydrological Monitoring Program was continued. All radioactivity concentrations in the samples collected during the year were at natural background levels with the exception of samples collected at USGS Wells Nos. 4 and 8 at the Project Gnome site and the HT-2M Well at the Project Dribble/Miracle Play site. The USGS wells at the Gnome site were used in a U. S. Geological Survey radioactive tracer study in 1963, at which time ^{137}Cs, ^{131}I, ^{90}Sr, and ^{3}H were injected into Well No. 8, and water was pumped out of Well No. 4. As a result, high levels of ^{3}H and ^{90}Sr were observed in samples collected from both wells, while ^{137}Cs was detected only in the sample from Well No. 8. The highest concentration of radioactivity was for ^{90}Sr, which was 50 times its Concentration Guide of 3×10^{-7} μCi/ml for exposure to an individual in an uncontrolled area. The HT-2M Well at the Dribble site was drilled about 90 m (300 ft) from another well in which 1280 m^3 (338,000 gallons) of radioactive waste were injected during CY 1965. During this report period, elevated levels of ^{3}H were detected in the well, the highest being 8.0×10^{-5} μCi/ml, which is 2.7% of the Concentration Guide for ^{3}H, for an individual in an uncontrolled area. The radioactivity concentrations in all other samples collected from wells near the contaminated wells were representative of normal background levels. All of the contaminated wells are within a locked, fenced area.

Aerial surveillance and ground monitoring were provided for the Project Gasbuggy production test of 1973, during which about 49 Ci of

^{3}H and 5 Ci of ^{85}Kr were released in natural gas flared over the period May 15 to November 6. Various environmental media were sampled at intervals before, during, and after the test. The maximum concentration of ^{3}H that was detected in aerial or ground samples of atmospheric moisture was 3.0×10^{-10} μCi/ml of air. This sample was collected on the ground on July 25, 1973, 0.5 km (0.3 mi) at 341° from the flare stack. This concentration is about 0.4% of the Concentration Guide of 6.6×10^{-8} μCi/ml for a suitable population sample in an uncontrolled area. No ^{85}Kr was detected in samples collected on the ground; however, it was detected in one aircraft sample collected on July 25 at an elevation of 2250 m (7400 ft) above mean sea level, 1.8 km (1.1 mi) at 260° from the flare stack. This sample had a ^{85}Kr concentration of 2.1×10^{-11} μCi/ml, which is 0.028% of the Concentration Guide which is 1.0×10^{-7} μCi/ml for a suitable population sample in an uncontrolled area. Concentrations of ^{3}H above ambient background were found in the moisture of vegetation and soil samples; however, the vegetation was not used for human consumption, nor was the soil used for food-crop raising.

MONITORING DATA COLLECTION, ANALYSIS, AND EVALUATION

NEVADA TEST SITE

The major portion of the off-site radiological safety program for the NTS consists 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 affected by a possible release of radioactive material. These monitors, equipped with radiation survey instruments, gamma-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 by two-way radio communications. In addition, for each event at the NTS, a U. S. Air Force aircraft with two Reynolds Electrical and Engineering Co., monitors equipped with portable radiation survey instruments was airborne near surface ground zero to detect and track any radioactive effluent. Two NERC-LV cloud sampling and tracking aircraft were 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.

In addition, other surveillance programs were conducted. To assess the plutonium content of soil in areas surrounding the NTS, a special soil study was continued. Also, the Long-Term Hydrological Monitoring Program, which was begun for all off-NTS underground test areas during CY 1972 to monitor radioactivity concentrations in wells, springs, and surface waters downgradient of underground water in areas where underground nuclear detonations have been conducted, was expanded to include the NTS.

During this report period, only underground nuclear detonations were conducted. All detonations were contained except for infrequent releases of small concentrations of gaseous radioactivity, primarily radioxenon.

According to information provided by the Nevada Operations Office, AEC, the following effluents were reported for CY 1973:

Isotope	Curies	Isotope	Curies	Isotope	Curies
^{133}Xe	287.01	^{137}Xe	0.34	^{133}I	0.12
^{133m}Xe	9.07	^{138}Xe	3.73	^{135}I	0.02
^{135}Xe	17.84	^{131}I	0.03	^{88}Kr	0.73
^{135m}Xe	1.40	^{132}I	0.05	^{89}Kr	0.03
				^{3}H	1.27

Air Surveillance Network

The Air Surveillance Network, operated by the NERC-LV, consisted of 49 active and 72 standby sampling stations located in 21 western states (Figure 6). Samples of airborne particulates were collected continuously at each active station on 10-cm (4-in) diameter glass-fiber filters at a flow rate of about 350 m^3 of air per day. Normally samples were collected over a 24-hour period until October 1, 1973; however, at several stations operated by state health department and other government agency personnel, samples were not always collected on weekends and holidays, which resulted in 48- or 72-hour samples. Beginning October 1, the collection frequency was changed from daily to three times weekly, resulting in 48- or 72-hour samples from all active stations. Activated charcoal cartridges directly behind the glass-fiber filters were used regularly for the collection of gaseous radioiodines at 22 stations near the NTS. Charcoal cartridges could have been added to all other stations by notification by telephone. All air samples were mailed to the NERC-LV. Special retrieval could have been arranged at selected locations in the event a release of radioactivity was believed to have occurred.

The glass-fiber filters were counted 5 minutes for gross beta radioactivity as soon as they were received and again for 5 minutes at 5 and 12 days after collection. Samples were counted on gas flow proportional counters calibrated over a range of beta energies from 0.1 to 1.8 MeV. A conservative efficiency value of 45% (corresponding to an average maximum beta energy of 0.5 MeV) was used for data conversion. The 5- and 12-day counts were used to extrapolate gross beta concentrations to mid-collection time for reporting. Extrapolation was accomplished by computer programs and was routinely based on a $T^{-1.2}$ decay.

Those filters with a total gross beta radioactivity of 500 cpm or greater were gamma scanned on a 10- by 10-cm (4- by 4- in) sodium iodide (Tl-activated) crystal connected to a 400-channel gamma spectrometer. Individual radionuclides were quantitated from spectrometer data by use of a computer matrix technique. If fresh fission products related to an NTS event had been detected, radiochemical analyses for radionuclides such as $^{89-90}Sr$ and $^{238-239}Pu$ would have been made on selected filters. All charcoal cartridges were counted 10 minutes with a gamma spectrometer. Data from those cartridges having a net gross gamma count rate greater than 300 cpm were analyzed by computer matrix technique to quantitate individual radionuclides. Additional analytical information can be found in Table 2.

Gross beta averages for the year, with the exception of July, were about 1×10^{-13} μCi/ml throughout the Network. The July averages were slightly higher, with the highest concentration for the year being 4.5×10^{-12} μCi/ml on a sample collected at Monticello, UT, on July 11.

From gamma spectrometry results, ^{103}Ru was identified on one sample collected at Idaho Falls, ID, on July 11 and ^{95}Zr, ^{103}Ru, and ^{141}Ce were identified on one sample collected at Las Vegas, NV, on July 23. All concentrations were less than the minimum reporting concentration, which is 1×10^{-13} μCi/ml. In addition, a special study was made of composited air filters representing 120,000 m^3 of sampled air. Gamma spectrometer analysis of the composited filters indicated the presence of trace amounts of ^{95}Zr, ^{141}Ce, ^{103}Ru, and ^{140}Ba-La. The concentrations of these nuclides were too low for definite quantification. Since no other gamma-emitting radionuclides were identified in air samples during the year and slight increases in gross beta concentrations were observed at most stations during July, these radionuclides were attributed to the June 26, 1973 nuclear detonation by the People's Republic of China.

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 ^{3}H in the forms HT, HTO, and CH_3T. This Network consisted of four on-NTS and six off-NTS stations (Figure 7).

The equipment used in this Network comprises two separate systems: a compressed air sampler and a molecular sieve sampler. The compressed air equipment continuously samples air which is then compressed and stored over 7-day periods in two pressure tanks, which together hold approximately two cubic meters of air at atmospheric pressure. The bottles are replaced weekly and returned to the NERC-LV where the contents of one pressure tank are analyzed for ^{85}Kr, radioxenons, and CH_3T by gas chromatography and liquid scintillation techniques described by Stevenson and Johns.[6] The minimum detectable concentrations for ^{85}Kr, any of the radioxenons, and CH_3T are 5×10^{-12} μCi/ml, 2×10^{-12} μCi/ml, and 5×10^{-12} μCi/ml, respectively.

The molecular sieve equipment samples air through a filter to remove particulate matter and then through a 75 mm by 200 mm column containing 600 grams of 13X molecular sieve to remove atmospheric moisture. Tritium-free hydrogen carrier is added to the air stream by the electrolysis of antique water. The air is then passed through another molecular sieve column to remove any water from the electrolysis cell. The dry air with added hydrogen is then passed through a 13X molecular sieve on which is deposited a palladium catalyst. The hydrogen, converted to water by the catalyst, is immediately adsorbed on the molecular sieve. The volume of air passed through the sampler is measured by a dry gas meter. Approximately five cubic meters of air are passed through each sampler over a 7-day sampling period. After each sampler is returned to the laboratory, the first molecular sieve column and the catalytic column are degassed. The water from each column is then distilled and counted 200 minutes for ^{3}H by the liquid scintillation techniques described by Johns.[7] A complete summary of analytical procedures is listed in Table 2. From the ^{3}H content of atmospheric moisture adsorbed on the first molecular sieve column, the concentrations of HTO in μCi/ml of recovered moisture and as HTO in μCi/ml of sampled air are determined. The concentration of ^{3}H in the form of free hydrogen is determined from the ^{3}H collected on the last molecular sieve column.

Table 3 summarizes the results of this Network by listing the maximum, minimum, and average concentrations for ^{85}Kr, total Xe or ^{133}Xe, CH_3T, HTO, and HT. The annual average concentrations for each station were calculated

over the time period sampled assuming that all values less than the minimum detectable concentration (MDC) were equal to the MDC. In the table, all concentrations of ^{85}Kr, Xe or ^{133}Xe, CH_3T, HTO and HT are expressed in the same unit, μCi per ml of air. Since the moisture content of air can vary considerably and thereby affect the concentration of HTO in air, the ^{3}H concentration in μCi/ml of atmospheric moisture is also given in the table as a more reliable indicator of when background concentrations of HTO are exceeded.

As shown by Table 3, the maximum and average ^{85}Kr levels at all stations were essentially the same except for the BJY Station located on-NTS, where the concentration range of 1.3×10^{-11} to 2.7×10^{-11} μCi/ml and the average concentration of 1.8×10^{-11} μCi/ml were higher than those for all other stations. The next highest range was 1.2×10^{-11} to 2.2×10^{-11} μCi/ml, and all other average concentrations were 1.6×10^{-11} μCi/ml. The higher average concentration of ^{85}Kr at BJY was attributed to seepage of gases from underground nuclear tests at NTS.

The averages and ranges in concentrations of HTO and HT for the year were generally the same at all locations except for the on-NTS stations at BJY and Area 12, where concentrations were significantly higher than those for all other stations. The higher concentrations were associated with NTS operations.

The total of the average tritium concentrations (HTO+HT+CH_3T) for either of these stations was less than 0.02% of the Concentration Guide for ^{3}H in air, which is 5×10^{-6} μCi/ml for an exposure to a radiation worker. Concentrations of ^{3}H in the form CH_3T were occasionally detected above the MDC of 5×10^{-12} μCi/ml at all stations except Death Valley Jct., CA. The highest concentration was 1.8×10^{-11} μCi/ml in a sample collected at Tonopah, NV. No definite correlation between CH_3T and NTS testing could be made.

Concentrations of radioxenon greater than the MDC of 2×10^{-12} μCi/ml were detected during the year at all sampling locations except Beatty, and Tonopah, NV. The radioxenon, identified as ^{133}Xe, was detected on a few

occasions with concentrations as high as 2.4×10^{-10} μCi/ml at the on-NTS station at BJY, and 3.0×10^{-11} μCi/ml at Diablo, NV in the off-NTS area. The highest ^{133}Xe concentrations, which were detected in October, are considered to be anomalies, since there was no known release of radioactivity in the quantity that would have been required to cause the magnitude of ^{133}Xe concentrations which were detected in the off-NTS area. At each location the ^{133}Xe concentration, when averaged over the total sampling times for the year, was less than 0.003% of the Concentration Guide for this nuclide, which is 1×10^{-7} μCi/ml for a suitable sample of a population in an uncontrolled area, and 1×10^{-5} μCi/ml for radiation workers.

Dosimetry Network

The Dosimetry Network during 1973 consisted of 67 locations surrounding the NTS which were monitored continuously with thermoluminescent dosimeters (TLD's). The locations, shown in Figure 8, are all within a 300-mile radius of the center of the NTS and include both inhabited and uninhabited locations. Each Dosimetry Network station was equipped with three EG&G Model TL-12 dosimeters, which were exchanged monthly until September when quarterly exchange was initiated. Within the general area covered by the dosimetry stations, 52 off-site residents routinely wore one TLD each. These dosimeters were exchanged at the same time as the station dosimeters.

The TL-12 dosimeter has an internal or self-background exposure rate equivalent to 0.7 mR/d, which limits its minimum detection at the 95% confidence level to about 5 mR for a 30-day measurement period, and 15 mR for a 90-day measurement. All TLD readings were corrected to ^{137}Cs gamma-roentgen-equivalent values according to individual TLD calibration factors. For purposes of this report, these units of exposure were considered to be equivalent to whole-body gamma doses in mrems.

After appropriate corrections were made for the background exposure accumulated during shipment between the laboratory and the monitoring locations, the three TLD readings were averaged. The average exposure value for each monitoring period and station was statistically compared to values from the past twelve months to determine whether the new value was

within the range of environmental background, or significantly greater than background. Those which were greater led to calculations of net exposures, whereas those which were not were pooled with the background data bank, and the oldest value in the data bank was deleted. Values which were statistically lower than the background range were also deleted and considered invalid measurements. Each of the 52 personnel dosimeter results was compared to the background value of the nearest station.

No doses directly attributable to nuclear testing were detected by the dosimetry network during 1973. Table 4 lists the maximum, minimum, and average dose equivalent rate (mrem/d) measured at each station in the network during 1973. The maximum and minimum dose rates were selected from dose rates determined from the exposures (mrem) for each monitoring period divided by the number of days in the exposure period, which was about 30 days for the months January through September, depending on minor variation in schedules, and about 90 days for October through December. The annual average dose rate for each station was calculated by adding the products of the monthly dose equivalent values (mrem) and the exposure period, and dividing the sum of the products by the number of days in the period listed in Table 4 for each station. The annual adjusted background dose was derived from the product of the average dose rate and 365 days. As shown by this table, the average annual station background doses ranged from 80 to 180 mrem with a network average of 123 mrem/a. The range and average for the network are similar to last year's range of 84-200 mrem and average of 144 mrem/a. Among the 52 off-site residents who wore dosimeters continuously, no personnel doses greater than background were attributed to nuclear testing at NTS. The term "background" as used in this context, refers to naturally occurring radioactivity, plus a contribution from residual man-made fission products.

Figure 9 shows an isopleth plot of 1973 TLD exposures. This plot indicates that the higher exposures are in those areas which were downwind of past releases of radioactivity from the NTS during both atmospheric and underground testing. The plot also would tend to support the conclusion that the exposures to the southeast of NTS are closer to "normal" background since only a few releases of effluent from NTS have ever followed a southeast trajectory.

Several TLD's showed unexplained readings during 1973. These values, listed in Table 5 were considered to be anomalous readings; not true gamma exposures. Surveys of the locations and interviews with the individuals involved identified no sources of radiation which would produce the exposures. It is suspected that the high anomalies are due to phenomena associated with the TLD's rather than some external radiation source; however, the production of anomalies has never been reproduced in the Laboratory.

A network of 30 stationary gamma rate recorders placed at selected air sampling locations was used to document gamma exposure rates at fixed locations (Figure 6). This recorder, designated as the LSI recorder, uses a 2.5-by 30.5-cm (1-by 12- inch) constant-current ionization chamber detector filled with methane, and operates on either 110 V a.c. or on a self-contained battery pack. The recorder has a range of 0.004 mR/h to 40 mR/h with an accuracy of about ±10%. The recorder chart runs at a speed of 7.6 cm (3 in) per hour so that one chart will last for 10 days, although the charts are mailed to the NERC-LV weekly. A fresh battery pack will operate the monitor for about 2 weeks at radiation levels below 1 mR/h and about 5 days at radiation levels above 1 mR/h. The length of unattended operation for a.c. line power is limited only by the need to change paper in the recorder. During this report period, 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 of the cow due to its selective metabolism. However, those that are incorporated are very important from a radiological health standpoint, and since they are preferentially transferred to the cow's milk, it is a very sensitive measure of their concentrations in the environment. The five most common fission product radionuclides which can occur in milk are $^{89\text{-}90}Sr$, ^{131}I, ^{137}Cs, and ^{140}Ba. A sixth 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 NERC-LV were the routine Milk Surveillance Network (MSN) and the Standby Milk Surveillance Network (SMSN). The MSN during 1973 (Figure 10) consisted of 26 different locations at which NERC-LV personnel collected 3.8 litres (1 gal) milk samples from family cows, commercial 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 300 miles of the 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. Milk supplies and producers beyond 300 miles are sampled with the SMSN.

During 1973, 216 milk samples were collected from the MSN. Of the 26 locations, one was an alternate where milk was sometimes obtained in the event the primary sampling point did not have milk available. The routine locations were scheduled for monthly collection until October 1, 1973, when the collection frequency was changed to quarterly. Milk could not usually be obtained at all locations at any one collection time. Cows not lactating, no one home, or no milk on the day the route monitors arrived at the ranch, were some of the reasons why some of the samples were not collected each collection time. During the year, milk sampling points also changed as cows were sold, or were otherwise unavailable for regular milkings.

The SMSN consisted of about 175 Grade A milk processing plants in all states west of the Mississippi River, which 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 an occasional sample to check the network readiness and reliability. No analytical results are reported here for the SMSN, since the samples were not associated with any particular nuclear activity or installation.

Each milk sample was analyzed for gamma emitters, and only those samples collected in January, April, July, and October were analyzed for $^{89-90}Sr$. Samples collected at six locations from the MSN were routinely analyzed for ^{3}H. Table 2 lists the general analytical procedures and detection limits for these analyses as described by Johns[7] and Lem and Snelling.[8] For gamma spectroscopy analyses, the milk was placed in 3.5 litre Marinelli beakers, which are designed to place the samples around the crystal detector for high counting efficiency. All routine milk samples were counted for 40 minutes. A computer was used to calculate the activity concentration of each of the detected nuclides at the time of count and to extrapolate the results to time of milking.

The analytical results of milk samples collected from the MSN during 1973 are summarized in Table 6. 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 at which these analyses were scheduled. In the computation of the average concentrations, sample concentrations of less than the minimum detectable concentration (MDC) were assumed to be equal to the MDC. If any of the values used in computing the averages were "less than" values, the average was expressed as a "less than" value. During the year, there were a few samples which did not have enough volume to provide the usual minimum sensitivity for gamma spectrum analysis for ^{137}Cs (1.0×10^{-8} µCi/ml). In these cases, the minimum sensitivity was 1.0×10^{-7} µCi/ml.

No radionuclides from NTS operations were detected in any of the milk samples. The levels of ^{137}Cs, and $^{89-90}Sr$ varied during the year in accordance with what are normally observed as variations in world-wide fallout.

Water Surveillance Network

The Water Surveillance Network (WSN) operated in off-site areas around the NTS during 1973, consisted of 61 locations until July 1, when Ash Meadows Lodge was closed. This reduced the network to 59 locations (Figures 11 and 12) where NERC-LV personnel collected 3.8 litre (1 gal) water samples. The samples were collected from community water supplies, wells, open and closed springs, streams, lakes, and ponds. If a release of radioactivity from NTS had occurred, special sampling within the affected area would have been conducted to determine

radionuclide concentrations.

During 1973, 581 water samples were collected from these locations. All samples were scheduled to be collected monthly until October 1, when the collection frequency was changed to quarterly. In some cases operational priorities, frozen sources, etc., prevented the sampling of each location every time.

All water samples from the WSN were analyzed by gamma spectrometry and counted for gross alpha and gross beta radioactivity. Network samples from approximately 14 locations west, south, and southeast of NTS were also routinely analyzed for ^{3}H. For the purpose of identifying the source of the gross radioactivity in all network samples and comparing sample concentrations with the Concentration Guides, selected samples were given special analyses at least once during the year. For surface water samples, the special analyses included $^{89-90}Sr$, $^{238-239}Pu$, U, and ^{226}Ra. For drinking water samples, the analyses included $^{89-90}Sr$, U, and ^{226}Ra. Table 2 lists the general analytical procedures as described by Johns[7], Lem and Snelling[8], and Talvitie[9,10] along with the detection limits for each analysis.

The analytical results of all samples were published in Radiation Data and Reports.[11] For the purpose of this report, the special analytical results for only the surface water samples collected from the WSN during 1973 are presented in Table 7, which lists the concentrations of radioactivity detected in the samples and the percentage of the Concentration Guide for exposure of a suitable sample of a population in an uncontrolled area. Table 8 lists the maximum, minimum, and average concentrations of ^{3}H in water samples collected from the WSN and percentages of the Concentration Guide for this radionuclide. No gamma-emitting fission products were detected in any of the samples by gamma spectrometry. No significant trends were observed in the gross alpha, gross beta, or ^{3}H results, although surface waters generally contained higher concentrations than ground waters. The higher concentrations in surface waters were attributed to world-wide fallout and naturally occurring radionuclides.

Plutonium in Soil

This program began in September 1970 as an integral portion of the work

coordinated by the Nevada Applied Ecology Group (NAEG). The NAEG was formed by the AEC to coordinate environmental evaluations corresponding to specified areas of AEC operations. The NAEG's objective in the study is to determine the inventory, distribution, and movement in the ecosystem of on-NTS and off-NTS plutonium which was produced by nuclear testing at NTS. A detailed review of this program is to be the subject of another report.[12]

As part of this study, the NERC-LV has been involved in investigating off-NTS air and soil for plutonium content. Air sample analyses have been limited to filters collected at selected Air Surveillance Network Stations (ASN) over a period from 1965 to 1972. Two phases of research have been conducted. Filters from eight air sampling stations distributed over the western United States were chosen for analyses to determine ambient levels of airborne plutonium. Filters were selected for five sampling days near the middle of each month, and a plutonium assessment was made on composited filters. The second phase was to analyze filters collected near the NTS. Stations were selected which were located upwind and downwind of known on-NTS plutonium deposition areas. Filters were chosen for days when high winds and dry soil conditions existed in the general area of the NTS.

Analysis has been completed through December 1972 for filters from the eight stations remote from the NTS. These results are shown in Figure 13 through 16. The data were converted to natural log form and subjected to a one-way analysis of variance to test any significant difference in the means. A significant difference between station means was established at the 95% confidence level. A probable difference between stations was noted at the 99% confidence level. However, the difference at the 99% confidence level was insufficient to clearly establish any statistically valid difference between stations. A Sheffe comparison ("hindsight" individual comparison of means test) of the means was used to determine if the difference at the 95% confidence level could be established as being due to differences in individual group means. The Sheffe analysis did show a difference in the majority of the means in all cases; i.e., no more than three means were close enough to each other to be considered equal. The eight means may be split into three groups by the Sheffe comparison. These three groups are (1) Provo, UT, and

Barstow, CA, (2) Spokane, WA, Albuquerque, NM, and St. Joseph, MO, (3) Austin, TX, Aberdeen, SD, and Medford, OR. This indicates that no trends existed in the data which could be attributed to differences in station locations.

The plutonium-in-air data for the stations near the NTS were grouped according to an upwind and downwind selection made by the National Oceanic and Atmospheric Administration, Air Resources Laboratory (NOAA-ARL), Las Vegas, NV (see Table 9). A one-way analysis of variance was performed on the natural log of the results from each station. For seven of the ten stations selected, no significant difference in plutonium concentration was found between upwind and downwind locations. A difference was noted in two cases, and a probable difference was noted in one case.

Among eight locations in the western United States, plutonium levels vary according to location and time of collection. Long-term trend calculations show a generally stable plutonium level in air. Within annual cycles, plutonium concentrations may vary from 1.0×10^{-17} to 1.0×10^{-15} μCi/ml. The analysis of filters collected near the NTS has not detected any re-suspension of existing off-NTS plutonium deposition or transport of plutonium off of the NTS by wind. Comparison of downwind results for the ten near-NTS stations and results for the eight stations from other states indicates that only background concentrations were detected.

Initial soil sampling began in September 1970. The selected sampling method was first field tested and refined to suit operational and analytical requirements. This method is defined as the trench method. A trench was dug and a sample was removed from one side of the trench, over a given surface area, and at various sampling depths. By this method a preliminary soil profile sampling survey was performed to determine the vertical distribution of plutonium and to define an optimum sampling depth. Since this preliminary survey showed that 90% or more of the plutonium concentration was found in the top 3 cm of soil in 86% of the samples collected, a 5-cm depth was chosen with a sampling area of 10 by 10 cm. Ten 10- by 10-cm cores were composited to form a total sampling area of 1000 cm for each sample location. All sampling sites were chosen from undisturbed desert "pavement" areas at the

intersections of an 8- by 8-km (5-by-5-mi) grid, as much as possible.

Each sample was returned to the NERC-LV in a polyethylene bag and air dried. The total weight was measured and the sample screened with a U. S. Standard screen of 10-mesh. The portion passing through the 10-mesh screen was divided with a Jones sample splitter. Successive splits were made to achieve a sample of about 50 g for Pu analysis. The remainder of the fraction passing 10-mesh was redivided to yield a sample size of about 600 g, which was gamma counted. The 50-g sample for Pu analysis was oven dried and pulverized to less than 200 mesh. A one-gram aliquot was then collected from this sample for complete dissolution in nitric, hydrochloric, and hydrofluoric acids; the Pu being separated from the solution by ion exchange techniques and electrodeposited on a stainless steel planchet for alpha spectrometric analysis.[9,10]

The results of soil samples collected around the NTS and analyzed for plutonium content show that ^{239}Pu is present outside the boundaries of the NTS at levels greater than that which would be expected from world-wide fallout ($\sim 1.0 \times 10^{-3}$ $\mu Ci/m^2$). The preliminary results of analyses completed through 1973 are shown in Figure 17 which is a computer output of results. The program employed develops a grid based on the samples shown and interpolates the contours shown. The contours shown are not to be interpreted as defining the exact plutonium distribution, because of the variability in sample results and the existence of areas where sampling is incomplete. The contours will be revised with further sampling and further refinements in the computer contouring program. The figure should not be taken out of context or interpreted without qualification. It is shown here to illustrate the magnitude of the sampling program, show sample results, and give a preview of the final output of the program.

Included in the sampling design was a replicate sampling and replicate analysis project developed to give insight into the variance among samples and analyses. Various transformations of these data were attempted to develop meaningful statistics to describe the data. The logarithm base 10 of the data was found to be the most favorable transformation; however,

when this transformation was used to develop a log normal plot a heterogeneous distribution was shown within the data. The distribution of results of all samples was plotted which showed a similar log-normal curve. The total distribution was introduced into a computer analysis assuming two overlapping log-normal distributions. The data fit the assumption and yielded two distributions as follows:

% of Total Points	68% Confidence Interval of Geometric Mean (10^{-3} $\mu Ci/m^2$)		
14.5	4.2	<41	<400
85.5	1.0	< 3.5	< 12

The small underlying distribution is considered to be evidence of "hot particles" in the samples.

Long-Term Hydrological Monitoring Program, NTS Network

In previous years, hydrological monitoring and investigation programs were conducted for the AEC by the U. S. Geological Survey (USGS) and Teledyne Isotopes (formerly Isotopes, Inc.). As a continuation of this effort, the AEC requested the NERC-LV to establish a Long-Term Hydrological Monitoring Program in the vicinity of all active and inactive test areas. The purpose of this program, as outlined by the Nevada Operations Office, AEC, is to obtain and record appropriate data from reliable sources adequate to:

(1) assure the public safety;

(2) if the need should arise, inform the public, the news media, and the scientific community; and

(3) document compliance with existing federal, state, and local anti-contamination requirements.

To implement this long-term program, NERC-LV began sampling water from wells, springs, and spring-fed surface water which are down-gradient of the movement of ground water at the NTS and its environs, and at the sites of Project Shoal, Project Dribble, Project Gnome, Project Gasbuggy, Project Rulison, and the Faultless Event of the Central Nevada Test Area (CNTA).

Samples of underground water sources were collected from well heads or spring discharge points where possible. If pumps were not available, an electrical-mechanical water sampler capable of collecting three-liter samples at depths up to 1800 m (6000 ft) was used.

Samples of raw water, and filtered and acidified water were collected at each location. Raw, unfiltered samples were analyzed for ^{3}H, filtered water (water passing a 0.45-μm filter and adjusted to pH 1 with nitric acid) was given radiochemical analyses, and two filtered samples were collected for stable chemistry analyses. For the NTS network, the water was analyzed for ^{3}H, gross beta, gross alpha, and gamma emitters. In addition, the NTS monthly samples were routinely analyzed for U and Pu each quarter. In the event the gross alpha exceeded 3×10^{-9} μCi/ml, the samples were analyzed for ^{226}Ra, and if the gross beta exceeded 10×10^{-9} μCi/ml, Sr analyses were done. For

the NTS semi-annual locations all of the above analyses were performed except for ^{226}Ra which was done only if the gross alpha exceeded 3×10^{-9} μCi/ml. With all NTS samples ^{3}H enrichment techniques were used which lowers the MDC to ~6×10^{-9} μCi/ml. Table 2 shows a complete summary of analytical procedures.

Not all of the analyses have been completed for the NTS monthly samples collected in 1973. Tables 10 and 11 give the results of all the NTS hydrological sampling and analyses accomplished during this report period.

During this report period attempts were made to sample 9 stations monthly and 18 stations semi-annually (Figures 18 and 19). Additional wells will be added to the network in 1974. Not all stations could be sampled with the desired frequency because of weather preventing access to the wells and inoperative pumps. The criteria for selecting the 9 monthly stations were as follows:

(1) that they be wells on the Nevada Test Site used for public supply;
(2) that they be close-in wells along most probable flow lines downgradient from centers of testing, or wells at or near the most important exits from the test site;
(3) that they have currently operating pumps for ease of frequent sampling;
(4) that they can provide samples which are representative of a large volume of aquifer; and
(5) that they are likely to be available for sampling over a long period of time.

The criteria for selecting semi-annual sampling locations are essentially the same, but also include industrial supply wells on the Nevada Test Site and representative wells along possible, but less probable, flow lines. Several stations that are off the flow lines leading from the test areas, or that are so remote as to preclude any contamination, have been added for control stations and for public assurance. These include Watertown Well 3, two wells at Indian Springs, the spring at Shoshone, CA, and Well 11S/48-2dd near Beatty. Four sites in the Ash Meadows area were selected to provide data on the final

discharge from all areas in that ground water system.

All gamma scans were negligible for fission products, and the only radionuclide unusual to well water that was detected was ^{3}H in Wells C and C-1. The ^{3}H in these two wells was introduced as part of a tracer experiment. Well C-1 had an average concentration of ^{3}H, of about 1.0×10^{-7} μCi/ml; less than 0.001 of the Concentration Guide for radiation workers. No radioactivity which could be related to NTS tests was detected in any off-NTS wells. A sample collected in July from the Beatty, NV, city water supply did show a concentration of 1.5×10^{-8} μCi/ml of ^{3}H. A sample collected at the same location in January 1973, showed no ^{3}H concentrations above the MDC of $\sim 6 \times 10^{-9}$ μCi/ml. The July 1973 sample is being recounted, and a sample collected in January 1974, is also in analysis. At the present time the 1.5×10^{-8} μCi/ml concentration at Beatty is considered to be a statistical anomaly.

Whole Body Counting

Since 1966 the NERC-LV has maintained a whole-body counter for the purpose of measuring body burdens of radioactive contamination in employees exposed to or handling radioactive materials, and in off-site residents who might have been exposed to radioactivity released from the NTS.

The whole-body counter and scanner are contained in an underground vault located 8 m (25 ft) below ground level. Each instrument is housed in identical shielded rooms whose walls are 12.7 cm (5 in) pre-World War II steel, and 3.17 mm (1.8 in) of lead.

The detector used in counting area residents is a NaI(Tl) crystal with a diameter of 27.9 cm (11 in) and a thickness of 10.2 cm (4 in). The crystal is optically coupled to seven matched photo-multiplier tubes of the "venetian blind" type. The counting geometry is an arc with a radius of curvature of 0.6 m formed by a plexiglass chair. The lower level of detection in this geometry for ^{137}Cs is 5×10^{-9} μCi/g of body weight for a 40-minute count.

In late 1970, the AEC/NERC-LV decided to begin a regularly scheduled program of counting selected residents in the near-NTS environs. For this report, only the results of those individuals counted during 1973 are included. A report of the entire program, since its inception in 1970, is in preparation.

During 1973, eighty-seven individuals from 15 locations were counted. These locations included Pahrump, Springdale, Beatty, Moapa, Caliente, Pioche, Nyala, Diablo, Goldfield, Lathrop Wells, Ely, Tonopah, Twin Springs, Spring Meadow Farms, NV; and Death Valley Junction, CA. Each individual was given a complete hematological examination and thyroid profile, plus a physical examination which showed no conditions attributable to radioactivity. A urine sample was collected for ^{3}H and Pu analyses.

The maximum, minimum, and average concentration of ^{137}Cs was 5.6×10^{-8} μCi/g, 5×10^{-9} μCi/g, and 1.9×10^{-8} μCi/g body weight, respectively. The average concentration of 1.8×10^{-8} μCi/g for ^{137}Cs is somewhat lower than levels previously found in this study group, indicating the possibility of:

(1) a decrease of ^{137}Cs in the environment, (2) the lowering of ^{137}Cs uptake through reduction of the "beef vector," or a combination of the two factors.

The maximum concentration of ^{3}H was 3.9×10^{-6} μCi/ml, the minimum was 2.4×10^{-7} μCi/ml, and the average was 5.3×10^{-7} μCi/ml. No ^{238}Pu or ^{239}Pu was detected above the MDC's of 3.6×10^{-11} μCi/ml and 1.7×10^{-11} μCi/ml, respectively.

OTHER TEST SITES

Two programs were operative in 1973 to provide additional data on long-term surveillance at all continental test sites, past and present. The two programs now in effect are (1) sampling for ^{3}H in natural gas from wells adjacent to the Gasbuggy Test Well near Farmington, NM, and (2) scheduled water sampling of wells and other water sources in the vicinity of all continental sites. A description of the two programs is included in this section. During this reporting period, the NERC-LV also provided aerial and ground surveillance for a production test of the nuclear stimulated Gasbuggy natural gas well near Farmington, NM. This surveillance consisted of a scheduled collection of environmental samples before, during, and after the production test.

Long-Term Hydrological Monitoring Program

During 1973, the NERC-LV continued this program at all off-NTS test sites except for Amchitka Island, AK, and Project Rio Blanco, CO. These two sites are the responsibility of other agencies. Sampling frequency for the off-NTS test sites is normally once each year in the spring and after any flaring of natural gas from those sites where gas wells were stimulated by nuclear detonations. Collection procedures were essentially the same as those used in the NTS networks. Most samples were analyzed for ^{3}H, gross alpha, and gross beta by radio-chemistry techniques, and for gamma-emitters by gamma spectroscopy; however, there were some wells and surface supplies for which only ^{3}H analysis was performed. Selected samples were also analyzed for $^{89-90}Sr$ and ^{226}Ra. A complete summary of analytical procedures and detection limits is shown in Table 2.

The analytical results of all water samples collected during 1973 are summarized in Table 12. All locations sampled are shown on Figures 20 through 26. For each concentration, the percent of the appropriate Concentration Guide was calculated and listed. As shown by the table, concentrations of radioactivity above the Concentration Guides were found in samples collected at the sites of Project Dribble and Gnome. Well HT-2M, which is located on the Project Dribble site, is approximately 90 m (300 ft) from Well HT-2 in which approximately 1280 m^3 (338,000 gallons) of radioactive liquid waste were injected during 1965. As a consequence of this, high levels of ^{3}H were observed at most depths sampled in HT-2M. The maximum concentration observed was 8.0×10^{-5} μCi/ml in a sample collected from 716 m (2350 ft) below the surface on March 27, 1973. This concentration was 2.7% of the Concentration Guide for ^{3}H for exposure to an individual in an uncontrolled area. A second sampling of HT-2M was accomplished in 1973 as requested by AEC to verify the radioactivity concentrations which could be used in determining the final disposition of the well. These results are also included in Table 12. Although these contaminated wells are on private land, the wells are fenced, posted, and locked to prevent their use by unauthorized personnel.

USGS Wells Nos. 4 and 8 located on the Project Gnome site were used in a USGS radioactive tracer study during the first quarter of 1963. Cesium-137, ^{131}I, ^{90}Sr, and ^{3}H were injected in Well No. 8, and water was pumped from nearby Well No. 4. As a result, high levels of ^{3}H and ^{90}Sr were observed in samples collected from both wells in 1973, while ^{137}Cs was observed only in the sample from Well No. 8. As indicated by Table 12, the highest concentration of ^{3}H was 47% of its Concentration Guide for an individual in an uncontrolled area and the highest concentration for ^{90}Sr was 50 times its Concentration Guide. The concentrations of radioactivity in all the other wells sampled near the two contaminated wells were representative of normal background levels. These two contaminated wells, which are on federal land, are also within a locked, fenced area.

In 1972, gross beta levels above 3.0×10^{-8} μCi/ml were also observed in samples collected from Flowing Well No. 2 (3.8×10^{-8} μCi/ml) near the Project Shoal site, and Lake Jara (3.6×10^{-8} μCi/ml) and El Paso Natural Gas Well 10-36 (4.7×10^{-8} μCi/ml), both of which are near the Project Gasbuggy site. None of these sources of water is used for domestic purposes. Analyses were performed on these samples during 1973 to identify the radionuclides contributing to the gross radioactivity. The results of these analyses are also included in Table 12. No individual radionuclides were identified by these analyses which would explain the relatively high gross beta activities.

Natural Gas Burner Sampling, Gasbuggy Site

During 1973, integrated monthly samples of the water condensate from the combustion of natural gas were collected from a trunk line servicing 28 natural gas wells adjacent to the Gasbuggy Test Well near Farmington, NM, from January 1 through September 5. The unit was inoperative from September 5 until November 1, and one sample was collected for the period November 1 through December 31. This study, which became routine by November 1971 following the development of a gas burner system, was initiated to determine if natural gas from the nuclear-stimulated Gasbuggy test well would introduce radioactive contaminants into the surrounding producing wells. Tritium was chosen as a suitable indicator of radioactive contamination.

The gas burner system, described in more detail by Connolly,[13] operated by passing an air/gas mixture through a combustion chamber where it is continuously burned. The resultant water vapor is condensed out of the exhaust gases, collected, and sent to the NERC-LV for liquid scintillation counting for ^{3}H.

All concentrations of ^{3}H in the nine condensate samples collected in CY 1973, as in samples collected in previous years, were below the minimum detectable concentration of about 2.4×10^{-7} μCi/ml of condensate water.

Project Gasbuggy Production Test

During the production test conducted at the Project Gasbuggy site from May 15 to November 6, 1973, natural gas containing ^{85}Kr and ^{3}H was flared

continuously. On several occasions tritiated water, which had been removed from the natural gas, was converted to steam and injected into the flaring plume. The flow rate at which the natural gas was flared varied as shown on Figure 27, which also shows when steam containing ^{3}H was injected into the flaring plume and when aerial and ground sampling was conducted by NERC-LV personnel. The primary radionuclides of concern were identified from previous surveillance programs for Project Gasbuggy to be ^{3}H and ^{85}Kr, of which a total of approximately 49 Ci and 5 Ci, respectively, was released into the atmosphere during this production test.

Aerial sampling detected concentrations of ^{3}H above estimated background levels in the plume on each mission flown during the periods May 19-21 and July 25-26. The concentrations of ^{85}Kr in all samples collected during flaring operations were considered to be at background levels, about 1.7×10^{-11} µCi/ml except for one sample collected on May 19, which had a ^{85}Kr concentration of 2.1×10^{-11} µCi/ml. This concentration is about 0.02% of the Concentration Guide for a suitable population sample in an uncontrolled area. The highest concentration of ^{3}H detected in aircraft samples was 4.8×10^{-11} µCi/ml of air in a sample collected on July 25 at an altitude of 2250 m (7400 ft) MSL, 1.8 km (1.1 mi) at 260° from the flare stack. This concentration is approximately 0.07% of the Concentration Guide (6.7×10^{-8} µCi/ml) for continuous exposure to a suitable population sample in an uncontrolled area.

Mobile monitors on the ground, who were positioned downwind of the stack plume by personnel in the aircraft, also collected atmospheric moisture samples containing ^{3}H above estimated background during each sampling period in May and July. The highest ^{3}H concentration in atmospheric moisture samples collected by mobile monitors on the ground was collected at an unpopulated location 0.5 km (0.3 mi) at 341° from the flare stack, on July 25. This concentration, which was 3×10^{-10} µCi/ml of air, is approximately 0.4% of the Concentration Guide for a suitable population sample in an uncontrolled area.

Tritium concentrations above estimated background were found in vegetation and soil collected during the July 25-26 surveillance operations and the November 6-8 post-flaring surveillance; no ^{3}H was detected in these sample

types during the May 19-21 surveillance. No surface water samples showed concentrations of ^{3}H above estimated background. The highest ^{3}H concentration in vegetation (2.6×10^{-5} μCi/ml H_2O) was measured in a sample collected at Station 20 on November 7, 2 km (1.2 mi) and 333° azimuth from the flare stack. The highest ^{3}H concentration in soil (1.7×10^{-6} μCi/ml H_2O) was measured in a sample collected at Station 10 on November 7, 0.5 km (0.3 mi) and 102° azimuth from the flare stack.

From the highest concentrations of ^{3}H which were measured in atmospheric moisture samples, it is concluded that any direct exposures to the off-site population were all below 0.4% of the Concentration Guide for this radionuclide. There are no concentration guides for ^{3}H in vegetation or soil. However, all vegetation samples were native, uncultivated shrubs, which are not used for human consumption or known to be of consideration in the food chain of area residents.

All concentrations of radionuclides detected should be considered as maximum since considerable effort was made to sample at times, places, and under atmospheric conditions when plume material was most likely to be on or near the surface at maximum concentrations. In addition, much of the sampling of atmospheric moisture was done when stored, tritiated water was being deliberately injected at higher than normal rates into the flare. References to exposures to a suitable population sample are more hypothetical than real, since all samples containing concentrations of ^{3}H above estimated background were collected at unpopulated locations.

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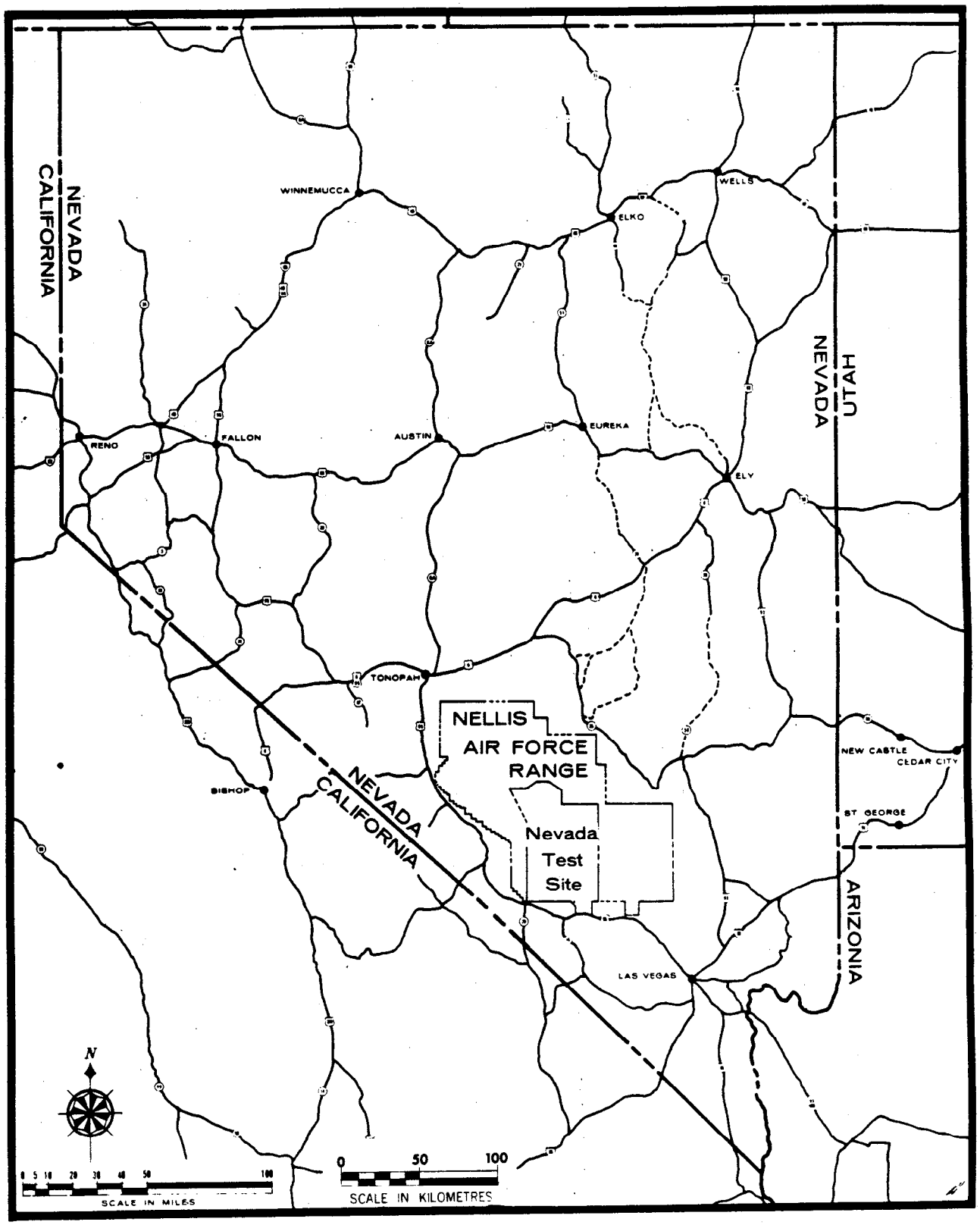

Figure 1. Nevada Test Site Location

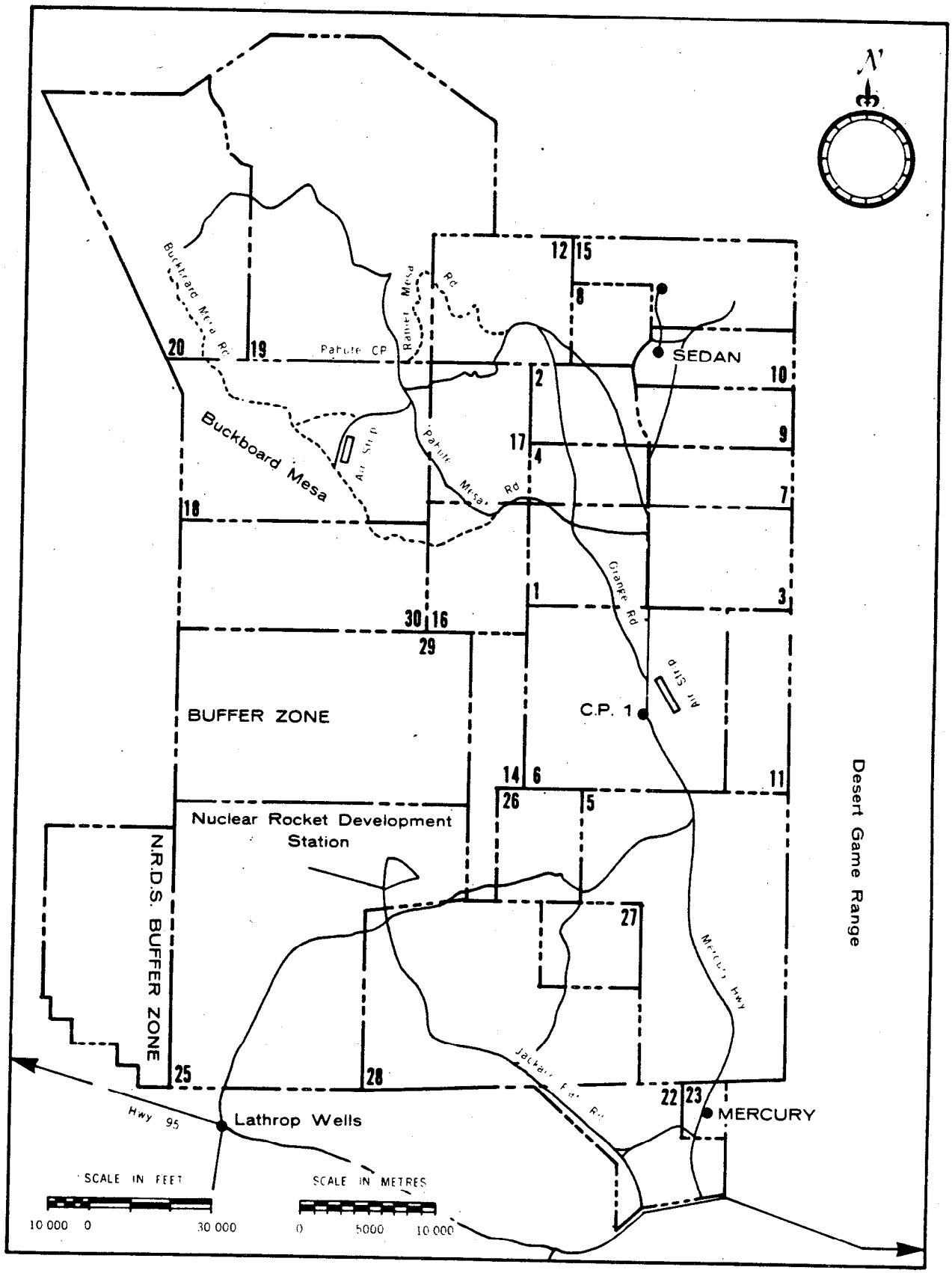

Figure 2. Nevada Test Site Road and Facility Map

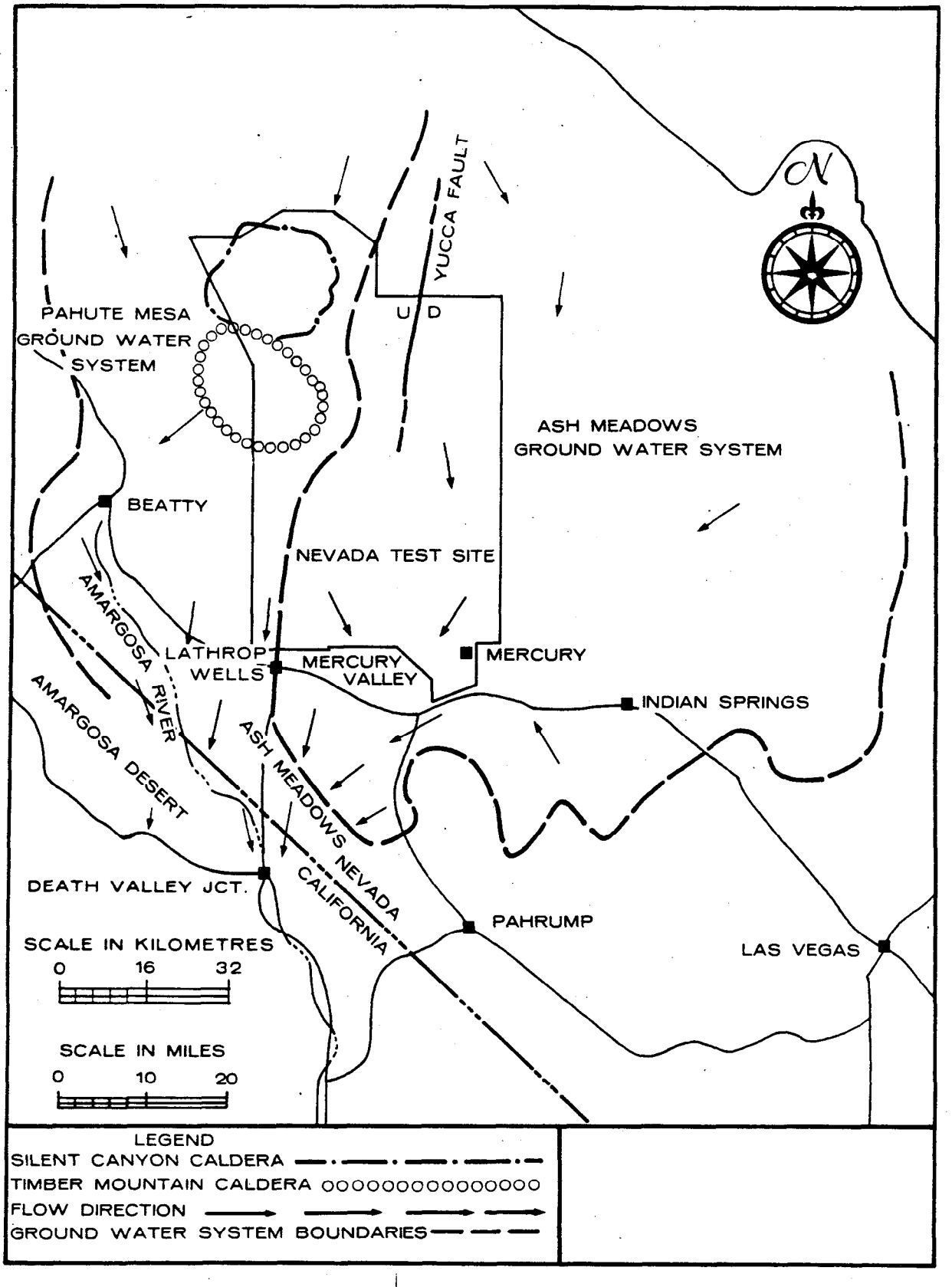

Figure 3. Ground Water Flow Systems - NTS

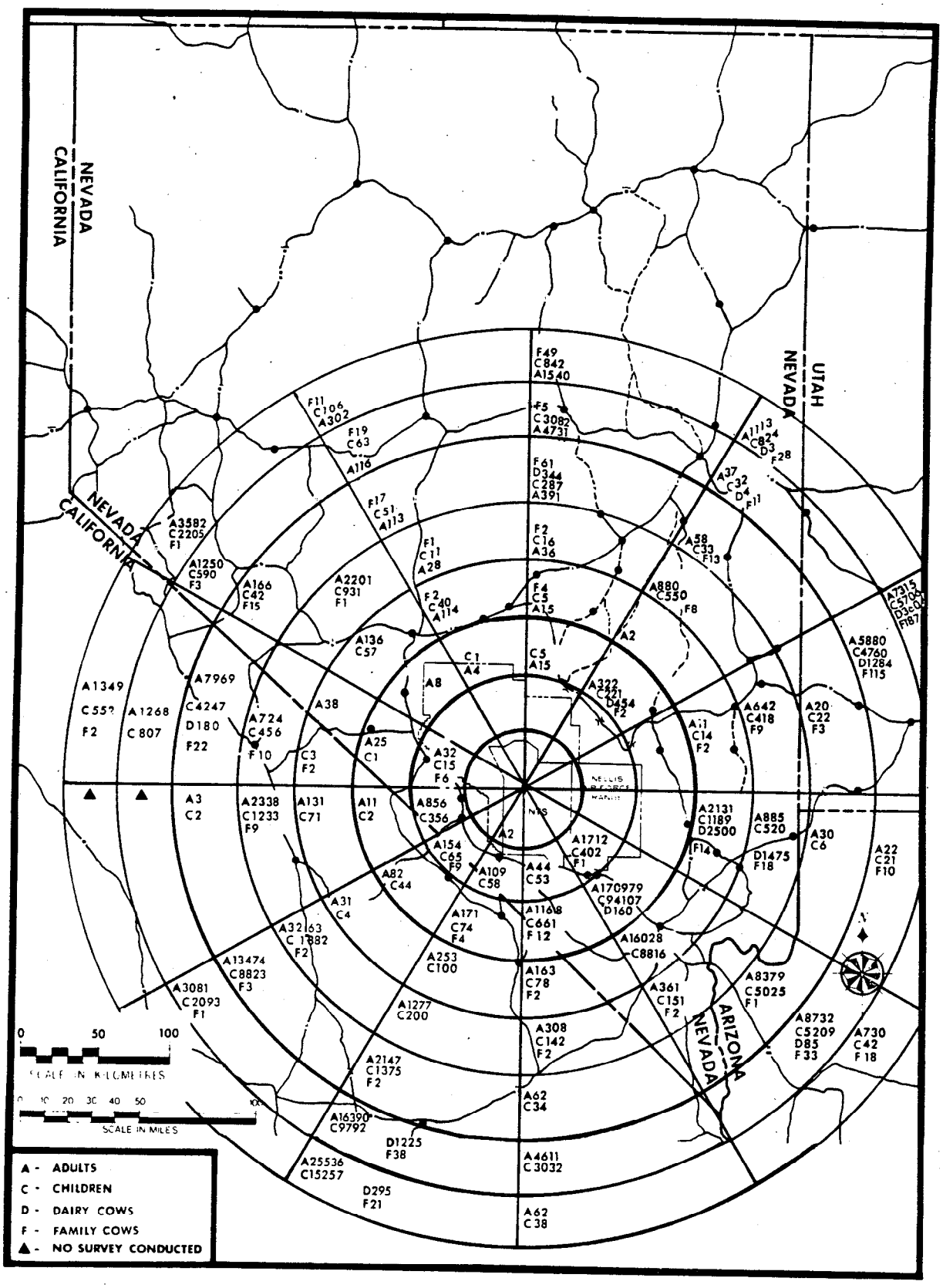

Figure 4. Population Distribution by Azimuth/Distance

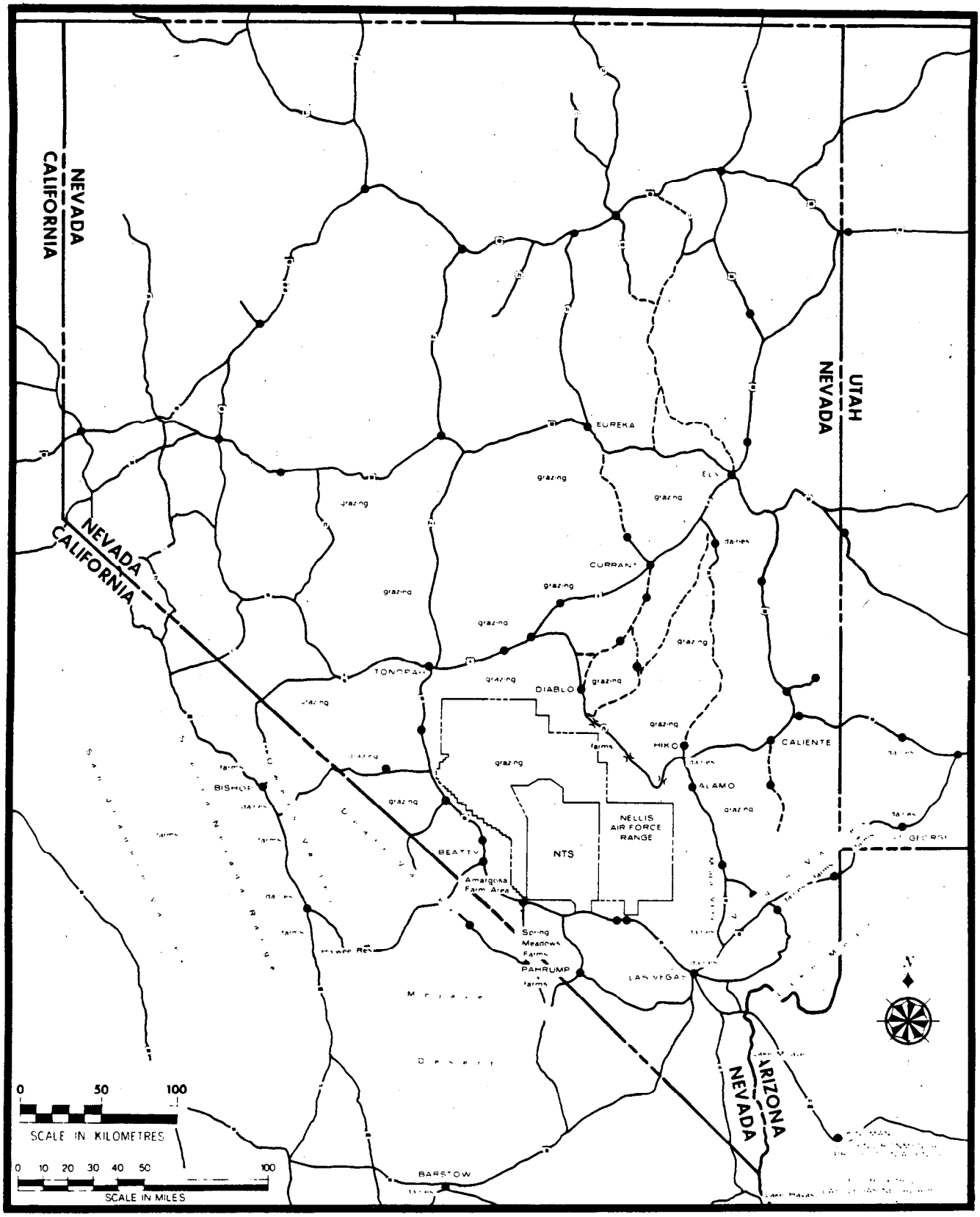

Figure 5. General Land Use, Nevada Test Site Vicinity

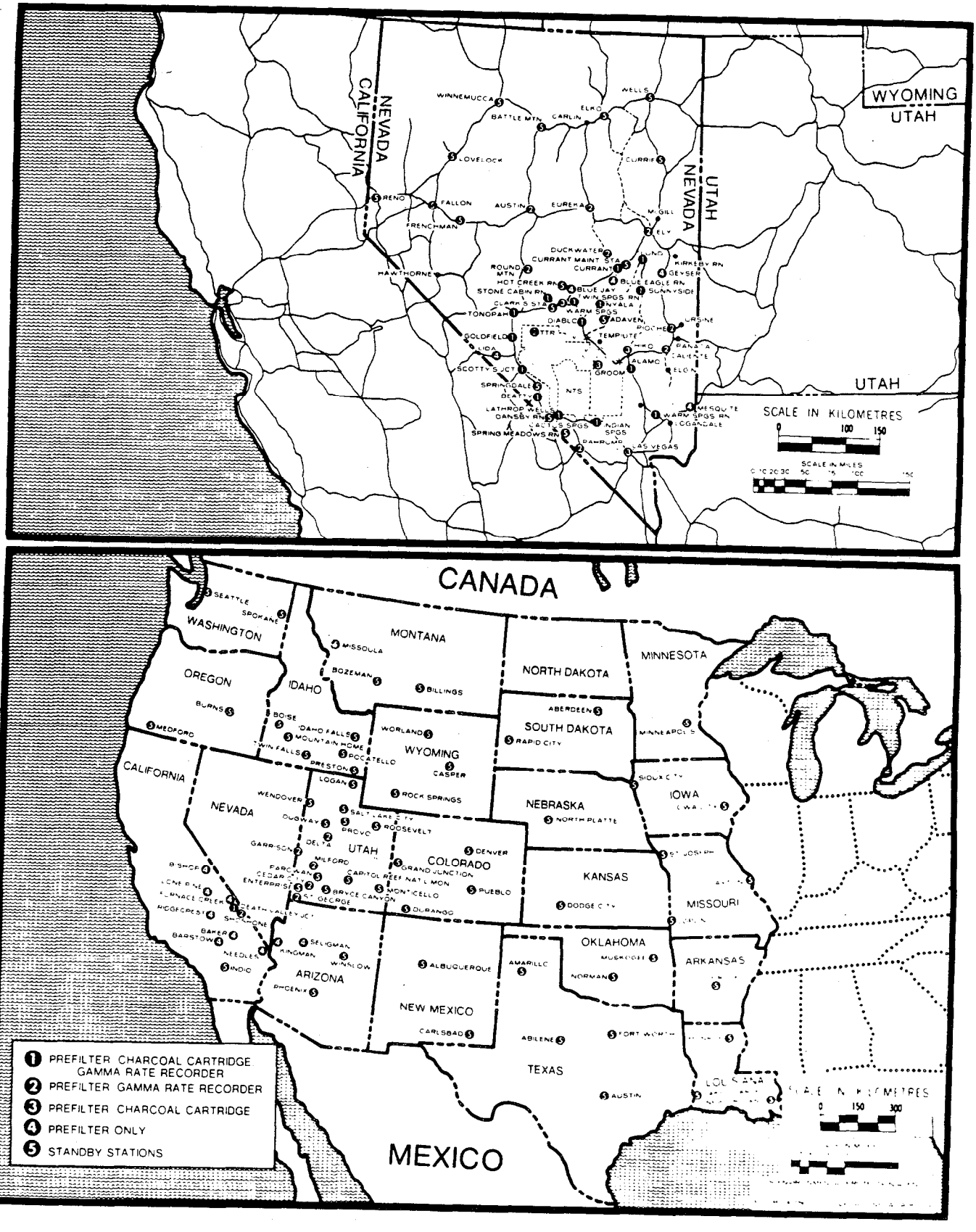

Figure 6. Air Surveillance Network

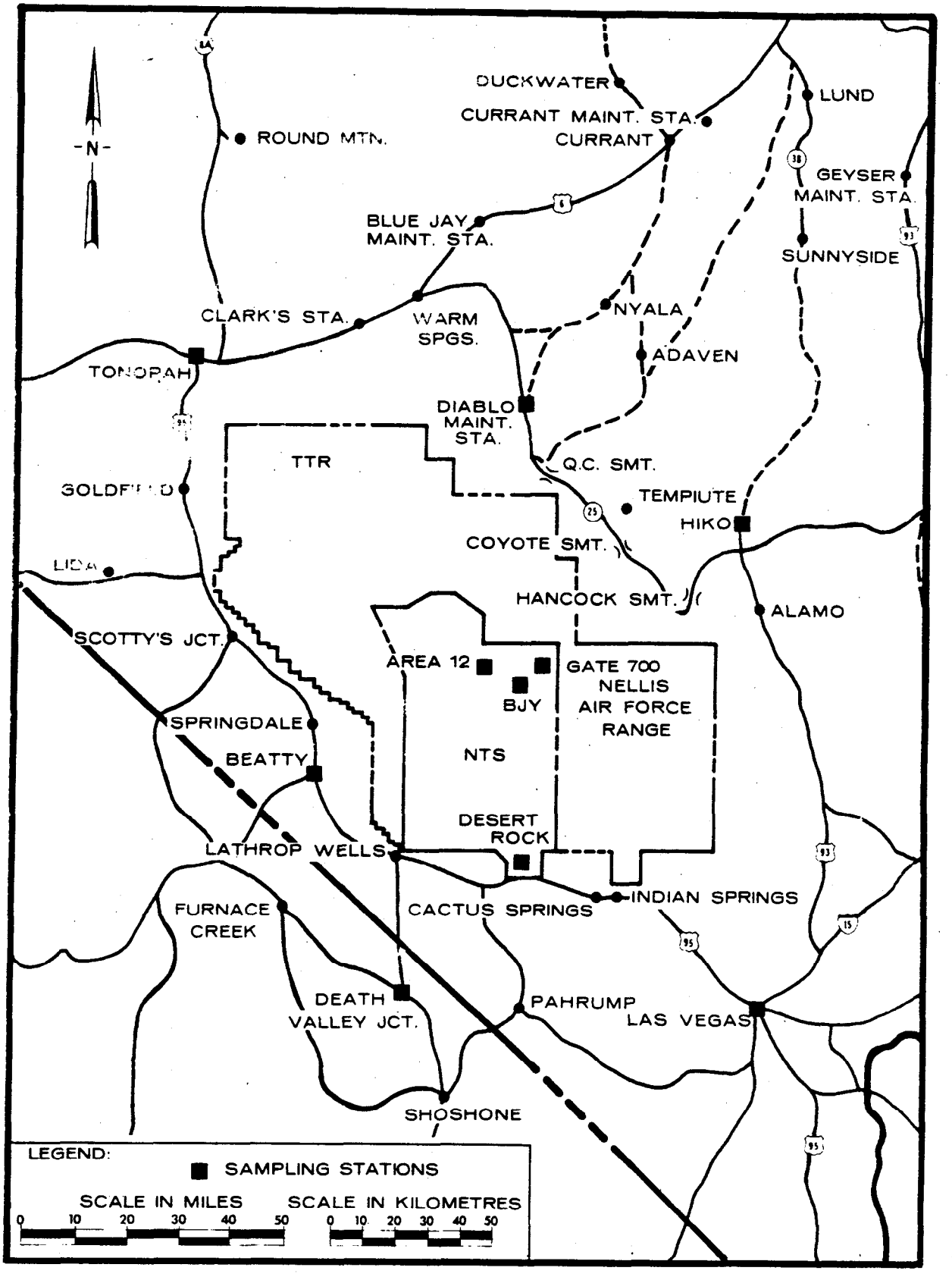

Figure 7. Noble Gas and Tritium Surveillance Network

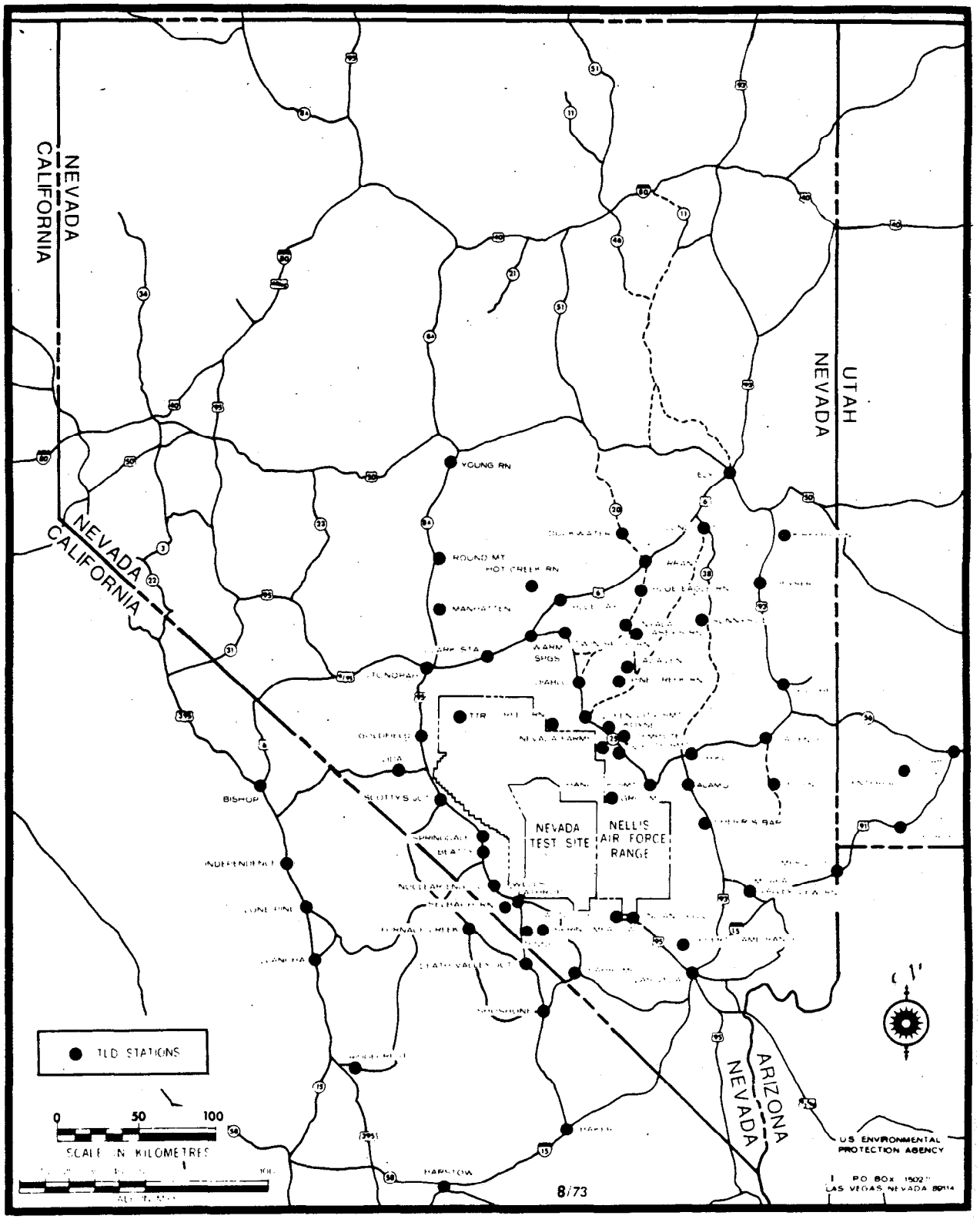

Figure 8. Dosimetry Network

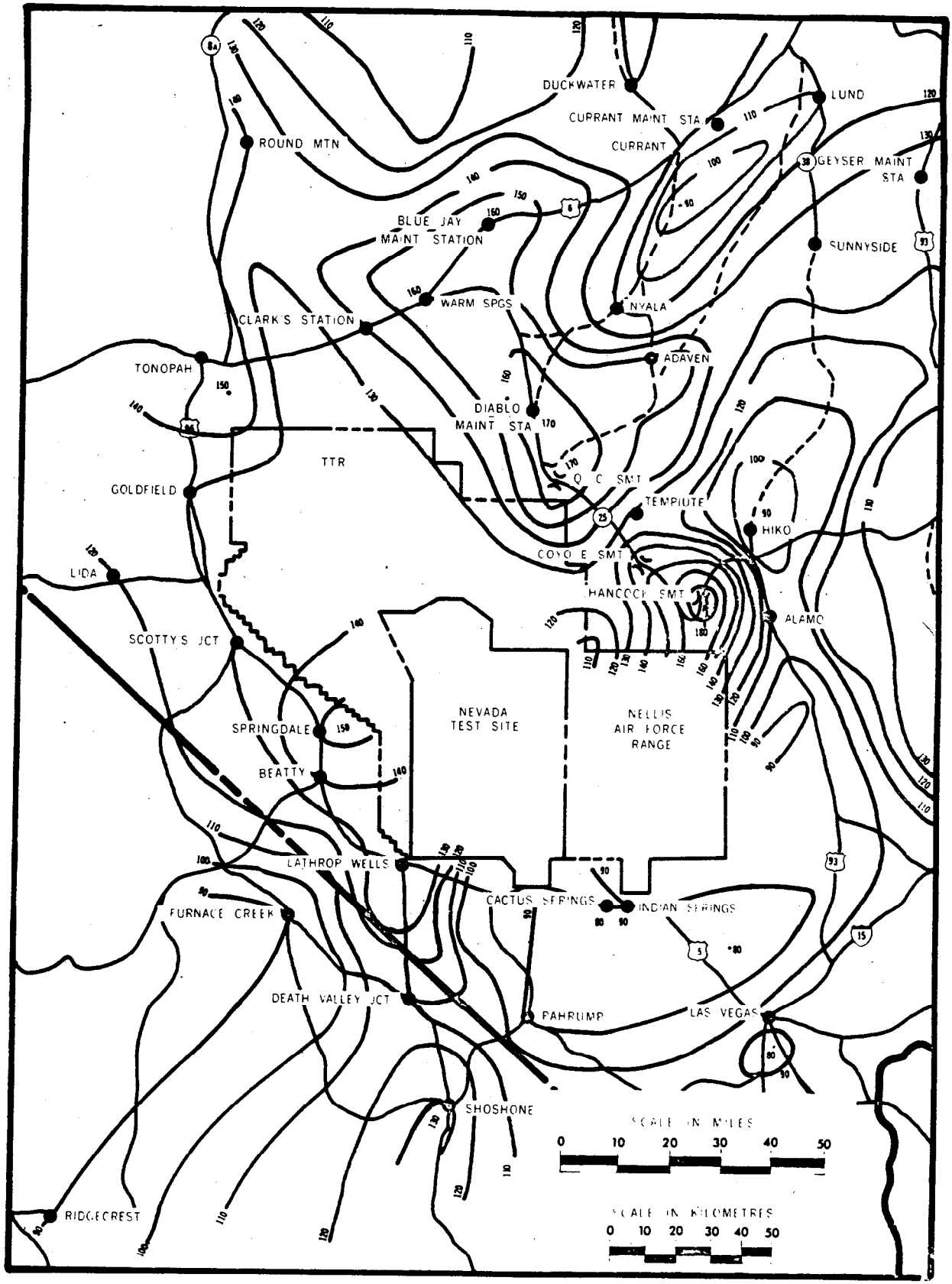

Figure 9. Isopleth Plot of 1973 TLD Exposures

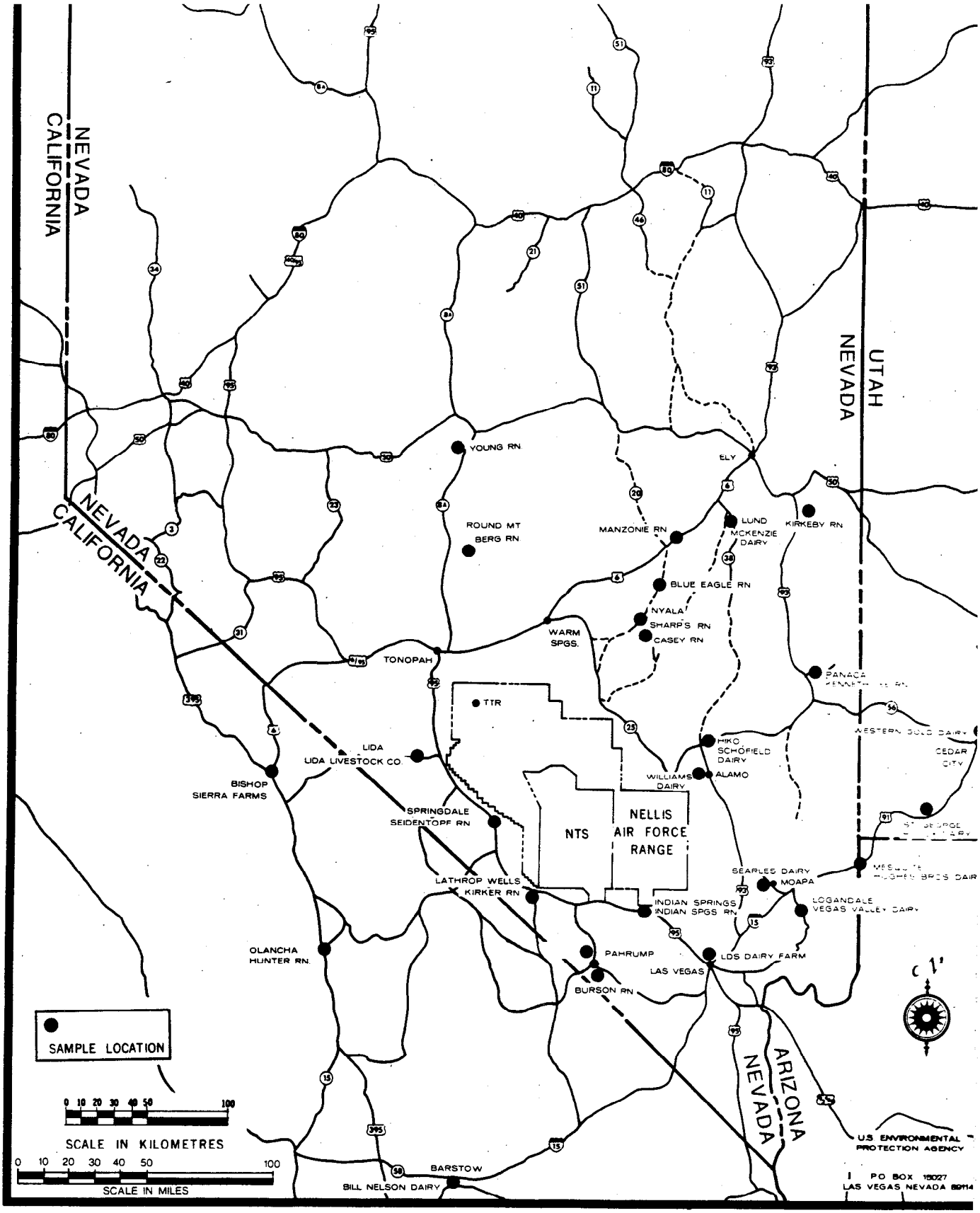

Figure 10. Milk Surveillance Network

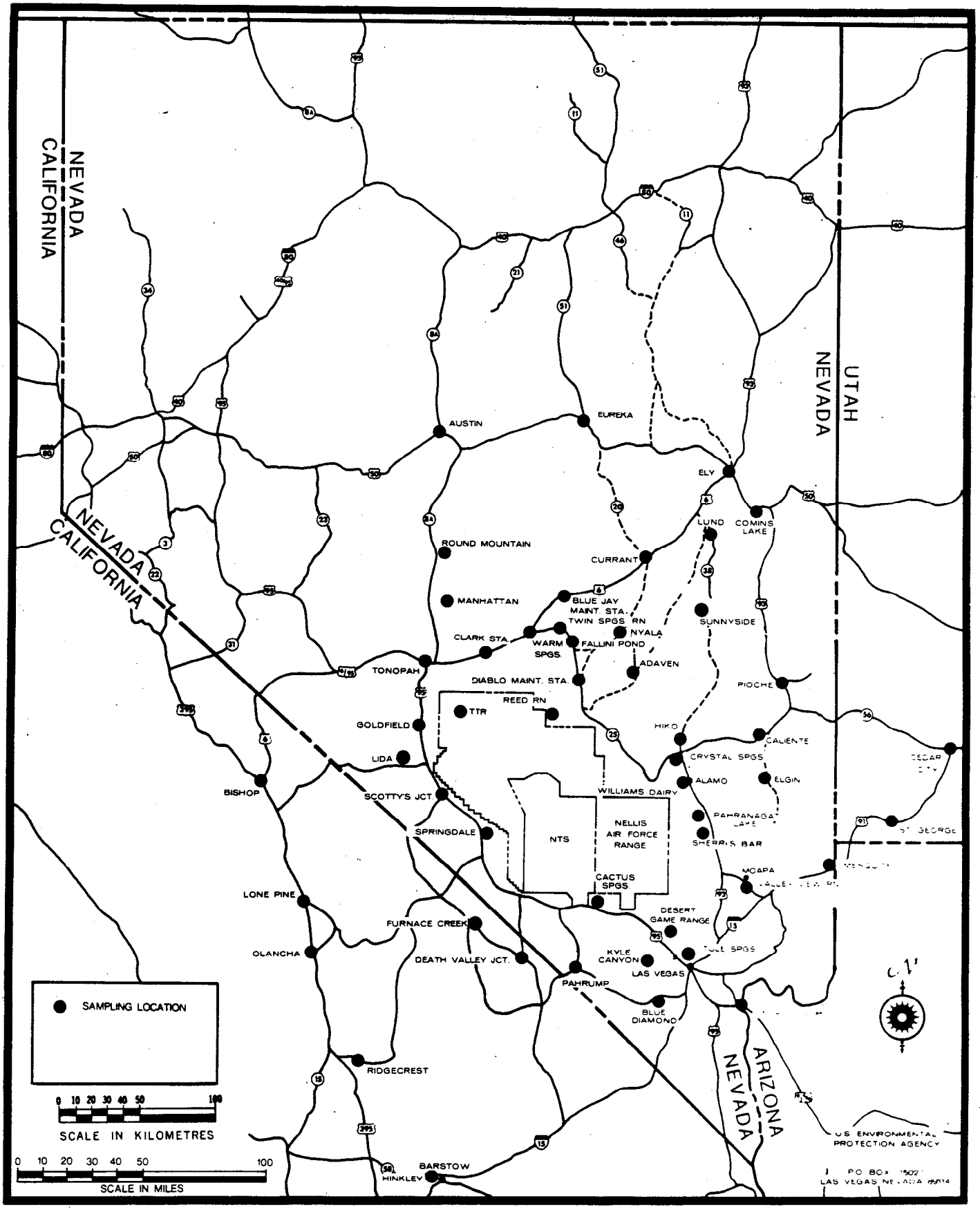

Figure 11. Water Surveillance Network

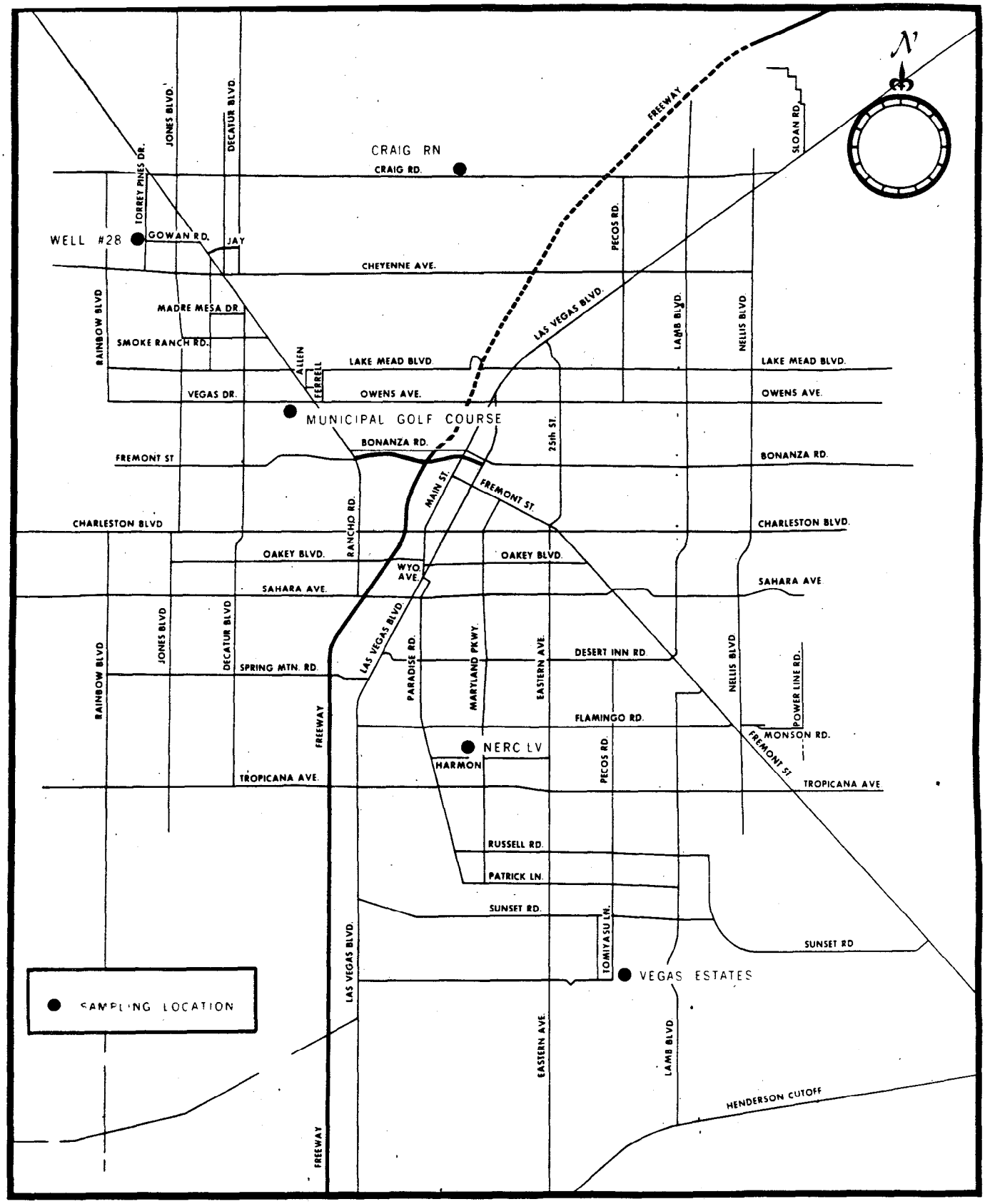

Figure 12. Water Surveillance Network, Las Vegas Valley

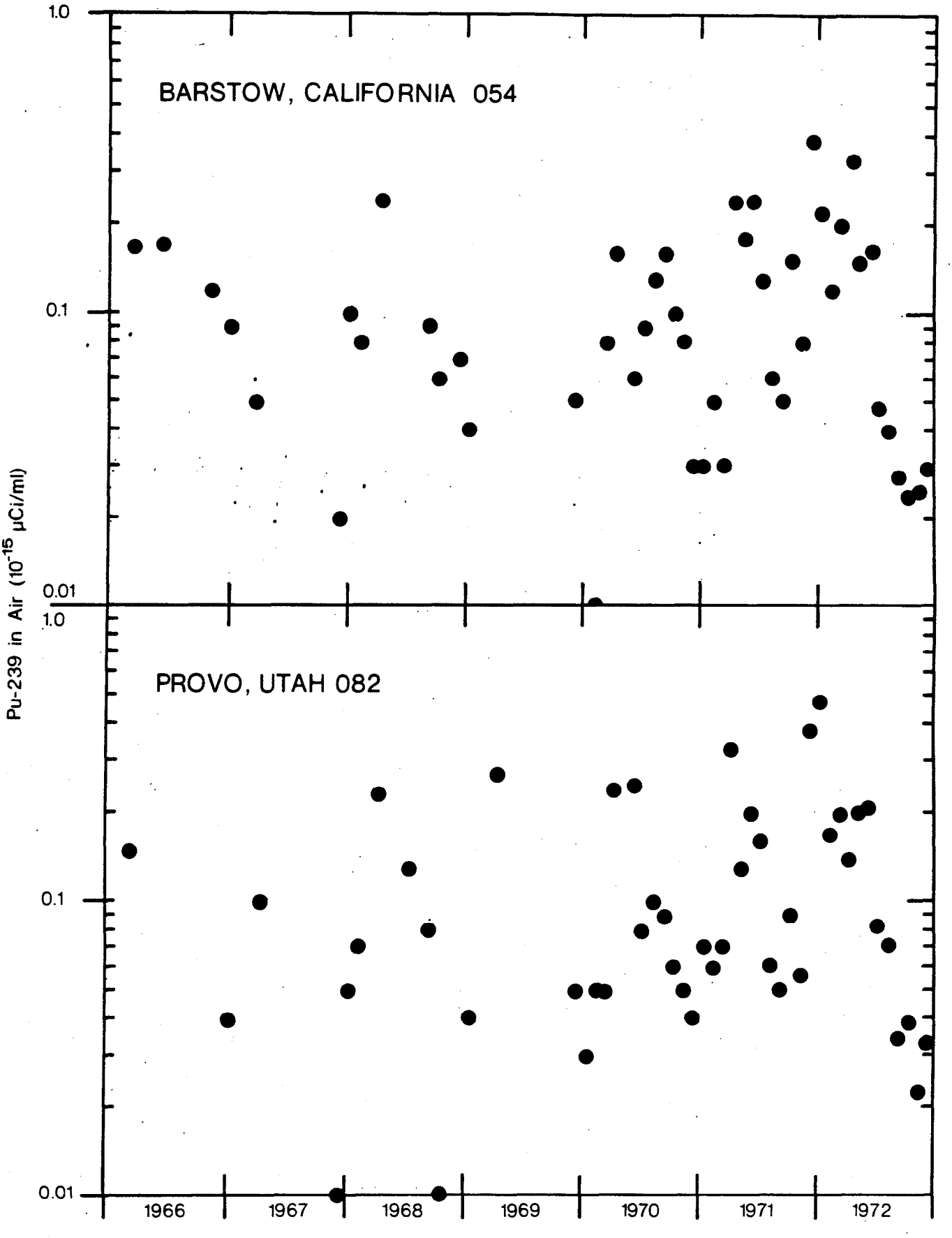

Figure 13. Pu-239 Concentrations in Air

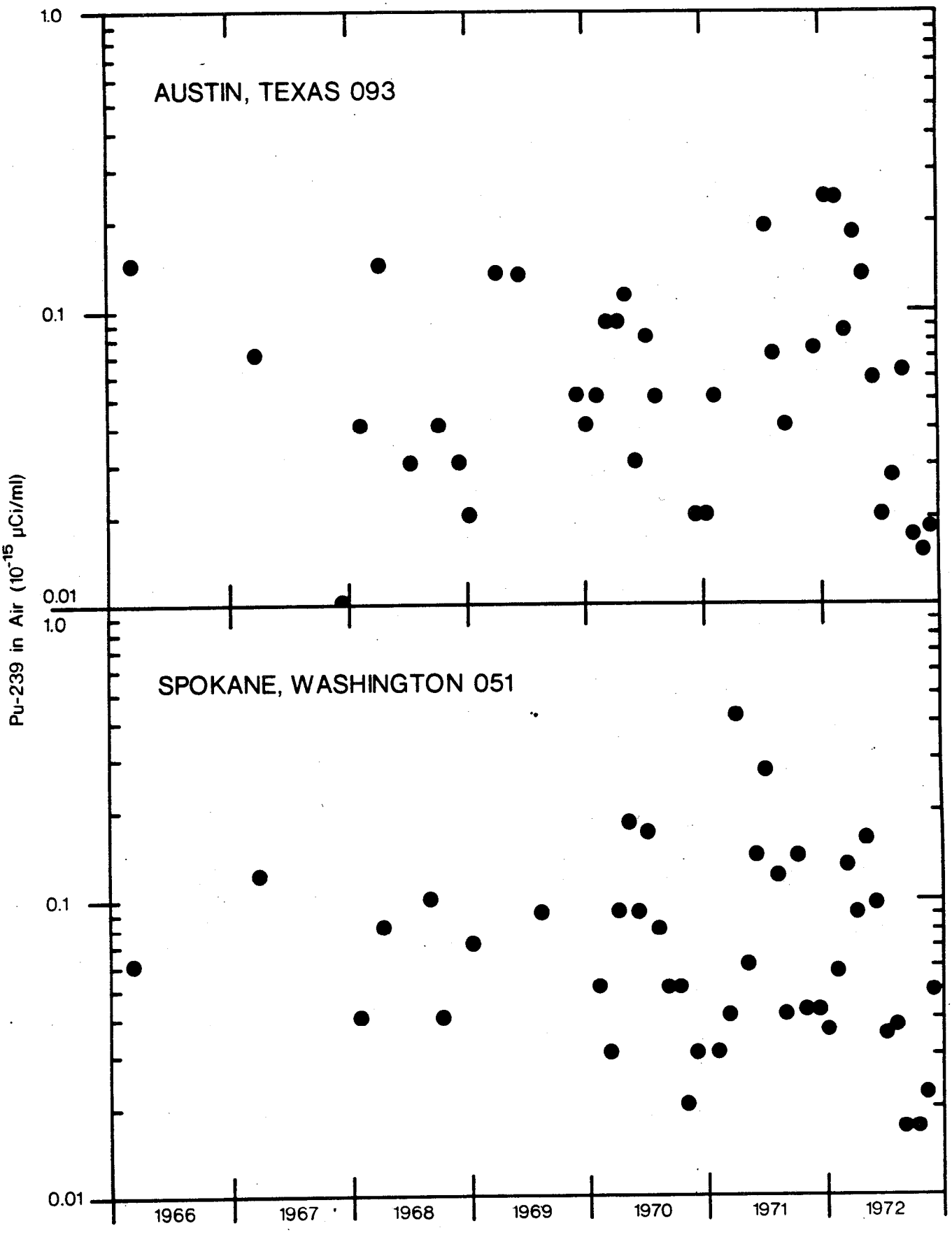

Figure 14. Pu-239 Concentrations in Air at Austin, TX and Spokane, WA

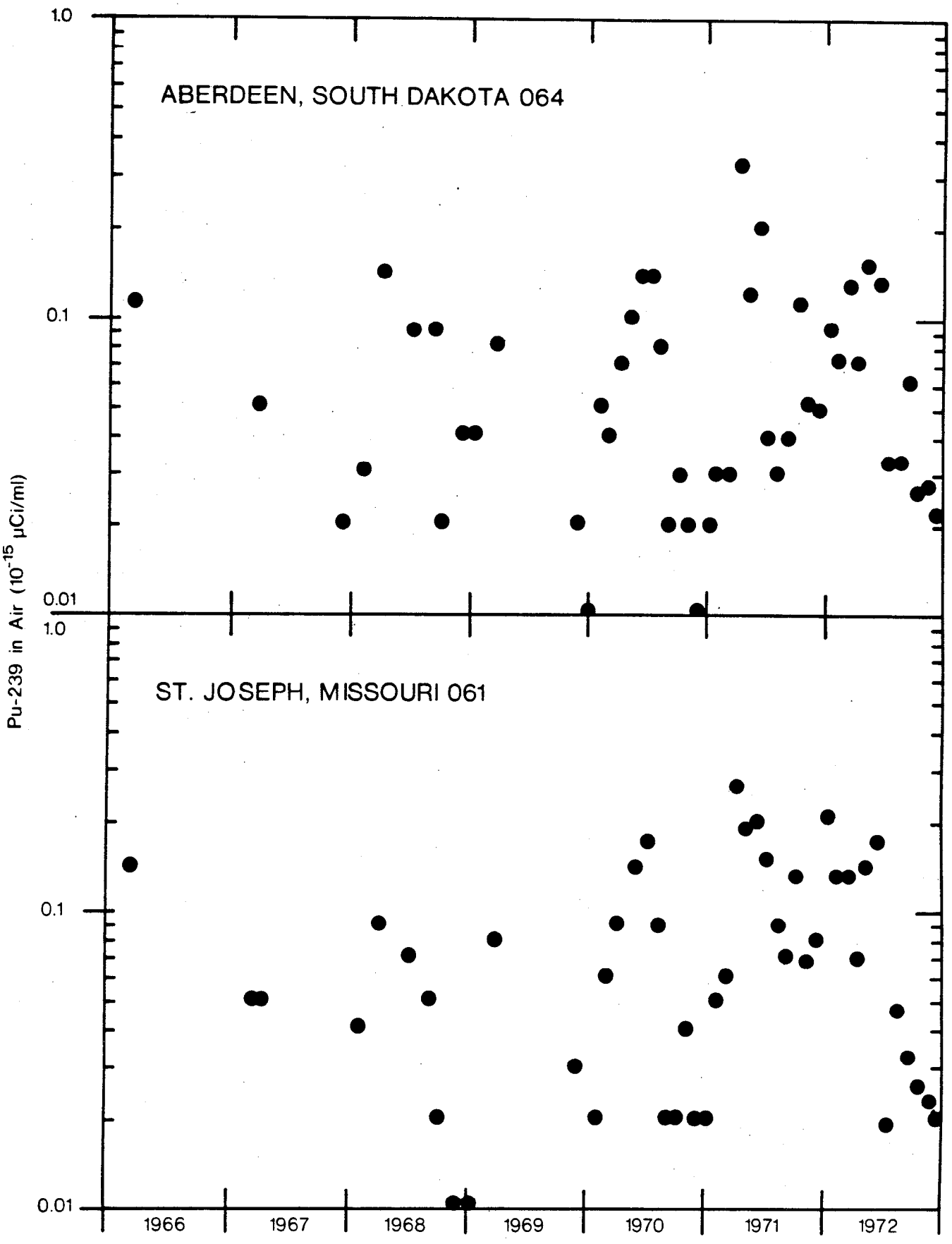

Figure 15. Pu-239 Concentrations in Air at Aberdeen, SD and St. Joseph, MO

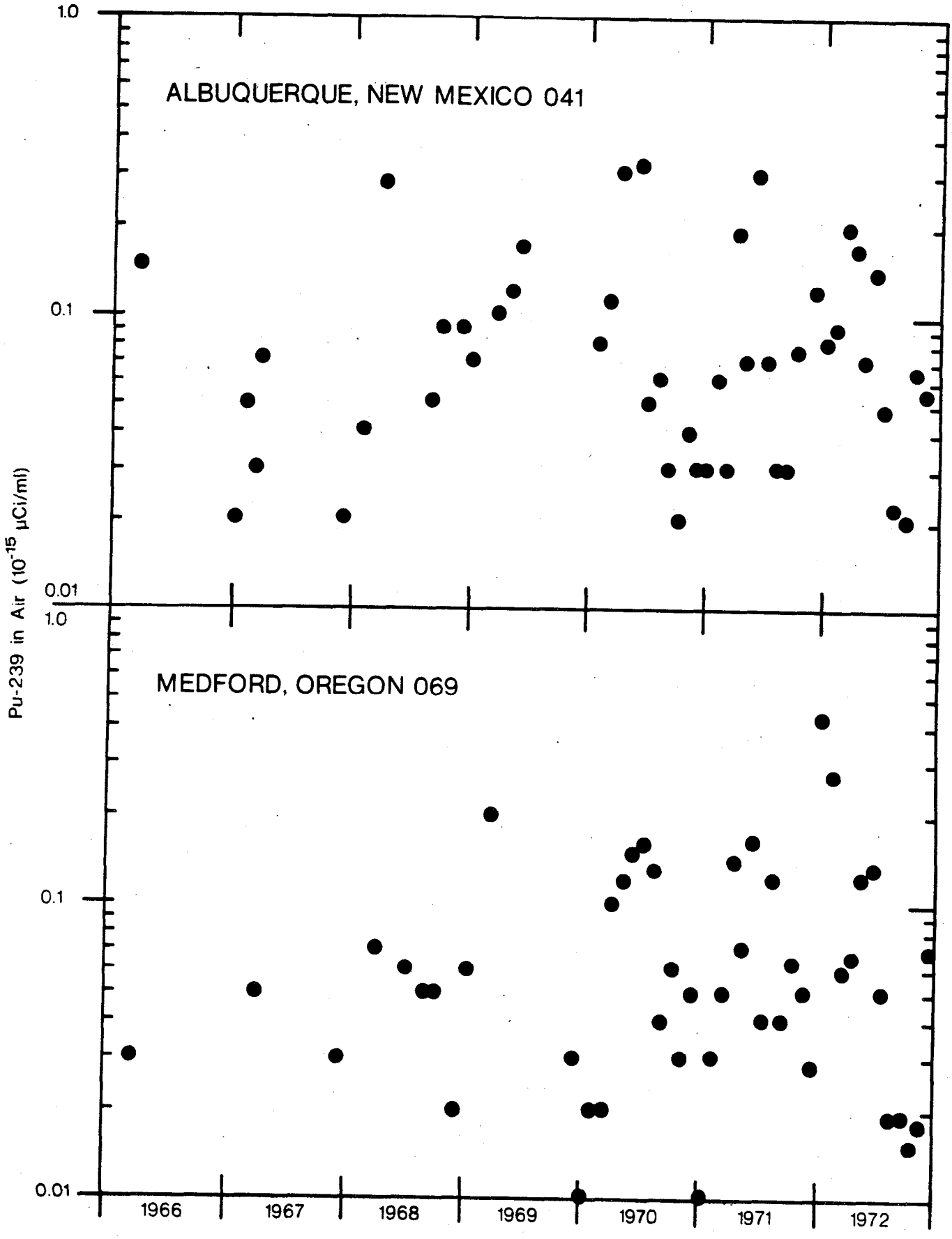

Figure 16. Pu-239 Concentrations in Air at Albuquerque, NM and Medford, OR

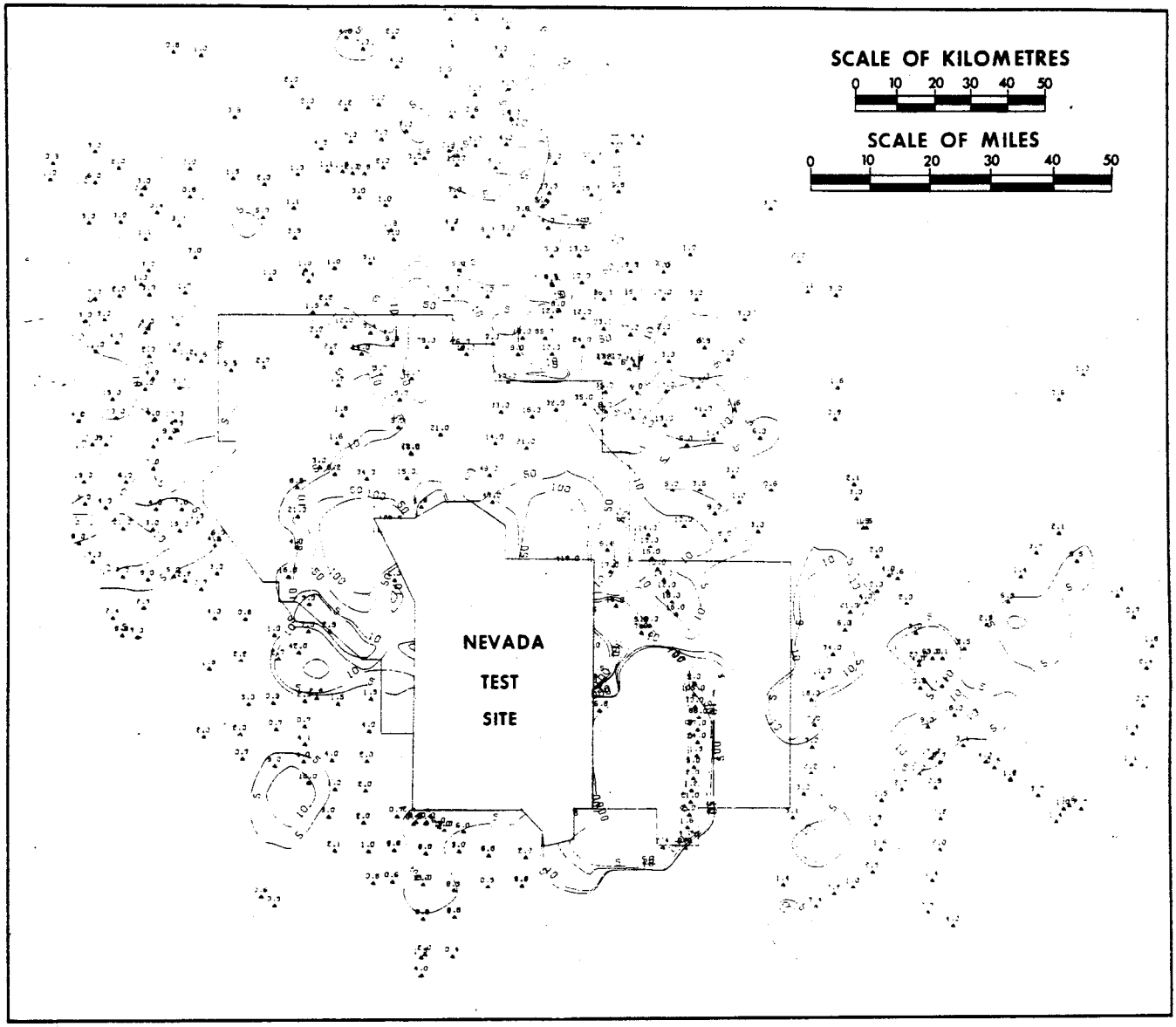

Figure 17. Plutonium in Soil (10^{-3} μCi/m^2)

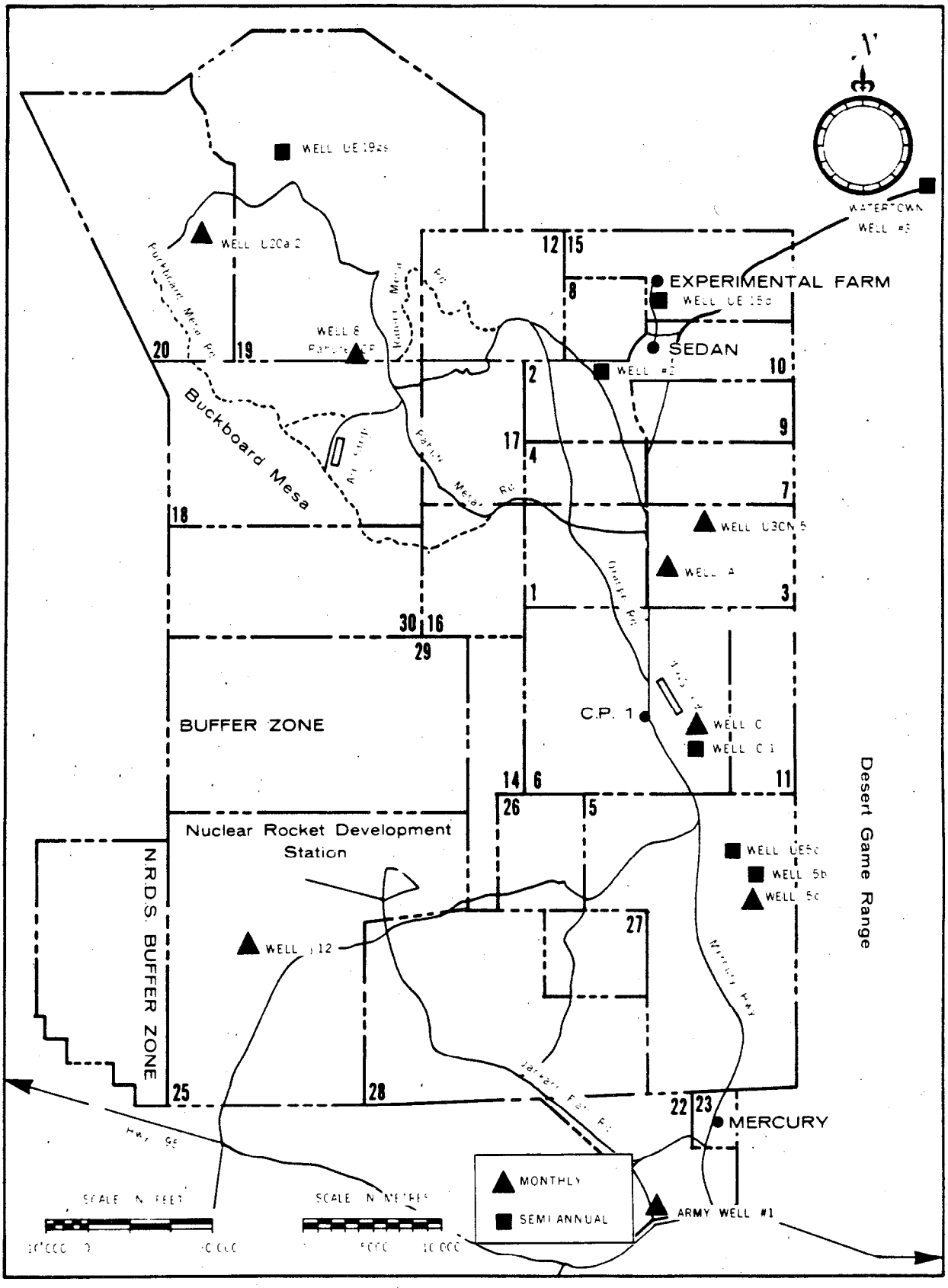

Figure 18. On-NTS Long-Term Hydrological Monitoring Network

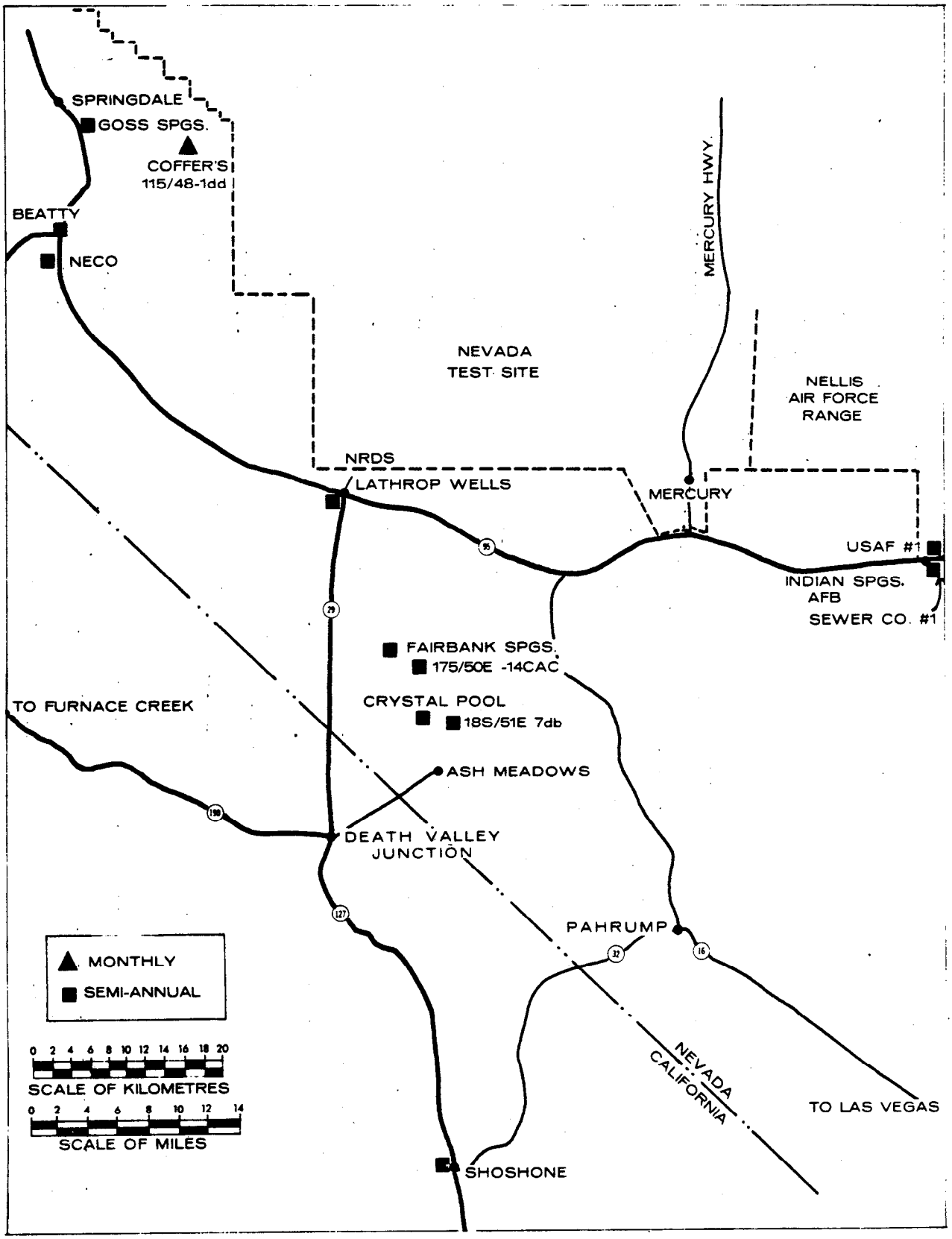

Figure 19. Off-NTS Long-Term Hydrological Monitoring Network

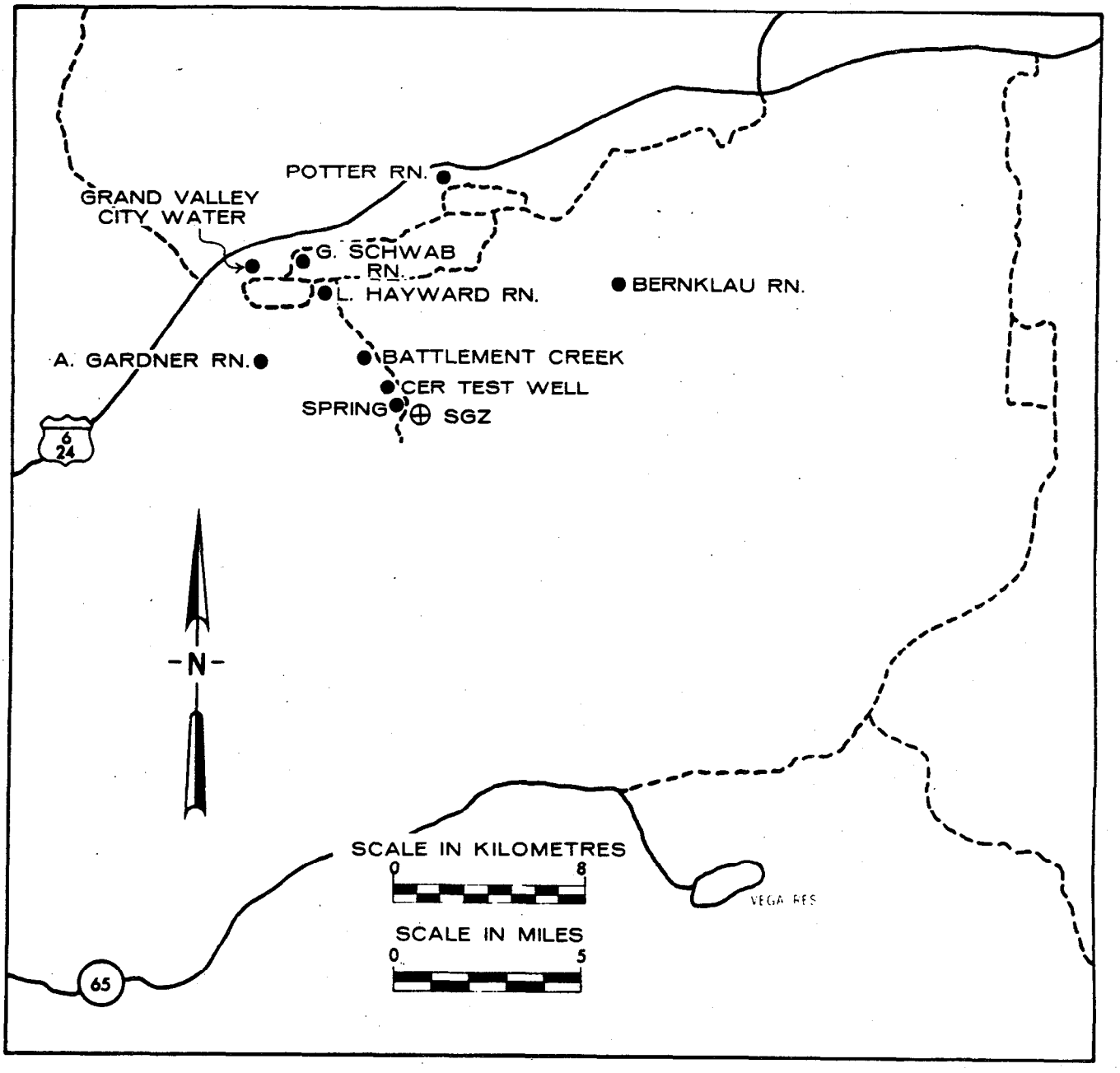

Figure 20. Long-Term Hydrological Monitoring Locations, Rulison, CO, Project Rulison

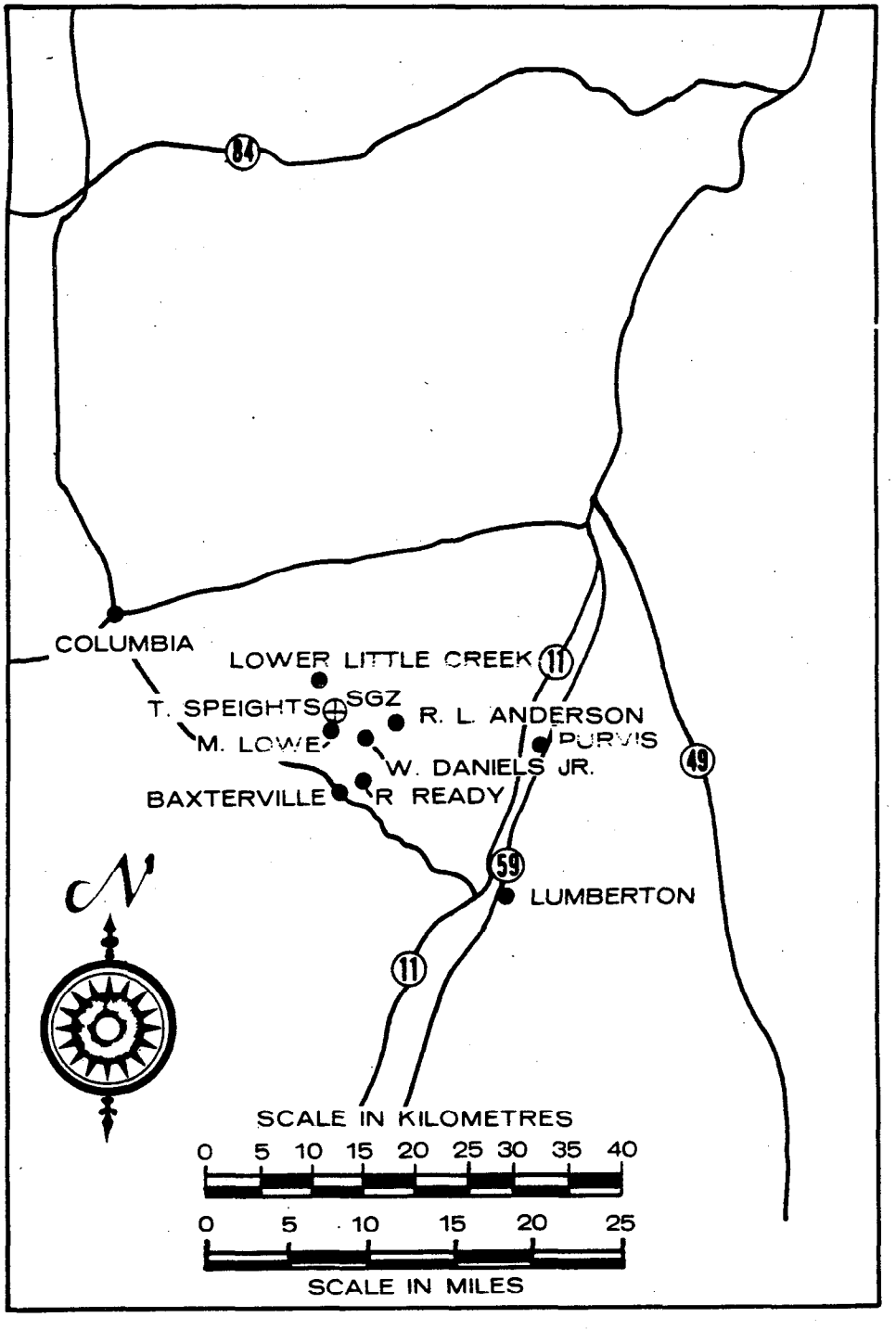

Figure 21. Long-Term Hydrological Monitoring Locations, Tatum Dome, MS, Project Dribble/Miracle Play

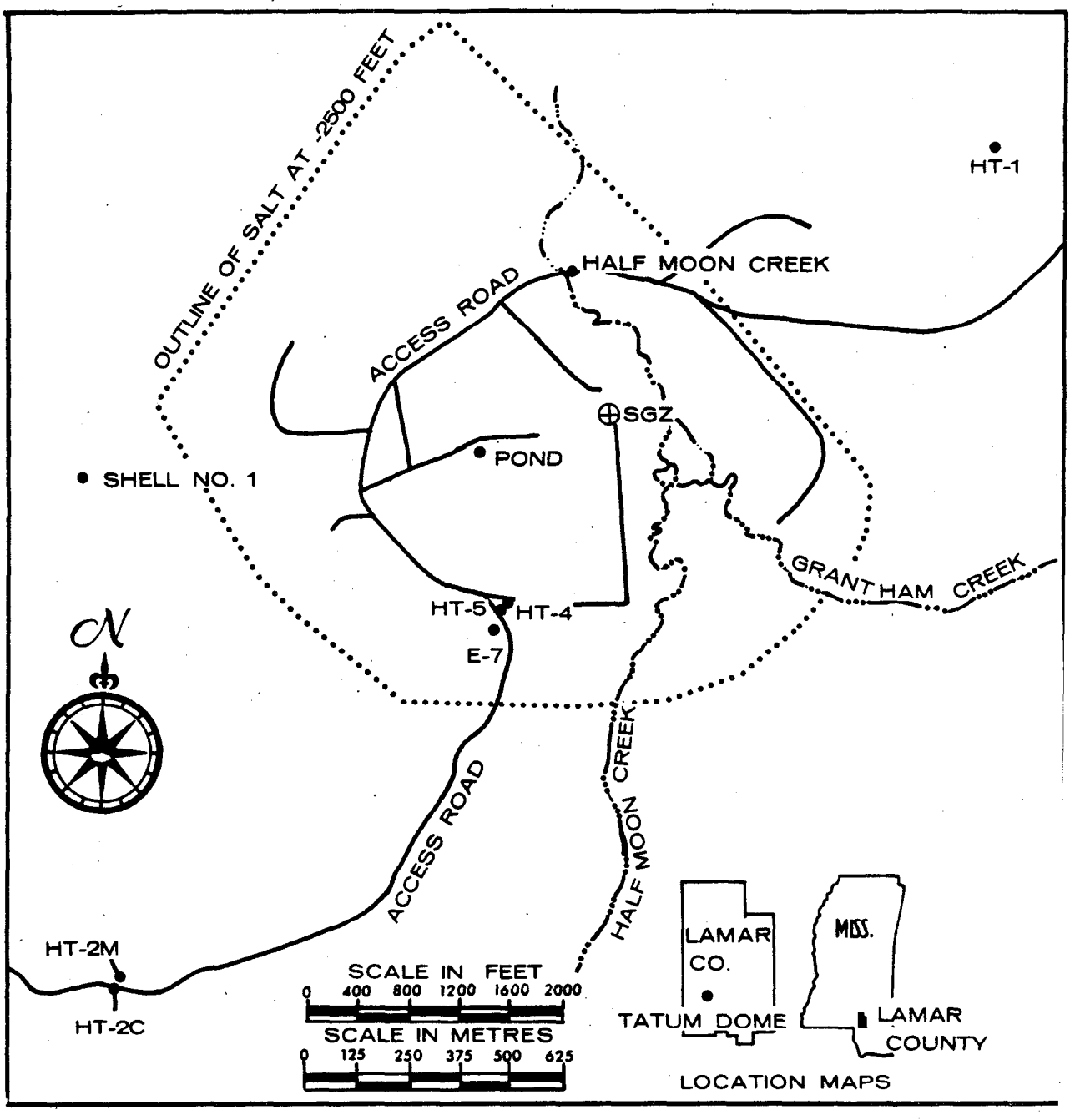

Figure 22. Long-Term Hydrological Monitoring Locations, Tatum Dome, MS, Project Dribble/Miracle Play

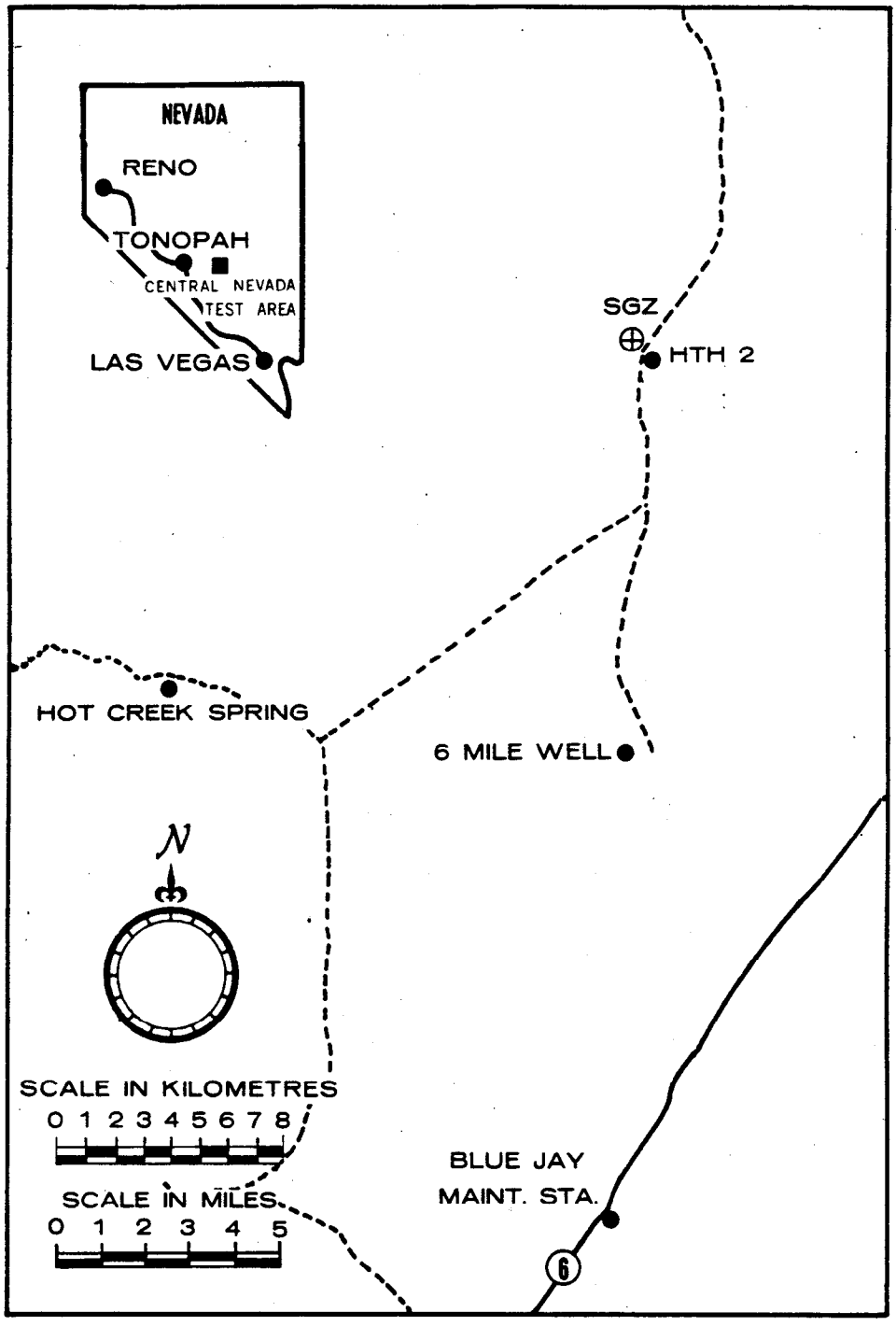

Figure 23. Long-Term Hydrological Monitoring Locations
Central Nevada Test Area, Faultless Event

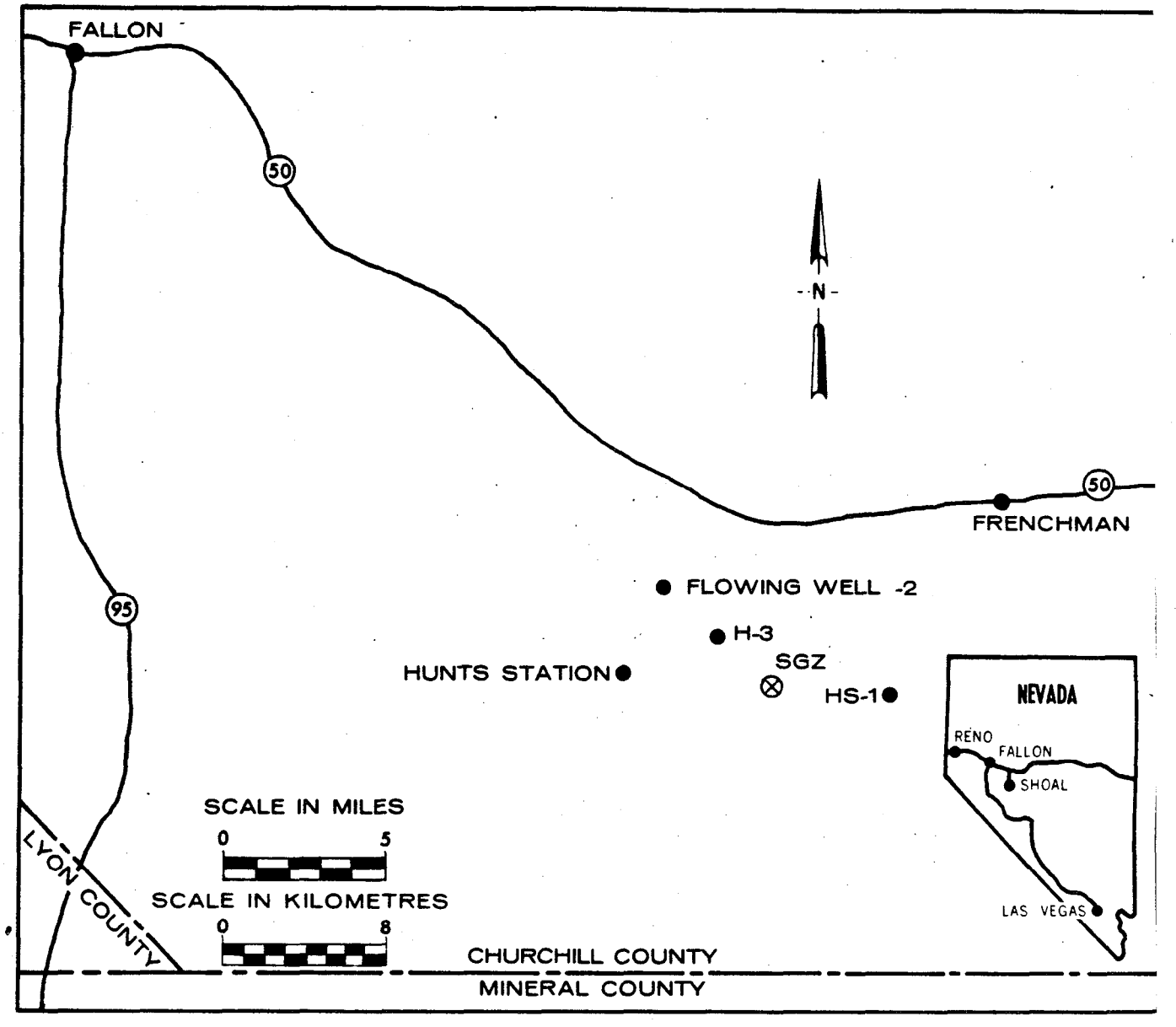

Figure 24. Long-Term Hydrological Monitoring Locations, Fallon, NV, Project Shoal

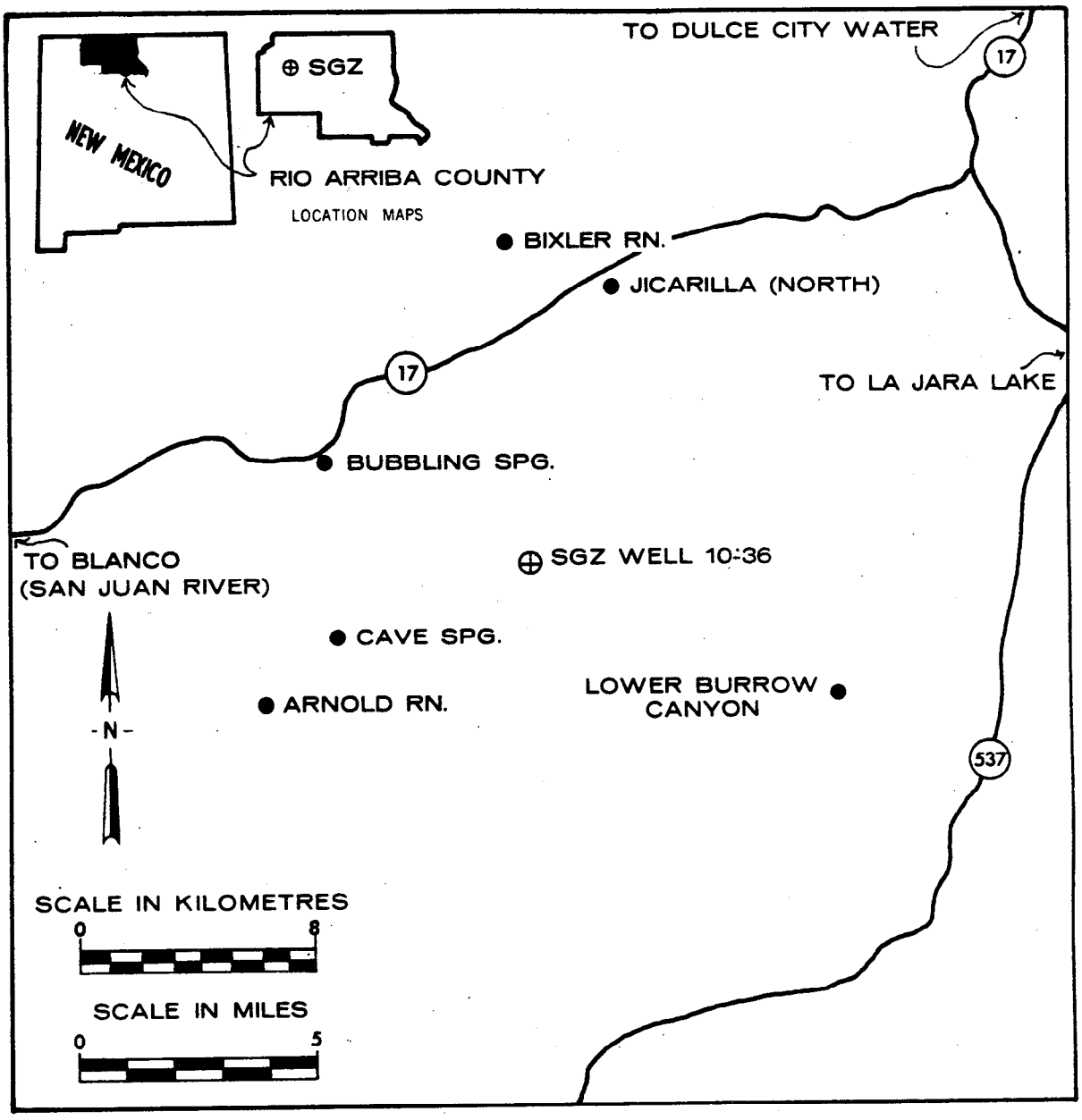

Figure 25. Long-Term Hydrological Monitoring Locations
Rio Arriba County, NM, Project Gasbuggy

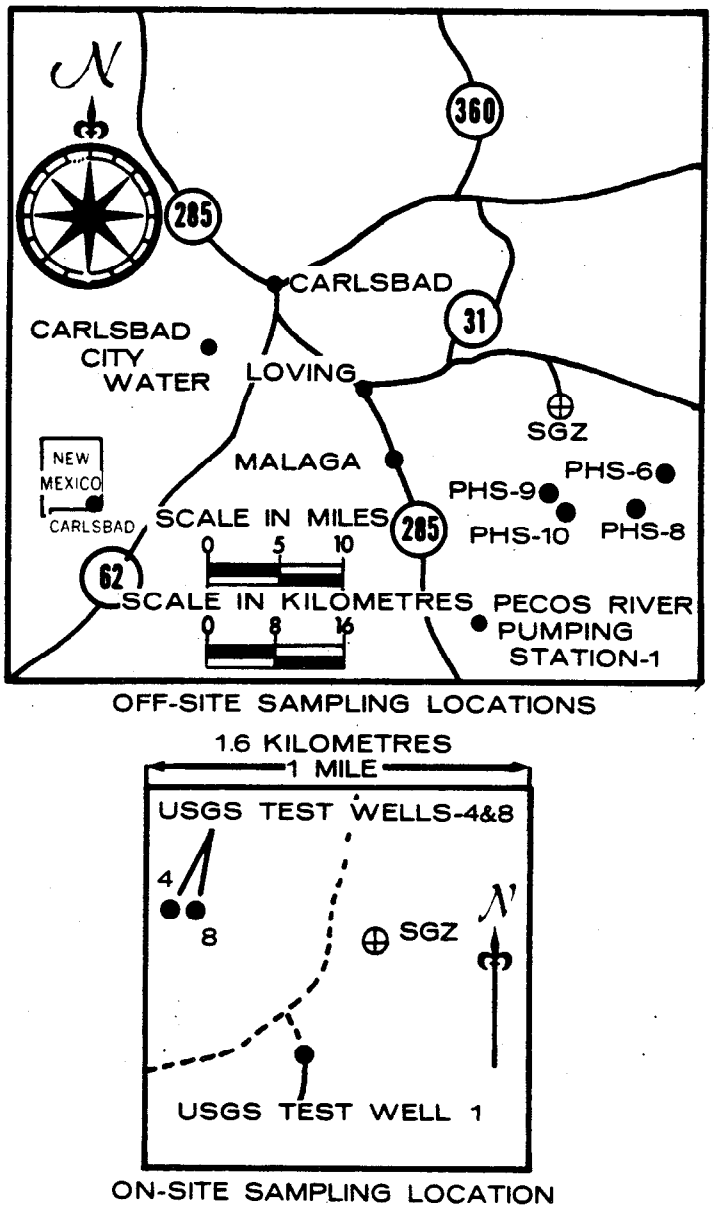

Figure 26. Long-Term Hydrological Monitoring Locations
Carlsbad, NM, Project Gnome/Coach

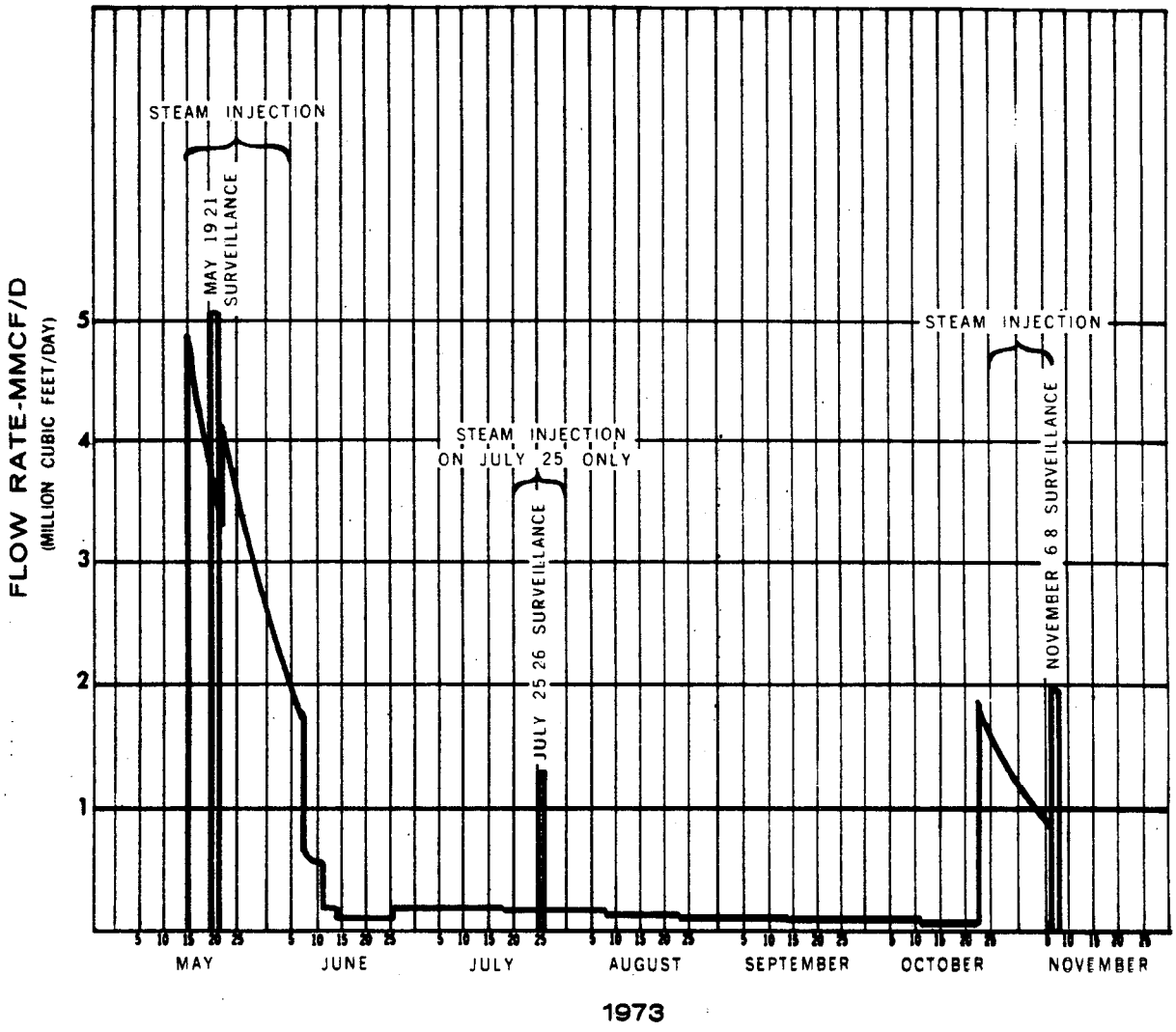

Figure 27. Variation of Natural Gas Flow Rate During Flaring Period, Project Gasbuggy Production Test

Table 1. Underground Testing Conducted Off the Nevada Test Site

Name of Test, Operation or Project	Date	Location	Yield[d]	Depth m (ft)	Purpose of the Event[d]
Project Gnome/ Coach[a]	12/10/61	48 km (30 mi) SE of Carlsbad, NM	3.1 kt[f]	350 (1184)	Multi-purpose experim
Project Shoal[b]	10/26/63	45 km (28 mi) SE of Fallon, NV	~12 kt	366 (1200)	Nuclear test detectio research experiment.
Project Dribble[b] (Salmon Event)	10/22/64	34 km (21 mi) SW of Hattiesburg, MI	5.3 kt	823 (2700)	Nuclear test detectio research experiment.
Operation Long Shot[b]	10/29/65	Amchitka Island, AK	~80 kt	716 (2350)	DOD nuclear test dete experiment.
Project Dribble[b] (Sterling Event)	12/3/66	34 km (21 mi) SW of Hattiesburg, MI	380 t	823 (2700)	Nuclear test detectio research experiment.
Project Gasbuggy[a]	12/10/67	88 km (55 mi) E of Farmington, NM	29 kt	1292 (4240)	Joint government-indus gas stimulation exper
Faultless Event[c]	1/19/68	Central Nevada Test Area 96 km (60 mi) E of Tonopah, NV	200 kt-1 Mt	914 (3000)	Calibration test.
Project Miracle Play (Diode Tube)[b]	2/2/69	34 km (21 mi) SW of Hattiesburg, MI	Non-nuclear explosion	823 (2700)	Detonated in Salmon/ Sterling cavity. Seismic studies.
Project Rulison[a]	9/10/69	19 km (12 mi) SW of Rifle, CO	40 kt	2568 (8425)	Gas stimulation exper
Operation Milrow[c]	10/2/69	Amchitka Island, AK	~1 Mt	1219 (4000)	Calibration test.
Project Miracle Play (Humid Water)[b]	4/19/70	34 km (21 mi) SW of Hattiesburg, MI	Non-nuclear explosion	823 (2700)	Detonated in Salmon/ Sterling cavity. Seismic studies.
Operation Cannikin[c]	11/6/71	Amchitka Island, AK	<5 Mt	1829 (6000)	Test of warhead for Spartan missle

Table 1. (continued) Underground Testing Conducted Off the Nevada Test Site

Name of Test, Operation or Project	Date	Location	Yield[d]	Depth m (ft)	Purpose of the Event[d,e]
Project Rio Blanco[a]	5/17/73	48 km (30 mi) SW of Meeker, CO	3x30 kt	1700 to 2000 (5840 to 6690)	Gas stimulation experim

[a] Plowshare events

[b] Vela Uniform Events

[c] Weapons tests

[d] Information from "Revised Nuclear Test Statistics," distributed on January 15, 1973, by Henry G. Vermillion, Director, Office of Information Services, U.S. Atomic Energy Commission, Las Vegas, Nevada.

[e] News release AL-62-50, AEC Albuquerque Operations Office, Albuquerque, New Mexico. December 1, 1961.

[f] "The Effects of Nuclear Weapons" Rev. Ed. 1964.

Table 2. Summary of Analytical Procedures

Type of Analysis	Analytical Equipment	Counting Period (Min)	Analytical Procedures	Sample Size (Litre)	Detection Limit
Gamma Spectroscopy	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.	40-100 for milk and water samples; 10-90 for air filters; 100 for Long-Term Hydrological Samples and Filters	Radionuclide concentrations quantitated from gamma spectrometer data by computer using the matrix technique.	0.4-3.5 for milk and water samples; 350m^3 of air for filter samples.	For milk and wat generally 1x10^{-8} µCi/ml for most common fallout r nuclides in a si spectrum. For a filters, 1x10^{-13} µCi/ml.
^{89}Sr-^{90}Sr	Low-background thin-window, gas-flow proportional counter with a 5.7-cm diameter window (80 µg/cm).	50	Chemical separation by ion exchange. Separated sample counted successively; activity calculated by simultaneous equations.	1.0	$^{89}Sr \simeq 2x10^{-9}$ µC $^{90}Sr \simeq 1x10^{-9}$ µC
^{3}H	Automatic liquid scintillation counter with output printer.	100	Sample prepared by distillation.	0.005	$\simeq 2.2x10^{-7}$ µCi/ml
^{3}H Enrichment (Long-term Hydrological Samples)	Automatic liquid scintillation counter with output printer.	100	Sample concentrated by electrolyses followed by distillation.	0.25	$\simeq 6.0x10^{-9}$ µCi/ml
$^{238,239}Pu$ $^{234,235,238}U$	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	$^{238}Pu = 4x10^{-11}$ µCi/ml[a] ^{239}Pu, ^{234}U, ^{235} $^{238}U = 2x10^{-11}$ µCi/ml[a]

Table 2. (continued) Summary of Analytical Procedures

Type of Analysis	Analytical Equipment	Counting Period (Min)	Analytical Procedures	Sample Size (Litre)	Detection Limit
^{226}Ra	Single channel analyzer coupled to P.M. tube detector.	30	Precipitated with Ba, converted to chloride. Stored for 30 days for ^{222}Ra ^{226}Ra to equilibrate. Radon gas pumped into scintillation cell for alpha scintillation counting.	1.5	$1x10^{-13}$ µCi/ml
Gross alpha Gross beta in liquid samples	Low-background thin-window, gas-flow proportional counter with a 5.7-cm diameter window (80 µg/cm^2)	50	Sample evaporated; residue counted.	0.2	$\alpha \simeq 3x10^{-9}$ µCi/ml[a] $\beta \simeq 2x10^{-9}$ µCi/ml[a]
Gross beta on air filters	Low-level end window, gas flow proportional counter with a 12.7-cm diameter window (100 mg/cm^2)	5	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 ≈350 m^3.	0.06×10^{-12} µCi/ml[1]

Table 2. (continued) Summary of Analytical Procedures

Type of Analysis	Analytical Equipment	Counting Period (Min)	Analytical Procedures	Sample Size (Litre)	Detection Limit
^{85}Kr Xe CH_3T	Automatic liquid scintillation counter with output printer.	50	Physical separation by gas chromatography; dissolved in toluene "cocktail" for counting.	400-1000	$^{85}Kr = 5x10^{-12}$ µCi/ml[a] $Xe = 2x10^{-12}$ µCi/ml[a] $CH_3T = 5x10^{-12}$ µCi/ml[a]

[a]The detection limit for a given sample is defined as that radioactivity which equals the 2-sigma counting error.

[b]Detection limit is defined as that concentration which produces a ±25% counting deviation at the 95% confidence level.

Table 3 1973 Summary of Analytical Results for the Noble Gas and Tritium Surveillance Network

Sampling Location	No. Days Sampled	Type of Radio-activity	Units	Radioactivity Concentrations C_{Max}	C_{Min}	C_{Avg}
Death Valley Jct, CA	316.3	^{85}Kr	10^{-12} µCi/ml air	19	12	15
	342.3	^{133}Xe	10^{-12} µCi/ml air	12	< 2.0	< 2.2
	328.3	CH_3T	10^{-12} µCi/ml air	< 5.0	< 5.0	< 5.0
	342.6	HTO	10^{-6} µCi/ml H_2O	0.55	< 0.22	< 0.33
	342.6	HTO	10^{-12} µCi/ml air	3.7	< 0.56	< 1.4
	335.7	HT	10^{-12} µCi/ml air	8.7	0.42	< 2.6
Beatty, NV	342.0	^{85}Kr	10^{-12} µCi/ml air	21	12	16
	356.0	Xe	10^{-12} µCi/ml air	< 2.0	< 2.0	< 2.0
	349.0	CH_3T	10^{-12} µCi/ml air	16	< 5.0	< 5.2
	327.5	HTO	10^{-6} µCi/ml H_2O	0.97	< 0.22	< 0.39
	327.5	HTO	10^{-12} µCi/ml air	5.2	< 0.49	< 2.0
	258.8	HT	10^{-12} µCi/ml air	13	< 0.50	< 3.4
Diablo, NV	343.2	^{85}Kr	10^{-12} µCi/ml air	22	12	16
	357.1	^{133}Xe	10^{-12} µCi/ml air	30	< 2.0	< 3.1
	350.2	CH_3T	10^{-12} µCi/ml air	5.1	< 5.0	< 5.0
	349.5	HTO	10^{-6} µCi/ml H_2O	< 0.77	< 0.22	< 0.39
	356.5	HTO	10^{-12} µCi/ml air	< 6.6	< 0.69	< 2.0
	320.7	HT	10^{-12} µCi/ml air	5.2	< 0.50	< 1.9
Hiko, NV	337.9	^{85}Kr	10^{-12} µCi/ml air	19	12	16
	335.8	^{133}Xe	10^{-12} µCi/ml air	9.2	< 2.0	< 2.1
	349.9	CH_3T	10^{-12} µCi/ml air	7.5	< 5.0	< 5.1
	349.5	HTO	10^{-6} µCi/ml H_2O	0.63	< 0.21	< 0.30
	349.5	HTO	10^{-12} µCi/ml air	6.3	< 0.48	< 1.7
	300.5	HT	10^{-12} µCi/ml air	4.2	< 0.50	< 1.2

Table 3 1973 Summary of Analytical Results
for the Noble Gas and Tritium Surveillance Network

Sampling Location	No. Days Sampled	Type of Radio-activity	Units	Radioactivity Concentrations C_{Max}	C_{Min}	C_{Avg}
Las Vegas, NV NVOO	314.3	^{85}Kr	10^{-12}µCi/ml air	20	12	16
	335.1	^{133}Xe	10^{-12}µCi/ml air	15	< 2.0	< 2.5
	335.1	CH_3T	10^{-12}µCi/ml air	7.0	< 5.0	< 5.0
	354.6	HTO	10^{-6} µCi/ml H_2O	1.5	< 0.22	< 0.35
	354.6	HTO	10^{-12}µCi/ml air	6.8	< 0.31	< 1.5
	288.7	HT	10^{-12}µCi/ml air	4.3	< 0.50	< 1.2
NTS, NV Desert Rock	335.0	^{85}Kr	10^{-12}µCi/ml air	21	13	16
	342.1	^{133}Xe	10^{-12}µCi/ml air	13	< 2.0	< 2.5
	342.0	CH_3T	10^{-12}µCi/ml air	13	< 5.0	< 5.3
	357.7	HTO	10^{-6} µCi/ml H_2O	1.4	< 0.22	< 0.42
	357.7	HTO	10^{-12}µCi/ml air	5.0	< 0.50	< 1.9
	274.8	HT	10^{-12}µCi/ml air	< 2.7	< 0.50	< 1.2
NTS, NV BJY	358.2	^{85}Kr	10^{-12}µCi/ml air	27	13	18
	351.3	^{133}Xe	10^{-12}µCi/ml air	240	< 2.0	<30
	358.2	CH_3T	10^{-12}µCi/ml air	17	< 5.0	< 6.1
	357.6	HTO	10^{-6} µCi/ml H_2O	26	0.35	< 5.7
	357.6	HTO	10^{-12}µCi/ml air	120	0.66	<25
	279.6	HT	10^{-12}µCi/ml air	21	< 0.50	< 4.4
NTS, NV Gate 700	323.1	^{85}Kr	10^{-12}µCi/ml air	20	13	16
	344.2	^{133}Xe	10^{-12}µCi/ml air	16	< 2.0	< 3.3
	337.2	CH_3T	10^{-12}µCi/ml air	8.3	< 5.0	< 5.2
	327.6	HTO	10^{-6} µCi/ml H_2O	1.5	< 0.23	< 0.56
	327.6	HTO	10^{-12}µCi/ml air	7.9	< 0.59	< 2.5
	274.8	HT	10^{-12}µCi/ml air	7.2	0.62	< 2.6

Table 3 1973 Summary of Analytical Results
for the Noble Gas and Tritium Surveillance Network

Sampling Location	No. Days Sampled	Type of Radio-activity	Units	Radioactivity Concentrations C_{Max}	C_{Min}	C_{Avg}
NTS, NV Area 12	315.3	^{85}Kr	10^{-12} µCi/ml air	21	12	16
	316.1	^{133}Xe	10^{-12} µCi/ml air	16	< 2.0	< 2.3
	322.3	CH_3T	10^{-12} µCi/ml air	8.7	< 5.0	< 5.1
	356.7	HTO	10^{-6} µCi/ml H_2O	66	0.35	9.6
	356.7	HTO	10^{-12} µCi/ml air	270	3.5	40
	300.9	HT	10^{-12} µCi/ml air	24	< 0.68	< 5.8
Tonopah, NV	350.8	^{85}Kr	10^{-12} µCi/ml air	21	13	16
	356.9	Xe	10^{-12} µCi/ml air	< 2.0	< 2.0	< 2.0
	349.9	CH_3T	10^{-12} µCi/ml air	18	< 5.0	< 5.5
	357.4	HTO	10^{-6} µCi/ml H_2O	0.75	< 0.23	< 0.34
	357.4	HTO	10^{-12} µCi/ml air	4.7	< 0.78	< 1.6
	336.4	HT	10^{-12} µCi/ml air	4.0	< 0.50	< 2.1

Table 4. 1973 Summary of Background Radiation Doses for the Dosimetry Network

Station Location	Measurement Period	Background Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Background Dose Equivalent (mrem/a)
Adaven, NV	1/17/73 - 1/16/74	0.51	0.36	0.46	170
Alamo, NV	1/8/73 - 1/7/74	0.40	0.12	0.29	110
Ash Meadows, NV[a]	1/9/73 - 8/8/73	0.43	0.27	0.33	120
Baker, CA	1/2/73 - 1/14/74	0.37	0.16	0.25	90
Barstow, CA	1/2/73 - 1/14/74	0.35	0.14	0.27	100
Beatty, NV	1/10/73 - 1/8/74	0.59	0.19	0.37	140
Bishop, CA	1/3/73 - 1/16/74	0.47	0.13	0.31	110
Blue Eagle Ranch, NV	1/10/73 - 1/16/74	0.36	0.16	0.25	90
Blue Jay, NV	1/11/73 - 1/17/74	0.57	0.38	0.44	160
Cactus Springs, NV	1/10/73 - 1/7/74	0.30	<0.10	<0.21	< 80
Caliente, NV	1/10/73 - 1/10/74	0.63	0.17	0.40	150
Casey's Ranch, NV	1/16/73 - 1/8/74	0.44	0.23	0.33	120
Cedar City, UT	1/9/73 - 1/16/74	0.45	0.22	0.32	120
Clark Station, NV	1/10/73 - 1/17/74	0.48	<0.10	<0.38	<140
Coyote Summit, NV	1/10/73 - 1/7/74	0.51	0.28	0.40	140
Currant, NV	1/10/73 - 1/16/74	0.46	0.24	0.32	120
Death Valley Jct., CA	1/4/73 - 1/17/74	0.46	<0.10	<0.31	<110
Desert Game Range, NV	1/11/73 - 1/7/74	0.33	<0.10	<0.22	< 80
Diablo Maint. Sta., NV	1/10/73 - 1/9/74	0.61	0.37	0.47	170
Duckwater, NV	1/10/73 - 1/16/74	0.47	0.25	0.35	130
Elgin, NV	1/10/73 - 1/11/74	0.63	0.28	0.45	160
Ely, NV	1/9/73 - 1/15/74	0.50	0.31	0.38	140
Enterprise, UT	4/10/73 - 1/16/74	0.52	0.22	0.39	140
Furnace Creek, CA	1/4/73 - 1/8/74	0.43	<0.10	<0.26	< 90
Geyser Maint. Sta., NV	1/8/73 - 1/14/74	0.48	0.23	0.37	140
Goldfield, NV	1/15/73 - 1/8/74	0.47	0.25	0.35	130
Groom Lake, NV	1/10/73 - 1/17/74	0.46	0.14	0.30	110
Hancock Summit, NV	1/10/73 - 1/7/74	0.60	0.36	0.49	180
Hiko, NV	1/8/73 - 1/7/74	0.36	<0.10	<0.26	< 90

Table 4. 1973 Summary of Background Radiation Doses for the Dosimetry Network

Station Location	Measurement Period	Background Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Background Dose Equivalent (mrem/a)
Hot Creek Ranch, NV	1/11/73 - 1/17/74	0.36	0.23	0.31	110
Independence, CA	1/3/73 - 1/16/74	0.38	0.14	0.28	100
Indian Springs, NV	1/11/73 - 1/7/74	0.43	<0.10	<0.24	< 90
Kirkeby Ranch, NV	1/12/73 - 1/14/74	0.45	0.26	0.33	120
Koynes, NV	1/10/73 - 1/9/74	0.47	0.26	0.35	130
Las Vegas (McCarren), NV	11/14/72 - 1/14/74	0.39	0.16	0.25	90
Las Vegas (Placak), NV	1/12/73 - 1/14/74	0.35	0.15	0.23	80
Las Vegas (USDI), NV	1/12/73 - 1/14/74	0.49	0.16	0.27	100
Lathrop Wells, NV	1/9/73 - 1/9/74	0.46	0.28	0.36	130
Lone Pine, CA	1/3/73 - 1/16/74	0.39	0.18	0.29	110
Lida, NV	1/15/73 - 1/7/74	0.46	0.25	0.33	120
Lund, NV	1/11/73 - 1/16/74	0.38	0.23	0.30	110
Manhattan, NV	1/16/73 - 1/10/74	0.46	0.23	0.36	130
Mesquite, NV	1/8/73 - 1/15/74	0.42	0.16	0.29	110
Nevada Farms, NV	1/10/73 - 1/7/74	0.50	0.30	0.40	150
Nuclear Eng. Co., NV	1/10/73 - 1/9/74	0.71	0.18	0.43	160
Nyala, NV	1/16/73 - 1/8/74	0.36	0.24	0.32	120
Olancha, CA	1/3/73 - 1/15/74	0.36	0.23	0.29	110
Pahrump, NV	1/8/73 - 1/10/74	0.35	0.12	0.24	90
Pine Creek Ranch, NV	1/17/73 - 1/16/74	0.44	0.36	0.40	150
Pioche, NV	1/9/73 - 1/10/74	0.41	0.21	0.34	120
Queen City Summit, NV	1/10/73 - 1/7/74	0.62	0.34	0.46	170
Reed Ranch, NV	1/10/73 - 1/7/74	0.44	0.30	0.37	140
Ridgecrest, CA	1/3/73 - 1/15/74	0.33	0.10	0.24	90
Round Mountain, NV	1/16/73 - 1/9/74	0.42	0.27	0.37	140
St. George, UT	1/8/73 - 1/17/74	0.45	0.19	0.29	110
Scotty's Jct., NV	1/15/73 - 1/7/74	0.46	0.23	0.36	130
Selbach Ranch, NV	1/9/73 - 1/9/74	0.48	0.21	0.36	130

Table 4. 1973 Summary of Background Radiation Doses for the Dosimetry Network

Station Location	Measurement Period	Background Dose Equivalent Rate (mrem/d) Max.	Min.	Avg.	Annual Adjusted Background Dose Equivalent (mrem/a)
Sherri's Bar, NV	1/8/73 - 1/7/74	0.39	0.10	0.26	90
Shoshone, CA	1/2/73 - 1/17/74	0.49	0.26	0.36	130
Springdale, NV	1/10/73 - 1/10/74	0.54	0.33	0.41	150
Spring Meadows, NV	1/9/73 - 1/10/74	0.40	<0.10	<0.27	<100
Sunnyside, NV	1/11/73 - 1/16/74	0.45	0.29	0.37	140
Tempiute, NV	1/10/73 - 1/9/74	0.50	0.18	0.35	130
Tenneco, NV	8/8/73 - 1/10/74	0.42	0.31	0.35	130
Tonopah (Airport), NV	1/17/73 - 1/8/74	0.55	0.34	0.40	150
Tonopah Test Range, NV	1/17/73 - 1/8/74	0.49	0.29	0.36	130
Twin Springs Ranch, NV	1/11/73 - 1/10/74	0.51	0.27	0.41	150
Valley View Ranch, NV[b]	1/8/73 - 1/15/74	0.41	0.18	0.27	100
Warm Springs, NV	1/11/73 - 1/17/74	0.57	0.31	0.43	160
Young's Ranch, NV	1/16/73 - 1/9/74	0.35	0.24	0.30	110

[a] Station deleted in August 1973

[b] Same location as Warm Springs Ranch reported in 1972 report.

Table 5 Anomalous TLD Readings in 1973

Personnel TLD's

Personnel Location	Measurement Period Issue Date	Collection Date	TLD Readings (mrem)
Indian Springs, NV	8/6/73	9/11/73	2,400
Desert Game Range, NV	3/9/73	4/9/73	16
	9/10/73	10/23/73	14,000
	10/23/73	1/18/74	240

Station TLD's

Desert Game Range, NV	9/11/73	10/15/73	-0.3[a]	-1.2[a]	-0.5[a]
St. George, UT	2/27/73	4/11/73	9.7	19	41[a]
Casey's Ranch, NV	6/12/73	7/11/73	9.0	9.1	86[a]
Groom Lake, NV	9/4/73	10/1/73	4.6	6.0	0.5[a]
Tempiute, NV	4/30/73	6/12/73	22	11	170[a]
Death Valley Jct, CA	9/14/73	10/25/73	5.9	7.7	-5.6[a]
Furnace Creek, CA	9/14/73	10/25/73	2.9	-6.1[a]	3.0
	2/28/73	4/12/73	17	8.8	59[a]
Independence, CA	9/18/73	10/24/73	8.6	2.5[a]	9.4

[a]Anomalous values

Note: Values with a minus sign indicate that the total exposure on the TLD was less than that which would be expected from a combination of the internal TLD background and transit time.

Table 6 1973 Summary of Analytical Results for the Milk Surveillance Network

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml C_{Max}	C_{Min}	C_{Avg}
Bishop, CA Sierra Farms	11	10	^{137}Cs	10	<10	<10
		4	^{89}Sr	< 3.0	< 2.0	< 2.3
		4	^{90}Sr	2.9	< 1.2	< 1.9
Hinkley, CA Bill Nelson Dairy	12	10	^{137}Cs	<100	<10	<19
		4	^{89}Sr	< 2.0	< 1.9	< 2.0
		4	^{90}Sr	7.5	< 1.0	< 2.8
Olancha, CA Hunter Ranch	13	6	^{137}Cs	<100	<10	<40
		3	^{89}Sr	< 2.0	< 1.8	< 1.9
		3	^{90}Sr	< 5.5	< 1.0	< 2.7
Alamo, NV Williams Dairy	12	10	^{137}Cs	< 10	<10	<10
		4	^{89}Sr	< 2.0	< 2.0	< 2.0
		4	^{90}Sr	< 1.5	< 1.1	< 1.3
Austin, NV Young's Ranch	13	9	^{137}Cs	< 10	<10	<10
		4	^{89}Sr	< 2.0	< 2.0	< 2.0
		4	^{90}Sr	3.9	2.0	2.7
		9	^{3}H	1000	470	670

Table 6 1973 Summary of Analytical Results for the Milk Surveillance Network

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml C_{Max}	C_{Min}	C_{Avg}
Currant, NV Blue Eagle Ranch	13	8	^{137}Cs	<100	<10	<34
		3	^{89}Sr	< 3.0	< 2.0	< 2.3
		3	^{90}Sr	2.8	2.3	2.5
Currant, NV Manzonie Ranch	13	10	^{137}Cs	<100	<10	<19
		4	^{89}Sr	< 3.0	< 2.0	< 2.3
		4	^{90}Sr	2.1	< 1.3	< 1.6
Hiko, NV Schofield Dairy	12	10	^{137}Cs	<100	<10	<19
		4	^{89}Sr	< 2.0	< 2.0	< 2.0
		4	^{90}Sr	< 1.3	< 1.1	< 1.2
		10	^{3}H	420	<230	<280
Indian Springs, NV Indian Springs Ranch	13	3	^{137}Cs	< 10	<10	<10
		2	^{89}Sr	< 2.0	< 1.0	< 1.5
		2	^{90}Sr	< 1.0	< 1.0	< 1.0
Las Vegas, NV LDS Dairy Farms	12	10	^{137}Cs	< 10	<10	<10
		4	^{89}Sr	< 2.0	< 1.0	< 1.3
		4	^{90}Sr	1.1	< 0.90	< 1.0
		10	^{3}H	360	<230	<260

Table 6 1973 Summary of Analytical Results for the Milk Surveillance Network

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml C_{Max}	C_{Min}	C_{Avg}
Lathrop Wells, NV William J. Kirker	13	10	^{137}Cs	< 10	<10	<10
		4	^{89}Sr	< 2.0	< 1.0	< 1.8
		4	^{90}Sr	1.8	< 1.1	< 1.4
Lida, NV Lida Livestock Company	13	7	^{137}Cs	<100	<10	<23
		3	^{89}Sr	< 2.0	< 2.0	< 2.0
		3	^{90}Sr	< 1.2	< 1.0	< 1.1
Logandale, NV Vegas Valley Dairy	12	10	^{137}Cs	< 10	<10	<10
		4	^{89}Sr	< 2.0	< 1.0	< 1.8
		4	^{90}Sr	2.5	< 1.0	< 1.5
Lund, NV McKenzie Dairy	12	10	^{137}Cs	10	<10	<10
		4	^{89}Sr	< 3.0	< 2.0	< 2.3
		4	^{90}Sr	6.1	1.7	2.9
		10	^{3}H	<380	<230	<270
Mesquite, NV Hughes Bros. Dairy	12	10	^{137}Cs	13	<10	<11
		4	^{89}Sr	< 2.0	< 2.0	< 2.0
		4	^{90}Sr	1.9	< 1.1	< 1.5
		10	^{3}H	420	<230	<300

Table 6 1973 Summary of Analytical Results for the Milk Surveillance Network

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$ C_{Max}	C_{Min}	C_{Avg}
Moapa, NV Searles Dairy	12	10	^{137}Cs	< 10	<10	<10
		4	^{89}Sr	< 2.0	< 2.0	< 2.0
		4	^{90}Sr	2.4	1.3	2.0
Nyala, NV Sharp's Ranch	13	10	^{137}Cs	<100	<10	<91
		4	^{89}Sr	< 2.0	< 1.0	< 1.8
		4	^{90}Sr	5.0	< 0.90	< 2.3
		10	^{3}H	530	<220	<300
Pahrump, NV Owens Ranch	13	10	^{137}Cs	<100	< 10	< 19
		4	^{89}Sr	< 2.0	< 1.0	< 1.5
		4	^{90}Sr	1.7	< 0.90	< 1.2
Panaca, NV Kenneth Lee Ranch	13	7	^{137}Cs	<100	< 10	< 23
		2	^{89}Sr	< 2.0	< 2.0	< 2.0
		2	^{90}Sr	2.5	< 1.1	< 1.8
Round Mt., NV Russell Berg Ranch	13	2	^{137}Cs	< 10	< 10	< 10

Table 6 1973 Summary of Analytical Results for the Milk Surveillance Network

Sampling Location	Sample Type[a]	No. of Samples	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$ C_{Max}	C_{Min}	C_{Avg}
Round Mt., NV Karl Berg Ranch	13	7	^{137}Cs	< 10	< 10	< 10
		3	^{89}Sr	< 3.0	< 2.0	< 2.3
		3	^{90}Sr	3.8	2.6	3.2
Shoshone, NV Kirkeby Ranch	13	7	^{137}Cs	< 10	< 10	< 10
		3	^{89}Sr	< 3.0	< 2.0	< 2.3
		3	^{90}Sr	2.6	< 1.3	< 2.07
Springdale, NV Seidentopf Ranch	13	10	^{137}Cs	< 10	< 10	< 10
		4	^{89}Sr	< 2.0	< 1.0	< 1.8
		4	^{90}Sr	1.4	< 1.1	< 1.3
Cedar City, UT Western Gold Dairy	12	10	^{137}Cs	< 10	< 10	< 10
		4	^{89}Sr	< 2.0	< 2.0	< 2.0
		4	^{90}Sr	5.1	< 1.4	< 2.6
St. George, UT R. Cox Dairy	12	10	^{137}Cs	< 10	< 10	< 10
		4	^{89}Sr	< 2.0	< 1.0	< 1.8
		4	^{90}Sr	< 1.5	< 0.90	< 1.2

[a] 11 = Pasteurized Milk
12 = Raw Milk from Grade A Producer(s)
13 = Raw Milk from family cow(s)

Table 7 1973 Summary of Analytical Results for the Water Surveillance Network - Surface Water Samples

Sampling Location	Sample Type[a]	Collection Date	Type of Radioactivity	Concentration (10^{-9} µCi/ml)	% of Conc. Guide
Furnace Creek, CA Pond	21	03/01/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 1.0	< 1.0
			^{226}Ra	0.16	1.6
			^{238}Pu	< 0.021	< 0.010
			^{239}Pu	< 0.017	< 0.010
			^{234}U	2.6	0.026
			^{235}U	0.024	< 0.010
			^{238}U	1.2	< 0.010
Olancha, CA Haiwee Reservoir	21	03/01/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 1.0	< 1.0
			^{226}Ra	0.19	1.9
			^{238}Pu	< 0.028	< 0.010
			^{239}Pu	< 0.012	< 0.010
			^{234}U	4.4	0.044
			^{235}U	0.097	< 0.010
			^{238}U	3.7	0.028
Alamo, NV Pahranagat Lake	21	03/01/73	^{89}Sr	< 1.0	< 0.10
			^{90}Sr	< 0.90	< 0.90
			^{226}Ra	0.92	9.2
			^{238}Pu	< 0.031	< 0.010
			^{239}Pu	< 0.046	< 0.010
			^{234}U	14	0.14
			^{235}U	0.19	< 0.010
			^{238}U	5.2	0.040

Table 7 1973 Summary of Analytical Results for the Water Surveillance Network

Surface Water Samples

Sampling Location	Sample Type[a]	Collection Date	Type of Radioactivity	Concentration (10^{-9} µCi/ml)	% of Conc. Guide
Ash Meadows, NV Ash Meadows Pond	21	04/10/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 1.0	< 1.0
			^{226}Ra	0.71	7.1
			^{238}Pu	< 0.039	< 0.010
			^{239}Pu	< 0.016	< 0.010
			^{234}U	25	0.25
			^{235}U	0.30	< 0.010
			^{238}U	8.8	0.068
Diablo, NV Reed Ranch	21	04/09/73	^{89}Sr	< 3.0	< 0.25
			^{90}Sr	4.6	< 3.0
			^{226}Ra	0.20	2.0
			^{238}Pu	< 0.036	< 0.010
			^{239}Pu	< 0.021	< 0.010
			^{234}U	19	0.19
			^{235}U	0.092	< 0.010
			^{238}U	2.4	0.018
Ely, NV Comins Lake	21	04/16/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 0.70	< 0.70
			^{226}Ra	0.14	1.4
			^{238}Pu	< 0.61	< 0.036
			^{239}Pu	< 0.74	< 0.044
			^{234}U	12	0.12
			^{235}U	0.24	< 0.010
			^{238}U	4.3	0.033

Table 7 1973 Summary of Analytical Results for the Water Surveillance Network - Surface Water Samples

Sampling Location	Sample Type[a]	Collection Date	Type of Radioactivity	Concentration (10^{-9} µCi/ml)	% of Conc. Guide
Hiko, NV Crystal Springs	27	03/01/73	^{89}Sr	< 1.0	< 0.10
			^{90}Sr	< 0.80	< 0.80
			^{226}Ra	0.64	6.4
			^{238}Pu	< 0.018	< 0.010
			^{239}Pu	< 0.016	< 0.010
			^{234}U	5.7	0.057
			^{235}U	0.043	< 0.010
			^{238}U	1.9	0.015
Las Vegas, NV Lake Mead Vegas Wash	21	02/12/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	3.1	3.1
			^{226}Ra	0.28	2.8
			^{238}Pu	< 0.018	< 0.010
			^{239}Pu	< 0.020	< 0.010
			^{234}U	7.1	0.071
			^{235}U	0.17	< 0.010
			^{238}U	4.5	0.035
Las Vegas, NV Tule Springs Pond	21	02/09/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 1.1	< 1.1
			^{226}Ra	0.34	3.4
			^{238}Pu	< 0.02	< 0.010
			^{239}Pu	0.063	< 0.010
			^{234}U	7.1	0.071
			^{235}U	0.080	< 0.010
			^{238}U	2.2	0.017

Table 7 1973 Summary of Analytical Results for the Water Surveillance Network

Surface Water Samples

Sampling Location	Sample Type[a]	Collection Date	Type of Radioactivity	Concentration (10^{-9} µCi/ml)	% of Conc. Guide
Lida, NV Pond at Storage Tank	21	02/05/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 1.0	< 1.0
			^{226}Ra	0.28	2.8
			^{238}Pu	< 0.024	< 0.010
			^{239}Pu	0.028	< 0.010
			^{234}U	6.1	0.061
			^{235}U	0.092	< 0.010
			^{238}U	1.6	0.012
Springdale, NV Pond	21	04/10/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 1.0	< 1.0
			^{226}Ra	0.22	2.2
			^{238}Pu	< 0.016	< 0.010
			^{239}Pu	< 0.018	< 0.010
			^{234}U	4.3	0.043
			^{235}U	0.027	< 0.010
			^{238}U	0.95	< 0.010
Sunnyside, NV Adam McGill Reservoir	21	04/17/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 0.70	< 0.70
			^{226}Ra	1.6	16
			^{238}Pu	< 0.026	< 0.010
			^{239}Pu	0.033	< 0.010
			^{234}U	3.5	0.035
			^{235}U	0.040	< 0.010
			^{238}U	1.1	< 0.010

Table 7 1973 Summary of Analytical Results for the Water Surveillance Network - Surface Water Samples

Sampling Location	Sample Type[a]	Collection Date	Type of Radioactivity	Concentration (10^{-9} µCi/ml)	% of Conc. Guide
Warm Springs, NV Fallini's Pond	21	04/11/73	^{89}Sr	< 2.0	< 0.20
			^{90}Sr	< 1.1	< 1.0
			^{226}Ra	0.29	2.9
			^{238}Pu	< 0.031	< 0.010
			^{239}Pu	0.047	< 0.010
			^{234}U	24	0.24
			^{235}U	0.33	< 0.010
			^{238}U	9.4	0.072

[a] 21 = Pond, Lake, Reservoir, Stock Tank, Stock Pond
27 = Spring

Table 8 1973 Summary of Tritium Results for the Water Surveillance Network

Sampling Location	Sample Type[a]	No. of Samples	^3H Concentration 10^{-9} µCi/ml C_{Max}	C_{Min}	C_{Avg}	% of Conc. Guide
Death Valley Jct, CA Lila's Cafe	23	9	480	<230	<300	<0.030
Ash Meadows, NV Ash Meadows Lodge	23	4	<250	<240	<250	<0.025
Blue Diamond, NV Post Office	23	10	<380	<240	<260	<0.026
Cactus Springs, NV Mobil Ser. Sta.	27	10	290	<230	<250	<0.025
Las Vegas, NV Lab II, NERC	24	10	1100	700	860	0.086
Las Vegas, NV Lake Mead Vegas Wash	21	10	1300	640	890	0.089
Las Vegas, NV Tule Springs	23	10	<270	<230	<250	<0.025
Las Vegas, NV Craig Rch. Golf Course	23	10	<260	<230	<250	<0.025
Las Vegas, NV Municipal Golf Course	23	10	<260	<230	<250	<0.025
Las Vegas, NV Vegas Estates	23	10	260	<230	<250	<0.025
Las Vegas, NV L.V. Water Dist. Well 28	23	10	<260	<230	<250	<0.025
Las Vegas, NV Desert Game Range	23	10	460	<230	<270	<0.027
Mt. Charleston, NV Kyle Cnyn. Fire Sta.	27	10	350	<230	<260	<0.026
Scotty's Jct, NV Chevron Ser. Sta.	23	10	390	<220	<280	<0.028

[a] 21 = Pond, Lake, Reservoir, Stock Tank, Stock Pond
23 = Well
24 = Multiple Supply - Mixed (A water sample consisting of mixed or multiple sources of water, such as well and spring.)
27 = Spring

Table 9 Plutonium-239 in Air Samples - Near the NTS

Location	Date	Downwind ^{239}Pu Concentration ($10^{-15}\mu Ci/ml$)	Date	Upwind ^{239}Pu Concentration ($10^{-15}\mu Ci/ml$)	F Ratio[a] Downwind vs Upwind
Furnace Creek, CA	2/20/71	<0.05	4/20/71	0.20	No difference
	10/30/72	<0.04	12/7/72	0.051	
Death Valley Jct. CA	2/20/71	0.20	5/2/71	0.20	No difference
	3/31/71	0.12	5/3/71	0.20	
	10/24/72	0.10	10/2/72	<0.065	
	10/28/72	<0.07	12/6/72	<0.048	
	12/13/72	<0.03	12/7/72	0.055	
Beatty, NV	2/3/71	0.09	6/28/70	0.40	Significant difference
	2/25/71	0.08	4/20/71	0.17	
	3/1/71	<0.06	5/2/71	0.20	
	3/17/71	0.19	5/20/71	0.12	
	10/28/71	<0.08	10/16/71	0.20	
	4/25/72	0.088	4/16/72	0.075	
Diablo, NV	4/20/71	0.20	2/20/71	<0.06	No difference
	5/4/71	0.20	3/1/71	<0.07	
	5/26/71	0.40	3/31/71	0.30	
Hiko, NV	3/26/71	0.20	9/25/70	<0.07	Significant difference
	4/25/71	0.20	2/20/71	<0.07	
	6/26/71	0.20	3/18/71	0.09	
	9/25/71	<0.70	10/28/71	<0.06	
Indian Springs, NV	3/13/71	0.10	4/20/71	0.15	Probable difference
	4/25/72	0.087	4/16/72	0.19	
Lathrop Wells, NV	3/18/70	<0.06	4/20/71	0.20	No difference
	9/25/70	0.17	6/26/71	0.30	
	3/18/71	0.20	9/25/71	0.20	
	10/24/72	0.04	10/2/72	0.042	
Pahrump, NV	5/17/71	0.30	4/20/71	<0.10	No difference
	10/30/72	<0.12	10/2/72	<0.044	
Scotty's Jct., NV	2/19/70	0.15	4/20/71	0.17	No difference
	3/31/71	0.20	5/3/71	0.20	
			5/27/71	0.20	
	10/24/72	0.068	12/4/72	<0.036	
	10/29/72	0.15	12/6/72	0.056	
	12/13/72	<0.059	12/7/72	<0.042	

Table 9 Plutonium-239 in Air Samples - Near the NTS

Location	Date	Downwind ^{239}Pu Concentration ($10^{-15}\mu Ci/ml$)	Date	Upwind ^{239}Pu Concentration ($10^{-15}\mu Ci/ml$)	F Ratio[a] Downwind vs Upwind
Warm Springs, NV	3/12/71	0.14	2/19/70	<0.09	No difference
	3/26/71	<0.08	3/18/70	0.23	
	4/25/71	0.13	3/31/70	0.10	
			2/3/71	<0.60	
			2/20/71	<0.60	
			3/17/71	0.20	
			3/31/71	0.12	

[a]Computation made on natural logarithm of the Pu-239 concentration.

Table 10 1973 Summary of Analytical Results for the NTS Monthly Long-Term Hydrological Monitoring Program

Sampling Location	No. Samples Collected	No. Samples Analyzed[a]	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml C_{max}	C_{min}	C_{avg}	% of Conc. Guide[b]
NTS Well 20A-2	4	1	^{3}H	<7.7	<7.7	<7.7	<0.01
		2	^{89}Sr	<1.0	<1.0	<1.0	<0.01
		2	^{90}Sr	<1.1	<1.0	<1.1	<0.01
		2	^{238}Pu	<0.034	<0.030	<0.032	<0.01
		2	^{239}Pu	<0.028	<0.014	<0.021	<0.01
		2	^{234}U	3.1	2.9	3.0	<0.01
		2	^{235}U	0.040	0.036	0.038	<0.01
		2	^{238}U	0.70	0.70	0.70	<0.01
		3	^{226}Ra	0.33	<0.13	<0.20	<0.05
NTS Well 8	12	5	^{3}H	<9.3	<5.1	<7.1	<0.01
		4	^{89}Sr	<2.0	<1.0	<1.5	<0.01
		4	^{90}Sr	<1.1	<0.90	<1.0	<0.01
		4	^{238}Pu	<0.061	<0.021	<0.014	<0.01
		4	^{239}Pu	<0.020	<0.010	<0.016	<0.01
		4	^{234}U	0.47	0.01	0.34	<0.01
		4	^{235}U	<0.010	<0.004	<0.007	<0.01
		4	^{238}U	0.20	0.090	0.013	<0.01
		1	^{226}Ra	0.16	0.16	0.16	0.04
NTS Well J-12	9	4	^{3}H	<8.9	<6.4	<7.3	<0.01
		3	^{89}Sr	<2.0	<1.0	<1.3	<0.01
		3	^{90}Sr	<1.1	<0.9	<1.0	<0.01
		3	^{238}Pu	<0.04	<0.02	<0.027	<0.01
		3	^{239}Pu	<0.021	<0.010	<0.017	<0.01
		3	^{234}U	0.99	0.94	0.96	<0.01
		2	^{235}U	0.016	0.013	0.015	<0.01
		3	^{238}U	0.22	0.10	0.16	<0.01

Table 10 1973 Summary of Analytical Results for the NTS Monthly Long-Term Hydrological Monitoring Program

Sampling Location	No. Samples Collected	No. Samples Analyzed[a]	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml C_{max}	C_{min}	C_{avg}	% of Conc. Guide[1]
NTS Well U3CN-5	7	5	^{3}H	<8.2	<6.7	<7.2	<0.01
		3	^{89}Sr	<2.0	<2.0	<2.0	<0.01
		3	^{90}Sr	<1.2	<1.0	<1.1	<0.01
		2	^{238}Pu	<0.030	<0.020	<0.025	<0.01
		2	^{239}Pu	<0.020	<0.020	<0.020	<0.01
		2	^{234}U	4.6	2.8	3.7	<0.01
		2	^{235}U	0.042	0.015	0.029	<0.01
		2	^{238}U	1.3	0.73	1.0	<0.01
		5	^{226}Ra	2.6	0.87	2.0	0.5
NTS Well A	12	5	^{3}H	<10.5	<5.7	<7.4	<0.01
		5	^{89}Sr	<2.0	<1.0	<1.6	<0.01
		5	^{90}Sr	<1.20	<1.00	<1.1	<0.01
		4	^{238}Pu	<0.040	<0.020	<0.031	<0.01
		4	^{239}Pu	<0.040	<0.020	<0.029	<0.01
		4	^{234}U	5.7	4.8	5.2	<0.01
		4	^{235}U	0.081	0.033	0.054	<0.01
		4	^{238}U	1.7	1.4	1.5	<0.01
		8	^{226}Ra	2.4	0.01	0.46	0.12
NTS Well C	12	5	^{3}H	115.2	80.0	97.3	<0.01
		7	^{89}Sr	<5.0	<1.0	<1.7	<0.01
		7	^{90}Sr	<5.0	<0.90	<1.6	<0.03
		4	^{238}Pu	<0.048	<0.020	<0.036	<0.01
		4	^{239}Pu	<0.020	<0.010	<0.018	<0.01
		4	^{234}U	8.6	4.2	7.2	<0.01
		4	^{235}U	0.10	0.050	0.08	<0.01
		4	^{238}U	2.3	1.1	1.9	<0.01
		9	^{226}Ra	1.8	0.20	1.3	0.5

Table 10 1973 Summary of Analytical Results for the NTS Monthly Long-Term Hydrological Monitoring Program

Sampling Location	No. Samples Collected	No. Samples Analyzed[a]	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml C_{max}	C_{min}	C_{avg}	% of Conc. Guide[b]
NTS Well 5C	12	5	^{3}H	<12.80	<6.7	<8.3	<0.01
		4	^{89}Sr	<2.0	<1.0	<1.8	<0.01
		4	^{90}Sr	<1.1	<0.90	<0.98	<0.01
		4	^{238}Pu	<0.049	<0.020	<0.032	<0.01
		4	^{239}Pu	<0.062	<0.020	<0.029	<0.01
		4	^{234}U	4.7	3.5	4.2	<0.01
		4	^{235}U	0.10	0.080	0.095	<0.01
		4	^{238}U	2.4	1.5	2.0	<0.01
		4	^{226}Ra	0.52	0.30	0.38	0.10
NTS Army Well No. 1	12	6	^{3}H	<8.2	<3.8	<6.9	<0.01
		4	^{89}Sr	<2.0	<1.0	<1.5	<0.01
		4	^{90}Sr	<1.1	<0.9	<1.0	<0.01
		4	^{238}Pu	<0.047	<0.020	<0.032	<0.01
		4	^{239}Pu	<0.020	<0.010	<0.016	<0.01
		4	^{234}U	2.5	0.81	1.9	<0.01
		4	^{235}U	0.031	0.014	0.025	<0.01
		4	^{238}U	0.88	0.64	0.77	<0.01
		6	^{226}Ra	0.97	0.37	0.72	0.18
Beatty, NV Well 11S/48-1dd	9	3	^{3}H	<8.9	<7.0	<8.0	<0.01
		4	^{89}Sr	<2.0	<1.0	<1.3	<0.04
		4	^{90}Sr	<1.1	<1.0	<1.1	<0.4
		4	^{238}Pu	<0.044	<0.030	<0.037	<0.01
		4	^{239}Pu	<0.024	<0.010	<0.017	<0.01
		4	^{234}U	7.9	0.81	5.2	<0.01
		4	^{235}U	0.076	0.035	0.054	<0.01
		4	^{238}U	1.7	1.1	1.4	<0.01
		7	^{226}Ra	1.4	0.17	0.46	0.15

[a] = Some samples are still to be analyzed for particular nuclides, especially ^{3}H.

[b] = All on-NTS percentages are for radiation workers. All off-NTS percentages are for an individual in an uncontrolled area.

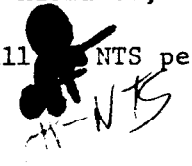

Table 11 1973 Summary of Analytical Results for
NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. 10^{-9}µCi/ml	% of Conc. Guide[b]
Well UE 19G-S NTS	7/3	23	^{3}H	<7.7	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.2	<0.012
			^{238}Pu	<0.040	<0.01
			^{239}Pu	<0.022	<0.01
			^{234}U	8.0	<0.01
			^{235}U	0.060	<0.01
			^{238}U	1.6	<0.01
			^{226}Ra	0.72	0.18
Well UE 15d NTS	1/18	23	^{3}H	<7.7	<0.01
			^{89}Sr	<1.0	<0.01
			^{90}Sr	<1.0	<0.01
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	4.4	<0.01
			^{235}U	<0.02	<0.01
			^{238}U	1.3	<0.01
			^{226}Ra	1.1	0.28
Well UE 15d NTS	7/5	23	^{3}H	<6.7	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.1	<0.01
			^{238}Pu	<0.030	<0.01
			^{239}Pu	<0.012	<0.01
			^{234}U	4.7	<0.01
			^{235}U	0.051	<0.01
			^{238}U	1.2	<0.01
			^{226}Ra	2.0	0.50
Well 2 NTS	1/23	23	^{3}H	<6.1	<0.01
			^{89}Sr	<1.0	<0.01
			^{90}Sr	<0.90	<0.01
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	1.5	<0.01
			^{235}U	<0.020	<0.01
			^{238}U	0.42	0.2

Table 11 1973 Summary of Analytical Results for
NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide[b]
Well 2 NTS	7/5	23	^{3}H	<8.2	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.2	<0.01
			^{238}Pu	<0.045	<0.01
			^{239}Pu	<0.047	<0.01
			^{234}U	1.8	<0.01
			^{235}U	0.013	0.01
			^{238}U	0.40	0.01
Well C-1 NTS	1/19	23	^{3}H	96.0	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.0	<0.01
			^{238}Pu	<0.030	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	8.1	<0.01
			^{235}U	0.048	<0.01
			^{238}U	2.4	<0.01
			^{226}Ra	2.0	0.50
Well C-1 NTS	7/2	23	^{3}H	102.0	<0.01
			^{89}Sr	<1.0	<0.01
			^{90}Sr	<1.1	<0.01
			^{238}Pu	<0.047	<0.01
			^{239}Pu	<0.026	<0.01
			^{234}U	5.6	<0.01
			^{235}U	0.055	<0.01
			^{238}U	1.5	<0.01
			^{226}Ra	0.79	0.20
Well UE 5c NTS	1/18	23	^{3}H	<8.9	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.0	<0.01
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	3.1	<0.01
			^{235}U	0.059	<0.01
			^{238}U	1.7	<0.01
Well UE 5c NTS	7/2	23	^{3}H	8.9	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	1.5	0.02
			^{238}Pu	<0.051	<0.01
			^{239}Pu	<0.013	<0.01

Table 11 1973 Summary of Analytical Results for
NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml	% of Conc. Guide[b]
Well UE 5 c (continued) NTS			^{234}U	1.6	<0.01
			^{235}U	0.075	<0.01
			^{238}U	1.5	<0.01
Well 5B NTS	1/17	23	^{3}H	<6.4	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.0	<0.01
			^{238}Pu	<0.022	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	2.7	<0.01
			^{235}U	0.044	<0.01
			^{238}U	2.1	<0.01
			^{226}Ra	0.81	0.20
Well 5B NTS	7/2	23	^{3}H	<8.0	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.5	<0.02
			^{238}Pu	<0.031	<0.01
			^{239}Pu	<0.028	<0.01
			^{234}U	1.9	<0.01
			^{235}U	0.046	<0.01
			^{238}U	1.8	<0.01
Watertown No. 3 NTS	1/18	23	^{3}H	<8.9	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.0	<0.01
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.040	<0.01
			^{234}U	1.6	<0.01
			^{235}U	<0.020	<0.01
			^{238}U	0.70	<0.01
			^{226}Ra	0.28	0.070
Watertown No. 3 NTS	7/6	23	^{3}H	<7.0	<0.01
			^{89}Sr	<2.0	<0.01
			^{90}Sr	<1.1	<0.01
			^{238}Pu	<0.037	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	0.67	<0.01
			^{235}U	0.030	<0.01
			^{238}U	0.63	<0.01

Table 11 1973 Summary of Analytical Results for
NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide[b]
Crystal Pool Ash Meadows, NV	1/30	27	^{3}H	<5.7	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<0.80	<0.3
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.030	<0.01
			^{234}U	13.8	<0.05
			^{235}U	0.20	<0.01
			^{238}U	5.7	<0.01
			^{226}Ra	0.18	0.60
Crystal Pool Ash Meadows, NV	7/11	27	^{3}H	<7.0	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<0.90	<0.3
			^{238}Pu	<0.083	<0.01
			^{239}Pu	<0.038	<0.01
			^{234}U	13.0	<0.01
			^{235}U	0.14	<0.01
			^{238}U	5.7	<0.01
			^{226}Ra	0.28	0.93
Well 18S/51E-7DB Ash Meadows, NV	1/30	23	^{3}H	<6.1	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<0.90	<0.3
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	2.6	<0.01
			^{235}U	0.040	<0.01
			^{238}U	1.0	<0.01
Well 17S/50E-14CAC Ash Meadows, NV	1/29	23	^{3}H	<7.3	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<0.90	<0.3
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	2.4	<0.01
			^{235}U	0.038	<0.01
			^{238}U	1.1	<0.01
Well 17S/50E-14CAC Ash Meadows, NV	7/11	23	^{3}H	<8.2	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.038	<0.01
			^{239}Pu	<0.022	<0.01
			^{234}U	1.9	<0.01
			^{235}U	0.033	<0.01
			^{238}U	0.75	<0.01

Table 11 1973 Summary of Analytical Results for
NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. 10^{-9}µCi/ml	% of Conc. Guide[b]
Fairbanks Springs Ash Meadows, NV	1/29	27	^{3}H	<7.3	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<0.90	<0.3
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	2.1	<0.01
			^{235}U	0.045	<0.01
			^{238}U	0.66	<0.01
Fairbanks Springs Ash Meadows, NV	7/11	27	^{3}H	NO DATA	
			^{89}Sr	<2.0	<0.07
			^{90}Sr	<1.3	<0.4
			^{238}Pu	<0.014	<0.01
			^{239}Pu	<0.010	<0.01
			^{234}U	1.3	<0.01
			^{235}U	0.016	<0.01
			^{238}U	0.40	<0.01
City Supply Beatty, NV	1/31	23	^{3}H	<4.8	<0.01
			^{89}Sr	<2.0	<0.07
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	10.8	0.01
			^{235}U	0.14	<0.01
			^{238}U	3.7	<0.01
			^{226}Ra	0.19	0.63
City Supply Beatty, NV	7/10	23	^{3}H	15.0	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.044	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	6.7	<0.01
			^{235}U	0.051	<0.01
			^{238}U	1.8	<0.01
Nuclear Engineering Co. Beatty, NV	1/25	23	^{3}H	<6.1	<0.01
			^{89}Sr	<1.0	<0.01
			^{90}Sr	<1.0	<0.01
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	6.2	<0.01
			^{235}U	0.077	<0.01
			^{238}U	2.1	<0.01

Table 11 1973 Summary of Analytical Results for
NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide[b]
Nuclear Engineering Co. Beatty, NV	7/10	23	^{3}H	13.7	<0.01
			^{89}Sr	<1.0	<0.01
			^{90}Sr	<1.0	<0.01
			^{238}Pu	<0.040	<0.01
			^{239}Pu	<0.014	<0.01
			^{234}U	5.7	<0.01
			^{235}U	0.064	<0.01
			^{238}U	1.9	<0.01
			^{226}Ra	0.32	1.1
USAF No. 1 Indian Springs, NV	1/24	23	^{3}H	<6.4	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.030	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	4.7	<0.01
			^{235}U	0.027	<0.01
			^{238}U	0.76	<0.01
			^{226}Ra	0.52	1.7
USAF No. 1 Indian Springs, NV	7/12	23	^{3}H	27.2	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.049	<0.01
			^{239}Pu	<0.018	<0.01
			^{234}U	3.09	<0.01
			^{235}U	0.027	<0.01
			^{238}U	0.44	<0.01
Sewer Co. Inc. Well No. 1 Indian Springs, NV	1/24	23	^{3}H	<5.4	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.030	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	3.6	<0.01
			^{235}U	0.030	<0.01
			^{238}U	0.73	0.3
Sewer Co. Inc. Well No. 1 Indian Springs, NV	7/12	23	^{3}H	<7.7	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.1	<0.4

Table 11 1973 Summary of Analytical Results for
NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. 10^{-9}μCi/ml	% of Conc. Guide[b]
Sewer Co. Inc. (continued) Well No. 1 Indian Springs, NV			^{238}Pu	<0.045	<0.01
			^{239}Pu	<0.048	<0.01
			^{234}U	2.8	<0.01
			^{235}U	0.019	<0.01
			^{238}U	0.56	<0.01
			^{226}Ra	0.42	1.4
City Supply Lathrop Wells, NV	1/24	23	^{3}H	<6.1	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.030	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	0.91	<0.01
			^{235}U	0.015	<0.01
			^{238}U	0.39	<0.01
City Supply Lathrop Wells, NV	7/11	23	^{3}H	<7.7	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.038	<0.01
			^{239}Pu	<0.018	<0.01
			^{234}U	0.80	<0.01
			^{235}U	<0.01	<0.01
			^{238}U	0.31	<0.01
Shoshone Spring Shoshone, CA	1/26	27	^{3}H	<5.4	0.01
			^{89}Sr	<3.0	<0.1
			^{90}Sr	<0.90	<0.3
			^{238}Pu	<0.020	0.01
			^{239}Pu	<0.020	0.01
			^{234}U	4.1	< .01
			^{235}U	0.061	<0.01
			^{238}U	1.3	<0.01
Shoshone Spring Shoshone, CA	7/13	27	^{3}H	<7.7	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.1	<0.4
			^{238}Pu	<0.035	<0.01
			^{239}Pu	<0.019	<0.01
			^{234}U	3.0	<0.01
			^{235}U	0.039	<0.01
			^{238}U	0.95	<0.01
			^{226}Ra	0.75	2.5

Table 11 1973 Summary of Analytical Results for
NTS Semi-Annual Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide[b]
Goss Springs Springdale, NV	1/31	27	^{3}H	<6.1	<0.01
			^{89}Sr	<1.4	<0.05
			^{90}Sr	<0.95	<0.3
			^{238}Pu	<0.020	<0.01
			^{239}Pu	<0.020	<0.01
			^{234}U	8.0	<0.01
			^{235}U	0.085	<0.01
			^{238}U	1.7	<0.01
Goss Springs Springdale, NV	7/10	27	^{3}H	<6.7	<0.01
			^{89}Sr	<1.0	<0.03
			^{90}Sr	<1.0	<0.3
			^{238}Pu	<0.029	<0.01
			^{239}Pu	<0.026	<0.01
			^{234}U	2.6	<0.01
			^{235}U	0.016	<0.01
			^{238}U	0.71	<0.01
			^{226}Ra	0.18	0.60

[a] 23 - Well
27 - Spring

[b] All on-NTS percentages are for radiation workers. All off-NTS percentages are for an individual in an uncontrolled area.

Table 12 1973 Summary of Analytical Results
for Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Depth Metres (Feet)[b]	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide
			PROJECT RULISON			
Rulison, CO Lee L. Hayward Ranch	5/20	23		^{3}H ^{226}Ra	<240 0.15	<0.01 0.50
Rulison, CO Glen Schwab Ranch	5/20	23		^{3}H	670	0.022
Grand Valley, CO Albert Gardner Ranch	5/19	23		^{3}H ^{226}Ra	420 0.14	0.014 0.47
Grand Valley, CO City Water	5/19	27		^{3}H	<240	<0.01
Grand Valley, CO 300 Yds. N.W. of G.Z.	5/20	27		^{3}H	740	0.025
Anvil Points, CO Bernklau Ranch	5/19	27		^{3}H	320	0.01
Grand Valley, CO Battlement Creek	5/20	22		^{3}H	500	0.017
Grand Valley, CO CER Water Well	5/20	23	13 (42.7)	^{3}H	800	0.027
Rulison, CO Potter Ranch	5/19	27		^{3}H ^{226}Ra	540 0.15	0.018 0.50
			PROJECT DRIBBLE			
Baxterville, MS City Water	3/28	23		^{3}H	<240	<0.01
Baxterville, MS Lower Little Creek	3/28	22		^{3}H	<240	<0.01
Tatum Salt Dome, MS HT-2C	3/25	23	108 (355)	^{3}H ^{89}Sr ^{90}Sr	<240 <3.0 <1.0	<0.01 <0.10 <0.30

Table 12 1973 Summary of Analytical Results

for Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Depth Metres (Feet)[b]	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide
Tatum Salt Dome, MS	3/25	23		^{3}H	<230	<0.01
HT-2M	3/27	23	31 (100)	^{3}H	<230	<0.01
	3/27	23	183 (600)	^{3}H	<230	<0.01
	3/27	23	335 (1100)	^{3}H	17,000	0.57
	3/27	23	488 (1600)	^{3}H	8,600	0.29
	3/27	23	640 (2100)	^{3}H	28,000	0.93
	3/27	23	716 (2350)	^{3}H	80,000	2.7
	3/27	23	716 (2350)	^{89}Sr	<5.0	<0.17
	3/27	23	716 (2350)	^{90}Sr	1.5	0.50
	3/27	23	762 (2500)	^{3}H	54,000	1.8
	10/2	23		^{3}H	350	0.01
	10/2	23	31 (100)	^{3}H	900	0.03
	10/2	23	183 (600)	^{3}H	9,000	0.3
	10/2	23	335 (1100)	^{3}H	42,000	1.4
	10/2	23	488 (1600)	^{3}H	42,000	1.4
	10/2	23	640 (2100)	^{3}H	38,000	1.3
	10/2	23	716 (2350)	^{3}H	35,000	1.2
	10/2	23	762 (2500)	^{3}H	35,000	1.2
Tatum Salt Dome, MS HT-4	3/26	23	122 (400)	^{3}H	<240	<0.01
Tatum Salt Dome, MS HT-5	3/26	23	183 (600)	^{3}H	<240	<0.01

Table 12 1973 Summary of Analytical Results

for Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Depth Metres (Feet)[b]	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml	% of Conc Guide
Tatum Salt Dome, MS E-7	3/26	23	282 (924)	^{3}H	<240	<0.01
Baxterville, MS Half Moon Creek	3/26	22		^{3}H	<240	<0.01
Half Moon Creek Overflow	3/26	22		^{3}H	270	<0.01
Baxterville, MS T. Speights Residence	3/28	23		^{3}H	<240	<0.01
Baxterville, MS R. L. Anderson Residence	3/28	23		^{3}H	<240	<0.01
Baxterville, MS M. Lowe Residence	3/28	23		^{3}H	<240	<0.01
Baxterville, MS R. Ready Residence	3/28	23		^{3}H	<240	<0.01
Baxterville, MS W. Daniels, Jr. Residence	3/28	23		^{3}H	<240	<0.01
Lumberton, MS City Water Well No. 2	3/29	23		^{3}H	<240	<0.01
Purvis, MS City Water	3/29	23		^{3}H	<240	<0.01
Columbia, MS City Water Well No. 64B	3/29	23		^{3}H	<240	<0.01
Baxterville, MS Pond West of G.Z.	3/26	21		^{3}H	400	0.013

Table 12 1973 Summary of Analytical Results
for Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Depth Metres (Feet)[b]	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide
			FAULTLESS EVENT			
Blue Jay, NV Highway Maintenance Station	4/12	23		^{3}H	<250	<0.01
Warm Springs, NV Hot Creek Ranch	4/11	27		^{3}H	<250	<0.01
Blue Jay, NV Six Mile Well	4/11	23		^{3}H	<250	<0.01
Site C, NV HTH-2	4/12	23	183 (602)	^{3}H	<250	<0.01
			PROJECT SHOAL			
Frenchman, NV Frenchman Station	8/22	23		^{3}H ^{226}Ra	<240 0.25	<0.01 0.83
Frenchman, NV[a] HS-1	11/29	23				
Frenchman, NV H-3	8/22	23	114 (375)	^{3}H ^{226}Ra	350 6.2	0.01 21
Frenchman, NV[c] H-3	11/29	23				
Frenchman, NV[d] Flowing Well No. 2	11/29/72	23		^{89}Sr ^{90}Sr ^{3}H ^{226}Ra	<2.0 <1.1 <220 0.28	<0.07 <0.4 <0.01 0.93
Frenchman, NV Flowing Well No. 2	8/22	23		^{3}H ^{89}Sr ^{90}Sr	280 <3.0 <1.2	<0.01 <0.1 <0.4
Frenchman, NV[c] Hunt's Station	11/29	23				

Table 12 1973 Summary of Analytical Results

for Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Depth Metres (Feet)[b]	Type of Radio-activity	Radioactivity Conc. 10^{-9} µCi/ml	% of Conc. Guide
			PROJECT GASBUGGY			
Gobernador, NM Arnold Ranch	7/25	27		^{3}H	<240	<0.01
				^{226}Ra	0.38	1.3
Gobernador, NM Arnold Ranch	11/6	27		^{3}H	<250	<0.01
Jicarilla Apache Reservation, NM Well 30.3.32.343	5/2	23		^{3}H	<240	<0.01
Jicarilla Apache Reservation, NM Well 30.3.32.343	11/7	23		^{3}H	<250	<0.01
Gobernador, NM Lower Burrow Canyon	7/25	23		^{3}H	<240	<0.01
				^{226}Ra	0.23	0.77
Gobernador, NM Lower Burrow Canyon	11/8	23		^{3}H	<250	<0.01
Gobernador, NM Bixler Ranch	5/3	23		^{3}H	<240	<0.01
				^{226}Ra	0.37	1.2
Gobernador, NM Bixler Ranch	11/8	23		^{3}H	<250	<0.01
Blanco, NM San Juan River	4/30	22		^{3}H	400	0.013
Blanco, NM San Juan River	11/8	22		^{3}H	290	<0.01
Gobernador, NM Cave Springs	7/24	27		^{3}H	<240	<0.01
				^{226}Ra	0.57	1.9
Gobernador, NM Cave Springs	11/6	27		^{3}H	<250	<0.01
Gobernador, NM Bubbling Springs	4/30	27		^{3}H	<240	<0.01

Table 12 1973 Summary of Analytical Results
for Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Depth Metres (Feet)[b]	Type of Radio-activity	Radioactivity Conc. $10^{-9}\mu Ci/ml$	% of Conc. Guide
Gobernador, NM Bubbling Springs	11/7	27		^{3}H	≤250	<0.01
Dulce, NM City Water	5/1	21		^{3}H	480	0.02
Dulce, NM City Water	11/8	21		^{3}H	<250	<0.01
Dulce, NM[d] La Jara Lake	9/13/72	21		^{89}Sr ^{90}Sr ^{3}H	<10 <11 740	<0.30 <3.7 0.025
Dulce, NM La Jara Lake	4/30	21		^{3}H ^{89}Sr ^{90}Sr	<240 <5.0 5.6	<0.01 <0.2 1.9
Dulce, NM La Jara Lake	11/8	21		^{3}H	260	<0.01
Gobernador, NM[d] EPNG Well 10-36	9/13/72	23		^{89}Sr ^{90}Sr ^{3}H	<3.0 <1.0 <210	<0.1 <0.3 <0.01
Gobernador, NM EPNG Well 10-36	5/2	23	1097 (3600)	^{3}H ^{89}Sr ^{90}Sr ^{226}Ra	<240 <3.0 <1.2 0.37	<0.01 <0.1 <0.4 1.2
Gobernador, NM EPNG Well 10-36	11/7	23	1097 (3600)	^{3}H	<250	<0.01
PROJECT GNOME						
Malaga, NM USGS Well No. 1	4/26	23	161 (528)	^{3}H ^{89}Sr ^{90}Sr ^{226}Ra	<250 <3.0 <1.0 4.5	<0.01 <0.1 <0.3 15
Malaga, NM USGS Well No. 4	4/26	23	148 (486)	^{3}H ^{89}Sr ^{90}Sr ^{226}Ra	1,200,000 <1,600 10,000 8.0	40 <53 3,300 27

Table 12 1973 Summary of Analytical Results

for Off-NTS Long-Term Hydrological Monitoring Program

Sampling Location	Date	Sample Type[a]	Depth Metres (Feet)[b]	Type of Radio-activity	Radioactivity Conc. 10^{-9}µCi/ml	% of Conc Guide
Malaga, NM USGS Well No. 8	4/26	23	144 (473)	^{3}H	1,400,000	47
				^{89}Sr	<2,500	<83
				^{90}Sr	15,000	5,000
				^{226}Ra	1.9	6.3
				^{137}Cs	190	1.0
Malaga, NM PHS Well No. 6	4/26	23		^{3}H	400	0.01
Malaga, NM PHS Well No. 8	4/25	23		^{3}H	<250	<0.01
				^{226}Ra	0.52	1.7
Malaga, NM PHS Well No. 9	4/26	23		^{3}H	<250	<0.01
Malaga, NM PHS Well No. 10	4/26	23		^{3}H	<250	<0.01
				^{89}Sr	<2.0	<0.07
				^{90}Sr	<1.0	<0.3
				^{226}Ra	0.65	2.2
Malaga, NM Pecos River Pumping Station	4/25	23		^{3}H	<250	<0.01
Loving, NM City Well No. 2	4/25	23		^{3}H	<250	<0.01
				^{226}Ra	0.73	2.4
Carlsbad, NM City Well No. 7	4/25	23		^{3}H	<250	<0.01
				^{226}Ra	1.0	3.3

[a] 21 - Pond, Lake, Reservoir, Stock Tank, Stock Pond

22 - Stream, River, Creek

23 - Well

24 - Multiple Supply - Mixed (A water sample consisting of mixed or multiple sources of water, such as well and spring.)

27 - Spring

[b] If depth is not shown, water was collected at surface. All depths are below surface level.

[c] Collected, but not analyzed as of 12/31/73.

[d] Not reported in 0513 report of 1972.

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90 - 91 Technical Information Center, Oak Ridge, TN (for public availability)