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Off-Site Environmental Monitoring Report:

Radiation Monitoring Around United States Nuclear Test Areas, Calendar Year 1986

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under Interagency Agreement
Number DE-AI08-76DP00539

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OFF-SITE ENVIRONMENTAL MONITORING REPORT
Radiation Monitoring Around United States Nuclear Test Areas, Calendar Year 1986

compiled by

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ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
OFFICE OF RESEARCH AND DEVELOPMENT
U.S. ENVIRONMENTAL PROTECTION AGENCY
LAS VEGAS, NEVADA 89114

NOTICE

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PREFACE

The U.S. Atomic Energy Commission (AEC) used the Nevada Test Site (NTS) from January 1951 through January 19, 1975, for conducting nuclear weapons tests, nuclear rocket-engine development, nuclear medicine studies, and other nuclear and non-nuclear experiments. Beginning January 19, 1975, these activities became the responsibility of the newly formed U.S. Energy Research and Development Administration (ERDA). On October 1, 1977 the ERDA was merged with other energy-related agencies to form the U.S. Department of Energy (DOE). Atmospheric nuclear tests were conducted periodically from January 27, 1951, through October 30, 1958, after which a testing moratorium was in effect until September 1, 1961. Since September 1, 1961, all nuclear detonations have been conducted underground with the expectation of containment, except for four slightly above-ground or shallow underground tests of Operation Dominic II in 1962 and five nuclear earth-cratering experiments conducted under the Plowshare program between 1962 and 1968.

Prior to 1954, an off-site surveillance program was performed by the Los Alamos Scientific Laboratory and the U.S. Army. From 1954 through 1970 the U.S. Public Health Service (PHS), and from 1970 to the present the U.S. Environmental Protection Agency (EPA) have provided an Off-Site Radiological Safety Program under an Interagency Agreement. The PHS or EPA has also provided off-site surveillance for U.S. nuclear explosive tests at places other than the NTS.

Since 1954, an objective of this surveillance program has been to measure levels and trends of radioactivity, if present, in the environment surrounding testing areas to ascertain whether the testing is in compliance with existing radiation protection standards. Off-site levels of radiation and radioactivity are assessed by sampling milk, water, and air; by deploying dosimeters; and by sampling food crops, soil, etc., as required. Personnel with mobile monitoring equipment are placed in areas downwind from the test site prior to each test in order to implement protective actions, provide immediate radiation monitoring, and obtain environmental samples rapidly after any release of radioactivity. Since 1962, aircraft have also been deployed to rapidly monitor and sample releases of radioactivity during nuclear tests. Monitoring data obtained by the aircraft crew immediately after a test are used to position mobile radiation monitoring personnel on the ground. Data from airborne sampling are used to quantify the amounts, diffusion, and transport of the radionuclides released.

Beginning with Operation Upshot-Knothole in 1953, a report was published by the PHS summarizing the surveillance data for each test series. In 1959 for reactor tests, and in 1962 for weapons and Plowshare tests, such data were published for those tests that released radioactivity detectable off the NTS.

The reporting interval was changed again in 1964 to semi-annual publication of data for each 6-month period which also included the data from the individual reports.

In 1971, the AEC implemented a requirement, now incorporated into DOE Order 5484.1, that each contractor or agency involved in major nuclear activities provide a comprehensive annual radiological monitoring report. This is the fifteenth annual report in this series; it summarizes the off-site activities of the EPA during CY 1986.

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ABBREVIATIONS, SYMBOLS AND CONVERSIONS

ASN	Air Surveillance Network
Bq	Becquerel, one disintegration per second
CG	Concentration Guide
Ci	Curie
CP-1	Control Point One
CY	Calendar Year
d	day
DOE	U.S. Department of Energy
DOE/NV	Department of Energy, Nevada Operations Office
EMSL-LV	Environmental Monitoring Systems Laboratory, Las Vegas
EPA	U.S. Environmental Protection Agency
eV	electron volt
g	gram
Gy	Gray, equivalent to 100 rad (1 J/kg)
GZ	Ground Zero
h	hour
HTO	tritiated water
L	liter
LTHMP	Long-Term Hydrological Monitoring Program
m	meter
MDC	Minimum Detectable Concentration
MSL	Mean Sea Level
MSN	Milk Surveillance Network
NGTSN	Noble Gas and Tritium Surveillance Network
NTS	Nevada Test Site
Pa	Pascal - unit of pressure
PIC	Pressurized ion chamber
R	Roentgen
rad	unit of absorbed dose, 100 ergs/g
rem	the rad adjusted for biological effect
Sv	Sievert, equivalent to 100 rem
TLD	thermoluminescent dosimeter

PREFIXES

a	atto	$= 10^{-18}$
f	femto	$= 10^{-15}$
p	pico	$= 10^{-12}$
n	nano	$= 10^{-9}$
µ	micro	$= 10^{-6}$
m	milli	$= 10^{-3}$
k	kilo	$= 10^{3}$
M	mega	$= 10^{6}$

CONVERSIONS

Multiply	By	To Obtain
<u>Concentration Guides</u>		
µCi/mL	10^{9}	pCi/L
µCi/mL	10^{12}	pCi/m^3
<u>SI Units</u>		
rad	10^{-2}	Gray (Gy = 1 Joule/kg)
rem	10^{-2}	Sievert (Sv)
pCi	0.037	Becquerel

SECTION 1

INTRODUCTION

The EMSL-LV operates an Off-Site Radiological Safety Program around the NTS and other sites as requested by the Department of Energy (DOE) under an Interagency Agreement between DOE and EPA. This report, prepared in accordance with DOE guidelines (DOE85), covers the program activities for calendar year 1986. It contains descriptions of pertinent features of the NTS and its environs, summaries of the EMSL-LV dosimetry and sampling methods, analytical procedures, quality assurance, and the analytical results from environmental measurements. Where applicable, dosimetry and sampling data are compared to appropriate guides for external and internal exposures of humans to ionizing radiation.

SECTION 2

SUMMARY

Purpose

It is U.S. Environmental Protection Agency (EPA) policy to protect the general public and the environment from pollution caused by human activities. This includes radioactive contamination of the biosphere and concomitant radiation exposure of the population. To this end and in concordance with U.S. Department of Energy (DOE) policy of keeping radiation exposure of the general public as low as reasonably achievable, the EPA's Environmental Monitoring Systems Laboratory in Las Vegas (EMSL-LV) conducts an Off-Site Radiological Safety Program around the DOE's Nevada Test Site. This program is conducted under an Interagency Agreement between EPA and DOE. The principal activity at the NTS is testing of nuclear devices, though other related projects are also conducted.

The principal activities of the Off-Site Radiological Safety Program are: routine environmental monitoring for radioactive materials in various media and for radiation in areas which may be affected by nuclear tests; and protective actions in support of the nuclear testing program. These are conducted to document compliance with standards, to identify trends, and to provide information to the public. This report summarizes these activities for CY 1986.

Locations

Most of the radiological safety effort is applied in the areas around the Nevada Test Site (NTS) in south-central Nevada. This portion of Nevada is sparsely settled, 0.5 person/km^2, and has a continental arid climate. The largest town in the near off-site area is Beatty, located about 65 km west of the NTS with a population of about 1,000.

Underground tests have been conducted in several other States for various purposes. At these sites in Alaska, Colorado, New Mexico, and Mississippi, a long-term hydrological monitoring program is conducted to detect any possible radioactive contamination of potable water and aquifers near these sites.

Special Test Support

During CY86, personnel were deployed in support of the 13 announced nuclear tests at the NTS. Twice radioactivity of NTS origin was detected off site. Once was during the planned purging of T-tunnel following the Mighty Oak test. Xenon-133 was detected at Penoyer Farms, Nevada, at concentrations which could have led to a dose of 2.7 x 10^{-4} mrem (2.7 x 10^{-6} mSv). The other was during a drillback operation when a xe-133 concentration of 84 pCi/m^3 was detected in the sample from Lathrop Wells the week ending March 31.

Pathways Monitoring

The pathways leading to human exposure to radionuclides (air, water, and food) are monitored by networks of sampling stations. The networks are designed not only to detect radiation from DOE/NV nuclear test areas but also to measure population exposure from other sources. Some positive results were obtained this year. These resulted from three incidents that occurred during 1986, namely: the tunnel purging following the Mighty Oak test, the accident at the Chernobyl nuclear plant in the Soviet Union, and the drillback operation on the NTS in March.

In 1986 the air surveillance network (ASN) consisted of 30 continuously operating stations surrounding the NTS and 83 standby stations (operated 1 or 2 weeks each quarter) in all States west of the Mississippi River. Gamma-emitting radionuclides were detected by the Air Surveillance Network. These included beryllium-7, a naturally occurring nuclide, and several fresh fission products (Tables E-1 and E-12) that resulted from the Chernobyl accident. The concentrations were too low to have any health significance. The average of gross beta results on selected air samples was higher during the Chernobyl fallout period in early to mid-May.

The noble gas and tritium sampling network (NGTSN) consisted of 17 stations off site (off the NTS and exclusion areas) in 1986. Krypton-85 concentrations in the Noble Gas and Tritium Sampling Network averaged 25 pCi/m^3 (0.9 Bq/m^3), consistent with the levels determined since 1981 (Table 2). Krypton-85 concentrations reported previously for 1984-86 have been changed in this report to correct an error in the calibration source. Xenon-133 was found in 45 samples with a maximum of 730 pCi/m^3 (27 Bq/m^3) which occurred at Groom Lake, Nevada, during the purging of the tunnel in which the Mighty Oak test was conducted. In about 32 of these samples the xenon-133 is attributed to the air emissions from the Chernobyl reactor.

The long-term monitoring of wells and surface waters near sites of nuclear tests showed only background radionuclide concentrations except for those wells that had detectable activity in previous years or those that had been spiked with radionuclides for hydrological tests.

The milk surveillance network consisted of 28 sampling locations within 300 km of the NTS and about 122 standby locations in the Western U.S. The tritium concentration in milk was at background levels, and strontium-90 from worldwide fallout continued the slow downward trend observed in recent years. Fission products from the Chernobyl accident were not detected in milk samples except for low concentrations of cesium-137 detected at Seattle, Washington and Flensburg, Minnesota (Table E-9). In addition, trace amounts of iodine-131 were detected in one group of special milk and green-chop (cattle feed) samples collected at Las Vegas. These were not part of the routine network samples.

Other foods analyzed have been mainly meat from domestic or game animals. The radionuclide most frequently found in the edible portion of the sampled animals is cesium-137. However, its concentration has been near the MDC since 1968. Strontium-90 in samples of animal bone remain at very low levels as does plutonium-239 in both bone and liver samples. Of the Chernobyl fission products, only radioiodine was detected in samples of cow thyroid.

External Exposure

External exposure is monitored by a network of TLD's at 129 fixed locations surrounding the NTS and by TLD's worn by 53 off-site residents. In a few cases, small exposures of a few mR above the average for the person were measured. Except for several occupational exposures, all such net exposures were very low and were not related to NTS activities. The range of exposures measured, varying with altitude and soil constituents, is similar to the range of such exposures found in other areas of the U.S.

Internal Exposure

Internal exposure is assessed by whole-body counting supplemented by phoswich and intrinsic detectors to measure lung burdens of radioactivity. In 1986, counts were made on 102 off-site residents, as well as on 106 other individuals for occupational or other reasons. Natural potassium-40 was found, as well as trace amounts of cesium-137 from the Chernobyl accident, but no nuclear test related radioactivity was detected. In addition, physical examinations of the off-site residents revealed a normally healthy population consonant with the age and sex distribution of that population.

Community Monitoring Stations

The 15 Community Monitoring Stations became operational in 1982. Each station is operated by a resident of the community who is trained to collect samples and interpret some of the data. Each station is an integral part of the ASN, NGTSN and TLD networks and is also equipped with a pressurized ion chamber system and recording barograph. Samples and data from the stations are analyzed by EMSL-LV and are also interpreted and reported by the Desert Research Institute, University of Nevada. Data from these stations are reported herein as part of the networks in which they participate. No detectable increase in the external gamma background was found when the low-level Chernobyl debris arrived in the Western U.S.

Dose Assessment

Doses were calculated for an average adult living in Nevada based on the Kr-85, Sr-90, HTO and Pu-239 measured in samples collected from the monitoring networks. Using conservative assumptions, the estimated dose would have been about 0.12 mrem/yr (1.2 μSv/yr), a small fraction of the variation of 10 mrem/yr due to the natural radionuclide content of the body. The only NTS-related radioactivity detected during 1986 was xenon-133 in a weekly sample from Lathrop Wells and in 12 special samples collected during the tunnel purging following the Mighty Oak test. The highest concentration could have caused a dose of 0.27 μrem (2.7×10^{-3} μSv) to a person outdoors for the entire purging period. No other radioactivity originating on the NTS was detectable by the monitoring networks so no dose assessment could be made on the reported emissions (Table 1). However, atmospheric dispersion calculations, based on those emissions, indicate that the highest individual dose would have been 1.4 μrem (0.014 μSv), and the dose to the population within 80 km of CP-1 (on the NTS, Figure 8) would have been 5.7×10^{-3} person-rem (5.7×10^{-5} person-Sv). Maximum annual dose equivalents to the infant thyroid (I-131) from Chernobyl fallout were about 0.8 mrem (8 μSv); for the whole body they were about 0.06 mrem (0.6 μSv).

SECTION 3

DESCRIPTION OF THE NEVADA TEST SITE

Historically, the major programs conducted at the NTS have been nuclear weapons development, proof-testing and weapons safety and effects, testing peaceful uses of nuclear explosives (Plowshare Program), reactor engine development for nuclear rocket and ramjet applications (Projects Rover and Pluto), high-energy nuclear physics research, seismic studies (Vela Uniform), and studies of high-level waste storage. During 1986, nuclear weapons development, proof-testing and weapons safety, nuclear physics programs, and studies of high-level waste storage were continued at the NTS. Project Pluto was discontinued in 1964; Project Rover was terminated in January 1973; Plowshare tests were terminated in 1970; Vela Uniform studies ceased in 1973. All nuclear weapons tests after 1962 have been conducted underground. More detail and pertinent maps for the portions of this section are included in Appendix A. Only selected information is presented in this Section.

SITE LOCATION

The NTS is located in Nye County, Nevada, with its southeast corner about 90 km northwest of Las Vegas (Figure 1). It has an area of about 3,500 square km and varies from 40 to 56 km in width (east-west) and from 64 to 88 km in length (north-south). This area consists of large basins or flats about 900 to 1,200 m above mean sea level (MSL) surrounded by mountain ranges rising 1,800 to 2,300 m above MSL.

The NTS is surrounded on three sides by exclusion areas, collectively named the Nellis Air Force Base Range Complex, which provide a buffer zone between the test areas and public lands. This buffer zone varies from 24 to 104 km between the test area and land that is open to the public. Depending upon wind speed and direction at the time of testing, from 2 to more than 6 hours will elapse before any release of airborne radioactivity could pass over public lands.

CLIMATE

The climate of the NTS and surrounding area is variable, due to its variations in altitude and its rugged terrain. Generally, the climate is referred to as continental arid. Throughout the year, there is insufficient precipitation to support the growth of common food crops without irrigation.

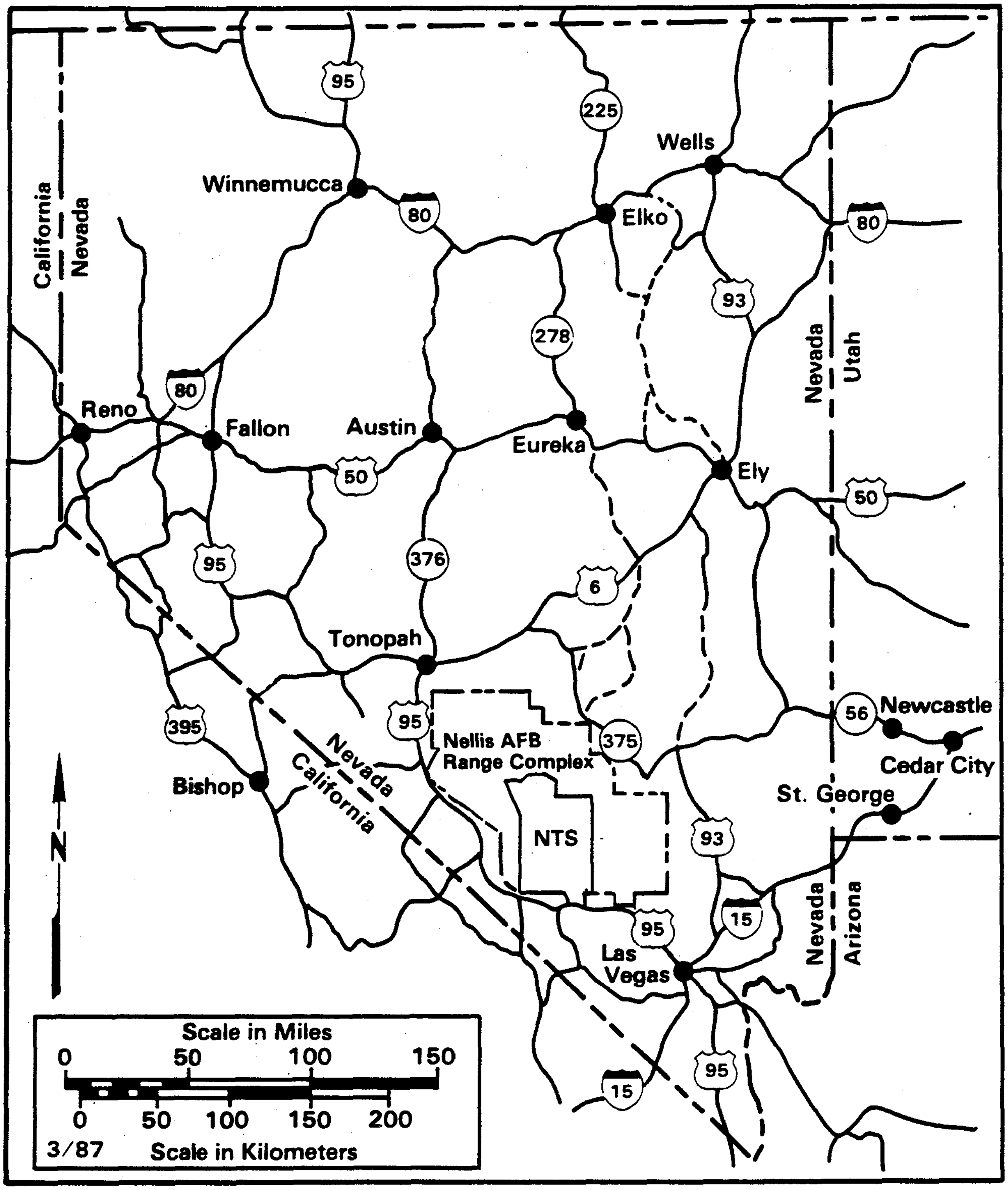

Figure 1. Location of the Nevada Test Site (NTS).

As Houghton et al. (Ho75) point out, 90 percent of Nevada's population lives in areas with less than 25 cm of rainfall per year or in areas that would be classified as mid-latitude steppe to low-latitude desert regions.

The wind direction, as measured on a 30 m tower at an observation station about 9 km NNW of Yucca Lake near CP-1, is predominantly northerly except during May through August when winds from the south-southwest predominate (Qu68). Because of the prevalent mountain/valley winds in the basins, south to southwest winds predominate during daylight hours of 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. Wind patterns are often quite different at other locations on the NTS because of local terrain effects and differences in elevation.

GEOLOGY AND HYDROLOGY

Geological and hydrological studies of the NTS have been in progress by the U.S. Geological Survey and various other organizations since 1956. Because of this continuing effort, the surface and underground geological and hydrological characteristics for much of the NTS are known in considerable detail (see Figure A-1). 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 1975 (Wi75).

The aquifers underlying the NTS vary in depths from about 200 m beneath the surface of valleys in the southeastern part of the site to more than 500 m beneath the surface of highlands to the north. Although much of the valley fill is saturated, downward movement of water is retarded by various tuffs and is extremely slow. The primary aquifer in these formations consists of Paleozoic carbonates that underlie the more recent tuffs and alluviums.

LAND USE OF NTS ENVIRONS

Industry within the immediate off-NTS area includes approximately 40 active mines and mills, oil fields in the Railroad Valley area, and several industrial plants in Henderson, Nevada. The number of employees for these operations may vary from one person at several of the small mines to several hundred workers for the oil fields north of the NTS and the industrial plants in Henderson. Most of the individual mining operations involve less than 10 workers per mine; however, a few operations employ 100 to 250 workers.

The major body of water close to the NTS is Lake Mead (120 km southeast, Figure A-2), a manmade lake supplied by water from the Colorado River. Lake Mead supplies about 60 percent of the water used for domestic, recreational, and industrial purposes in the Las Vegas Valley. Some Lake Mead water is used in Arizona, southern California, and Mexico. Smaller reservoirs and lakes located in the area are used primarily for irrigation, for watering livestock, and for wildlife refuges.

Dairy farming is not extensive within 300 km of the NTS. As shown in Figures A-4 and A-5 the family cows and goats are distributed in all directions around the NTS, whereas most dairy cows are located to the southeast (along the Muddy and Virgin River valleys and in Las Vegas, Nevada), northeast (Lund), and southwest (near Barstow, California).

Grazing is the most common land use within 300 km of the site. Approximately 500,000 cattle and 150,000 sheep are distributed within the area as shown in Figures A-6 and A-7, respectively. The estimates are based on information supplied by the California Crop and Livestock reporting service (CA85), from 1985 agricultural statistics supplied by the Nevada Department of Agriculture (NV86) and 1985 estimates based on 1982 census information supplied by the Utah Department of Agriculture (UT82).

POPULATION DISTRIBUTION

Excluding Clark County, the major population center (approximately 536,000 in 1984), the population density within a 150 km radius of CP-1 on the NTS is about 0.5 persons per square kilometer. For comparison, the 48 contiguous states (1980 census) had a population density of approximately 29 persons per square kilometer. The estimated average population density for all of Nevada in 1980 was 2.8 persons per square kilometer.

The off-site area within 80 km of the NTS (the area in which the dose commitment must be determined for the purpose of this report) is predominantly rural, Figure A-2. Several small communities are located in the area, the largest being in the Pahrump Valley. This growing rural community, with an estimated population of about 6,000, is located about 72 km south of the NTS CP-1. The Amargosa Farm Area, which has a population of about 750, is located about 50 km southwest of CP-1. The largest town in the near off-site area is Beatty, which has a population of about 1,000 and is located approximately 65 km to the west of CP-1.

AIRBORNE RELEASES OF RADIOACTIVITY AT THE NTS DURING 1986

All nuclear detonations during 1986 were conducted underground and were contained, although occasional releases of low-level radioactivity occurred during re-entry drilling, seepage through fissures in the soil or purging of tunnel areas. Table 1 shows the total quantities of radionuclides released to the atmosphere, as reported by the DOE Nevada Operations Office (DOE87). Because these releases occurred throughout the year and because of the distance from the points of releases to the nearest sampling station, only twice was any radioactive material listed in this table detected off site. In both cases only Xe-133 was detectable. Debris from the Chernobyl reactor arrived in the Western U.S. after the tunnel purging following the Mighty Oak test.

TABLE 1. TOTAL AIRBORNE RADIONUCLIDE EMISSIONS AT THE NTS DURING 1986

Radionuclide	Half-Life (days)	Quantity Released (Ci)
Tritium	4500	120.7
Krypton-85	3990	4.3
Xenon-133	5.24	36,000
Xenon-133m	2.2	0.058
Xenon-135	0.38	0.041
Iodine-131	8.07	2.4

SECTION 4

QUALITY ASSURANCE

GOALS

The goals of the EMSL-LV quality assurance program are to assure the collection and analysis of environmental samples with the highest degree of accuracy and precision obtainable with state-of-the-art instrumentation and to achieve the best possible completeness and comparability given the extent and type of networks from which samples are collected. To meet these goals, it is necessary to devote strict attention to sample collection, sample analysis, and quality assurance procedures.

SAMPLE COLLECTION

The collection of samples is governed by a detailed set of Standard Operating Procedures (SOP's). These SOP's prescribe the frequency and method of collection, the type of collection media, sample containment and transport, sample preservation, sample identification and labeling, and operating parameters for the instrumentation. Sample control is an important segment of these activities as it enables tracking from collection to analysis for each sample and governs the selection of duplicate samples for analysis and the samples chosen for replicate analysis.

These procedures provide assurance that sample collection, labeling and handling are standardized to minimize sample variability due to inconsistency among these variables.

SAMPLE ANALYSIS

All of the networks operated by the EMSL-LV have individual Quality Assurance Project Plans. The procedures required by these plans assure that the results of analysis will be of known quality and will be comparable to results obtained elsewhere with equivalent procedures. These Plans are summarized in the following sections.

<u>External QA</u>

External QA provides the data from which the accuracy of analysis (a combination of bias and precision) can be determined. Bias is assessed from the results obtained on intercomparison study samples and on samples "spiked" with known amounts of radionuclides. The Off-Site Radiological Safety Program participates in Intercomparison Study Programs that include environmental sample analysis, TLD dosimetry, and whole-body counting. Also, samples which are undisclosed to the analyst are spiked by adding known amounts of radionuclides and then entered into the normal chain of analysis.

Data for precision are collected from duplicate and replicate analyses. At least 10 percent of all samples are collected in duplicate. When analyzed, the data indicate the precision of both sample collection and analysis. Replicate counting of at least 10 percent of all samples yield data from which the precision of counting can be determined.

If the bias and precision data are of sufficient quality (i.e., normalized deviation in Table C-3 is less than 3), then comparability, i.e., comparison of the data with those of other analytical laboratories, can be assessed with confidence. The results of external QA procedures are shown in Appendix C.

Internal QA

Internal QA consists of those procedures used by the analyst to assure proper sample preparation and analysis. The principal procedures used are the following:

- Instrument background counts
- Blank and reagent analyses
- Instrument calibration with known nuclides
- Laboratory control standards analysis
- Performance check-source analysis
- Maintenance of control charts for background and check-source data
- Scheduled instrument maintenance

These procedures ensure that the instrumentation is not contaminated, that calibration is correct, and that standards carried through the total analytical procedure are accurately analyzed.

VALIDATION

After the results are produced, supervisory personnel examine the data to determine whether or not the analysis is valid. This includes checking all procedures from sample receipt to analytical result with particular attention to the internal QA data and comparison of the results with previous data from similar samples at the same location. Trend analysis of krypton-85 data suggested a problem was occurring. Investigation led to the standard. When new NBS standards were obtained, the old standard was found to be faulty. All noble gas data from January 1984 on were then revised; the revised values are included in this report.

Any variant result or failure to follow internal QA procedures during sample analysis will trigger an internal audit of the analytical procedures and/or a re-analysis of the sample or its duplicate.

AUDITS

All analytical data are reviewed by personnel of the Dose Assessment Branch for completeness and consistency. Investigations are conducted to resolve any inconsistencies and corrective actions are taken if necessary. SOP's and QA project plans are revised as needed following review of procedures and methodology. The EMSL-LV QA Officer audits the operations periodically.

SECTION 5

RADIOLOGICAL SAFETY ACTIVITIES

The radiological safety activities of the EMSL-LV are divided into two major areas: special test support and routine environmental surveillance which includes pathways monitoring and internal and external exposure monitoring. Both of these activities are designed to detect any increase in environmental radiation which might cause exposure to individuals or population groups so that protective actions may be taken, to the extent feasible. These activities are described in the following portions of this report.

SPECIAL TEST SUPPORT

Before each nuclear test, mobile monitoring personnel are positioned in the off-site areas most likely to be affected should a release of radioactive material occur. They ascertain the locations of residents, work crews and animal herds and obtain information relative to controllability of residents in communities and remote areas. These monitors, equipped with radiation survey instruments, gamma exposure-rate recorders, thermoluminescent dosimeters (TLD's), portable air samplers, and supplies for collecting environmental samples, are prepared to conduct a monitoring program as directed from the NTS Control Point (CP-1) via two-way radio communications.

For those tests which might cause ground motion detectable off site, EPA monitors are stationed at locations where hazardous situations might ensue. At these locations, occupants are notified of potential hazards so they can take precautionary measures.

Professional EPA personnel serve as members of the Test Controller's Advisory Panel to provide advice on possible public and environmental impact of each test and on feasible protective actions in case accidental releases of radioactivity should occur.

An EG&G cloud sampling and tracking aircraft is always flown over the NTS to obtain samples, assess total cloud volume, and provide long-range tracking in the event of a release of airborne radioactivity. A second aircraft is also flown to gather meteorological data and to perform cloud tracking. Information from these aircraft can be used in positioning the radiation monitors.

During CY 1986, EMSL personnel were deployed in support of the 13 announced underground tests, none of which accidently released radioactivity which could be detected off site. However, following the Mighty Oak event, conducted on April 10, radioactivity was detected in the tunnel leading to the test point, although containment measures prevented escape of the radioactivity to the atmosphere. To gain entry to the tunnel and the instrumentation contained therein, the tunnel was purged and the escaping gas passed through high efficiency and charcoal filters. Special air samplers were installed at near off-site locations during the purging. The sampler at the Penoyer Farms near Rachel, Nevada, detected the highest xenon-133 integrated concentration, 11.5 nCi-hr/m^3. An individual who remained outdoors during the 170 hours of the collection period would have received an exposure of 0.27 μrem (2.7×10^{-3} μSv) to the skin or equivalent to 1-1/2 minutes exposure to background at that location. A complete description of the monitoring for this event is reported separately (EPA86). Prior to this, a small amount of xe-133 was detected in the weekly noble gas sample collected March 31 from Lathrop Wells. This was apparently due to seepage from a drillback operation.

PATHWAYS MONITORING

The off-site radiation monitoring program includes a pathways monitoring system consisting of air, water and milk surveillance networks surrounding the NTS and a limited animal sampling project. These are explained in detail below.

Air Surveillance Network (ASN)

Network Design--

The ASN monitors an important route of human exposure to radionuclides: inhalation of airborne materials. The concentration and the source must both be determined if appropriate corrective actions are to be taken. The ASN is designed to monitor the areas within 350 km of the NTS with some concentration of stations in the prevailing downwind direction (Figure 2). The coverage is constrained to those locations having available electrical power and a resident willing to operate the equipment. This continuously operating network is supplemented by a standby network which covers the contiguous States west of the Mississippi River (Figure 3).

Methods--

During 1986 the ASN consisted of 30 continuously operating sampling stations and 83 standby stations. The air sampler at each station was equipped to collect both particulate radionuclides and reactive gases.

Samples of airborne particulates were collected at each active station on 5-cm diameter glass-fiber filters at a flow rate of about 81 m^3 per day until April, when the flow rate was increased to about 122 m^3 per day. Filters were changed after sampler operation periods of 2 or 3 days (160 to 360 m^3). Activated charcoal cartridges placed directly behind the filters to collect gaseous radioiodine were changed at the same time as the filters. The standby network was activated for 1 to 2 weeks per quarter at most locations and for several weeks following the Chernobyl accident on April 26, 1986, near Kiev, Ukrainian Republic, USSR. The standby samplers are identical to those used in the ASN and are operated by State and municipal health department personnel or by local residents. All air filters and charcoal cartridges were analyzed at the EMSL-LV.

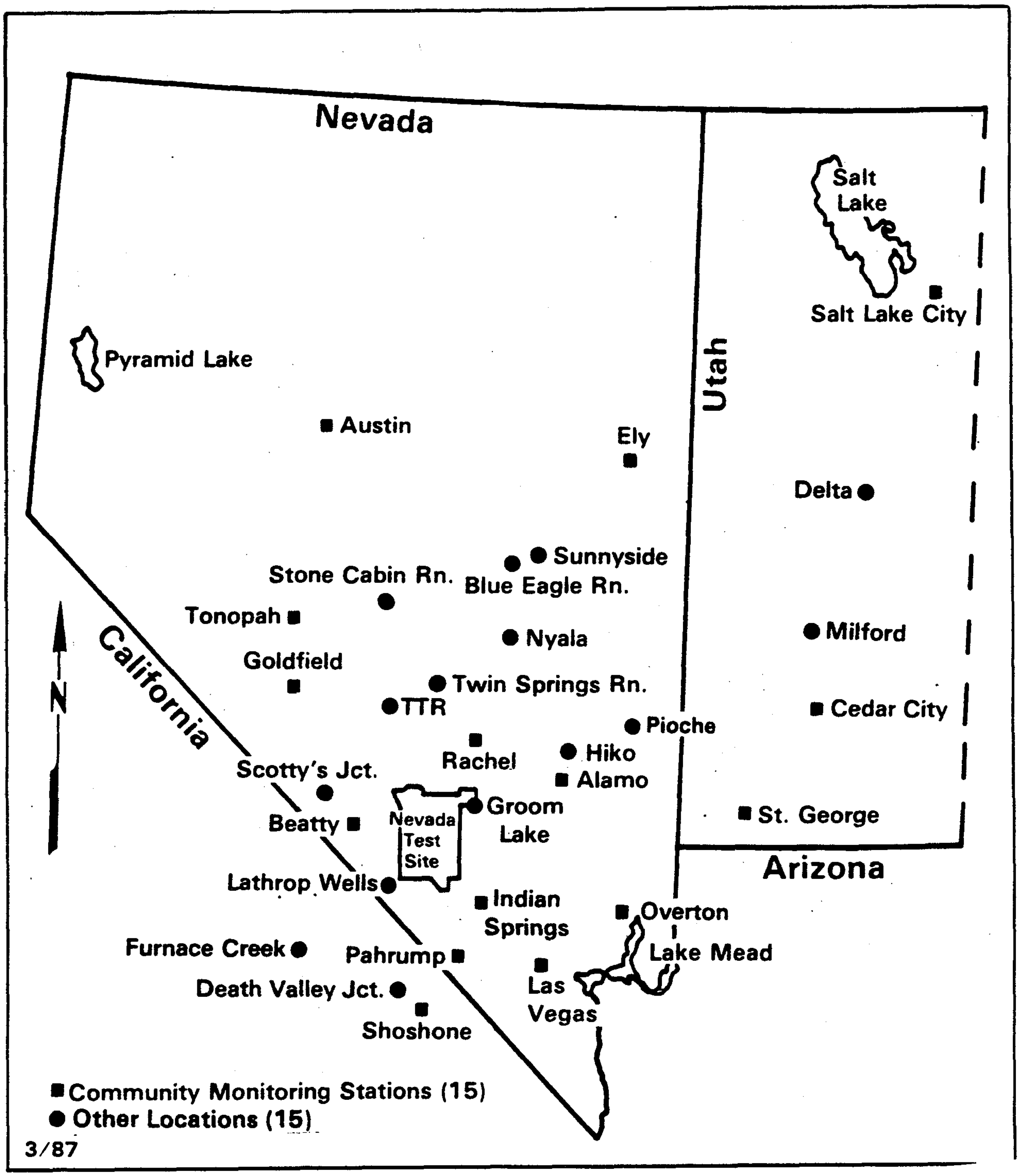

Figure 2. Air Surveillance Network stations (1986).

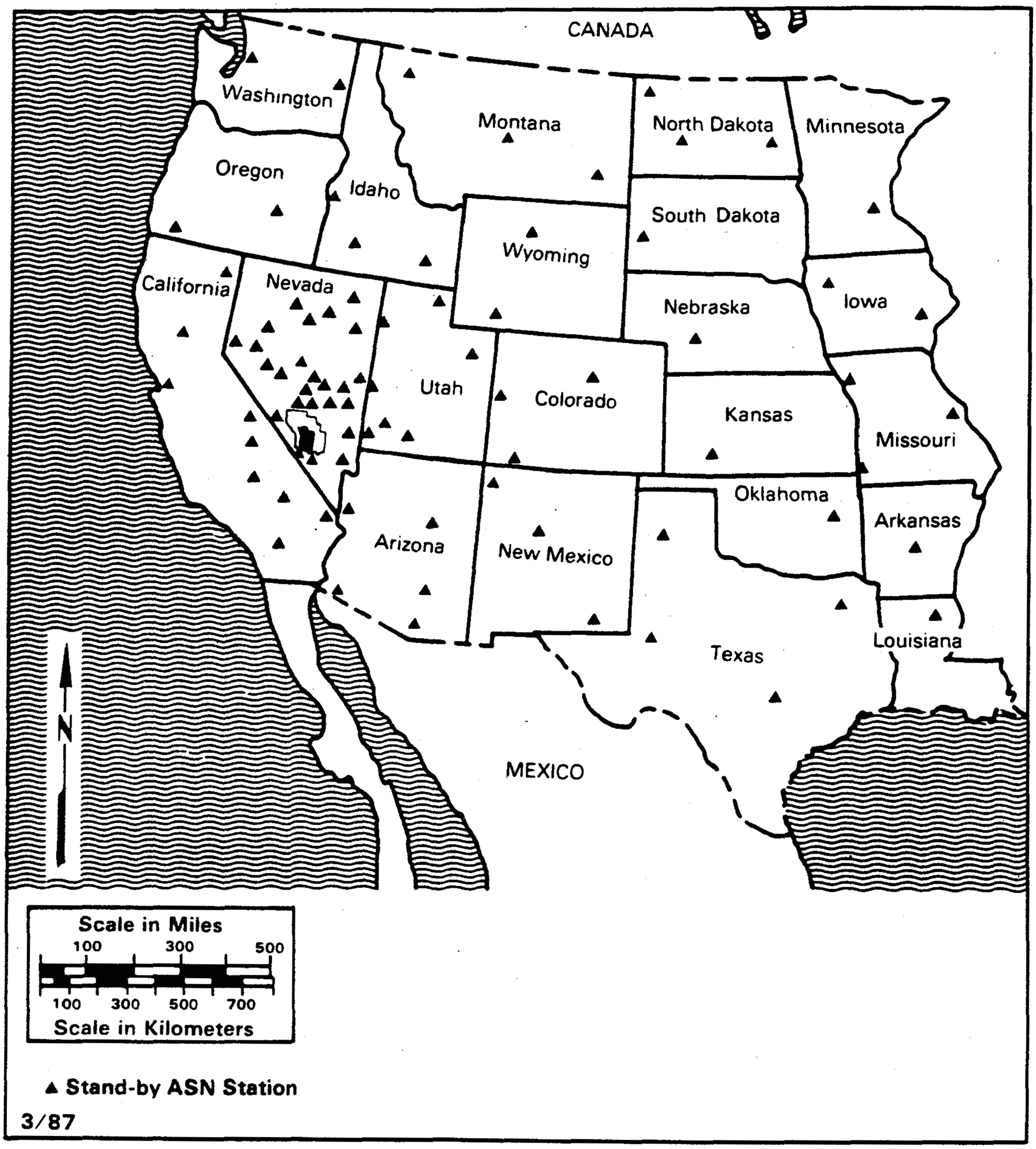

Figure 3. Standby Air Surveillance Network stations (1986).

Results--

During 1986, no airborne radioactivity related to nuclear testing at the NTS was detected on any sample from the ASN. However, naturally occurring beryllium-7 was detected by gamma spectroscopy, as were fission products from the Chernobyl accident. Appendix Tables E-1 and E-2, summarize the data from the ASN samples.

In addition to beryllium-7, the radionuclides listed in the table below were detected. The presence of these fresh fission products is attributed to the Chernobyl nuclear reactor accident. Gamma-emitting radionuclides from Chernobyl were also detected in most samples collected by the standby stations, which were activated following the accident. Although these radionuclides were not detected on all days of the quarter, each average concentration was calculated using the total sampling time as the collection period and assuming zero concentration for the periods when the nuclide was not detected. This is a time-weighted average so it is possible for the average concentration to be less than the minimum reported concentration (Tables E-1 and E-2). A complete report on the Chernobyl fallout and its significance is being prepared for publication.

The fresh fission products from the Chernobyl accident were first observed in air samples collected on May 7 from Denver, Colorado, and from Delta, Milford, and Vernal, Utah. No fission products were detected in air samples after June, 1986. The locations where the samples had the highest concentrations of each radionuclide detected were as follows:

Radionuclide	Collection Date	(pCi/m^3)	Sampling Location
Nb-95	May 15*	0.11	Wendover, UT
Ru-103	May 11	1.0	Reno, NV
Ru-106	May 18	0.24	Furnace Creek, CA
I-131	May 11	8.9	Reno, NV
Te-132	May 11	0.45	Reno, NV
Cs-134	May 11	0.55	Nampa, ID
Cs-136	May 13	0.081	Ridgecrest, CA
Cs-137	May 11	1.5	Grand Junction, CO
Ba-140	May 12	0.26	Currie, NV
La-140	May 12*	1.8	Bishop, CA
Ce-141	May 15*	0.058	Wendover, UT

*Samples collected over 3-day period; all other samples are for 1-day sampling.

Two additional analyses are performed on selected samples from the ASN: a gross beta analysis of the filters from 5 stations, and plutonium-238 and plutonium-239 analysis of composited filters from 15 states. The gross beta analysis is used to detect trends in atmospheric radioactivity because this analysis is more sensitive than gamma spectrometry for detecting low levels of radioactivity. For this study, three stations north and east of the NTS, and two stations south and west of the NTS are used. The three filters per week from each station are analyzed for gross beta activity after a 7-day delay to decrease the contribution from radon and thoron daughter activity. The data suggest little significant difference among stations, but show the influence of low level fission products from the Chernobyl accident which arrived in the U.S. during the spring of 1986 (Figure 4). The maximum concentration measured was 1.1 pCi/m^3, the minimum was <0.001 pCi/m^3, and the arithmetic average was 0.025 pCi/m^3 (0.9 mBq/m^3). The maximum and average values were about 5 and 1.6 times the values for 1985, respectively. A summary of the data is shown in Appendix Table E-3. The results from the plutonium-239 analyses, all less than the MDC, are shown in Appendix Table E-4; plutonium-238 results were also <MDC.

Noble Gas and Tritium Surveillance Network (NGTSN)

Network Design--

There are several sources for the radionuclides monitored by this network. Noble gases are emitted from nuclear power plants, propulsion reactors, reprocessing facilities and nuclear explosions. Tritium is emitted from the same sources and is also produced naturally. The monitoring network will be affected by all these sources, but must be able to detect NTS emissions. For this purpose some of the samplers are located close to the NTS and particularly in drainage-wind channels leading from the test areas. In 1986 this network consisted of 17 stations as shown in Figure 5.

Methodology--

Samples of air are collected by either of two methods; by directly compressing or by liquefying air using cryogenic techniques. Either type of equipment continuously samples air over a 7-day period and stores approximately 1 m^3 of air in pressure tanks. The tanks are exchanged weekly and returned to the EMSL-LV where their contents are analyzed. Analysis starts by condensing the samples at liquid nitrogen temperature and using gas chromatography to separate the gases. The separate fractions of radioxenon and radiokrypton are dissolved in scintillation cocktails and counted in a liquid scintillation counter (see Appendix B).

For tritium sampling, a molecular sieve column is used to collect water from air after it passes through a particulate filter. Up to 10 m^3 of air are passed through the column over a 7-day sampling period. Water adsorbed on the molecular sieve is recovered, and the concentration of tritium in the water (HTO) is determined by liquid scintillation counting techniques (see Appendix B).

Results--

The results from the samples collected by the NGTSN are shown in the Appendix (Table E-5) as the maximum, minimum and average concentration for each station. The average krypton-85 concentration per station ranged from 24 to 26 pCi/m^3. The concentration over the whole network appeared to have a normal distribution with a mean of 25.0 pCi/m^3 (0.92 Bq/m^3) and a standard deviation of 0.5. The weekly averages plus and minus one standard deviation for the network are shown in Figure 6. During the second quarter of 1986 the krypton-85 calibration source was found to be in error. Investigation showed this problem has affected results since 1984. The data in Table 2 and all other krypton-85 data in this report have been corrected and should replace all published data

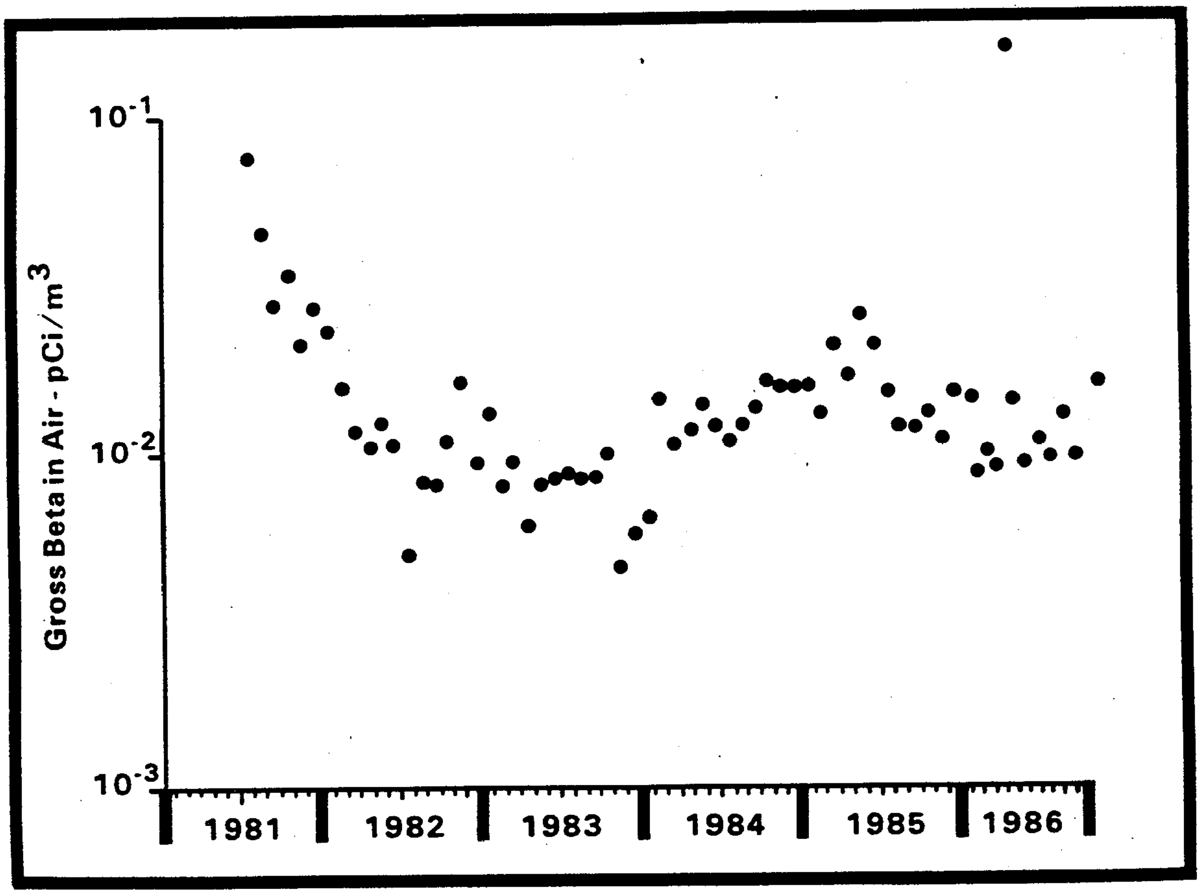

Figure 4. Monthly average gross beta in air samples, 1981-86.

for 1984 through 1986. The new values are 1 to 3 pCi/m^3 lower than reported previously. The master database has also been corrected. This network average concentration, as shown in Table 2, gradually increased since sampling began in 1972 until 1981. This increase, observed at all stations, reflects the worldwide increase in ambient concentrations resulting from the increased use of nuclear technology. The increase in ambient krypton-85 concentration was projected by Bernhardt, et al., (Be73). However, the measured network average in 1986 is only about 10 percent of the 250 pCi/m^3 (9 Bq/m^3) predicted by Bernhardt. Since nuclear fuel reprocessing is the primary source of krypton-85, the decision of the United States to defer fuel reprocessing may be one reason why krypton-85 levels have not increased as fast as predicted. The average concentrations have remained relatively constant since 1981.

Using published data for krypton-85 concentrations in air (NCRP75) and the data from our network (Table 2), the change over time was plotted as shown in Figure 7. Linear correlation analysis indicates that the krypton concentration/time relation is pCi/m^3 = 6.4 + 0.76 t where t is number of years after 1960. The correlation coefficient, R, is 0.98.

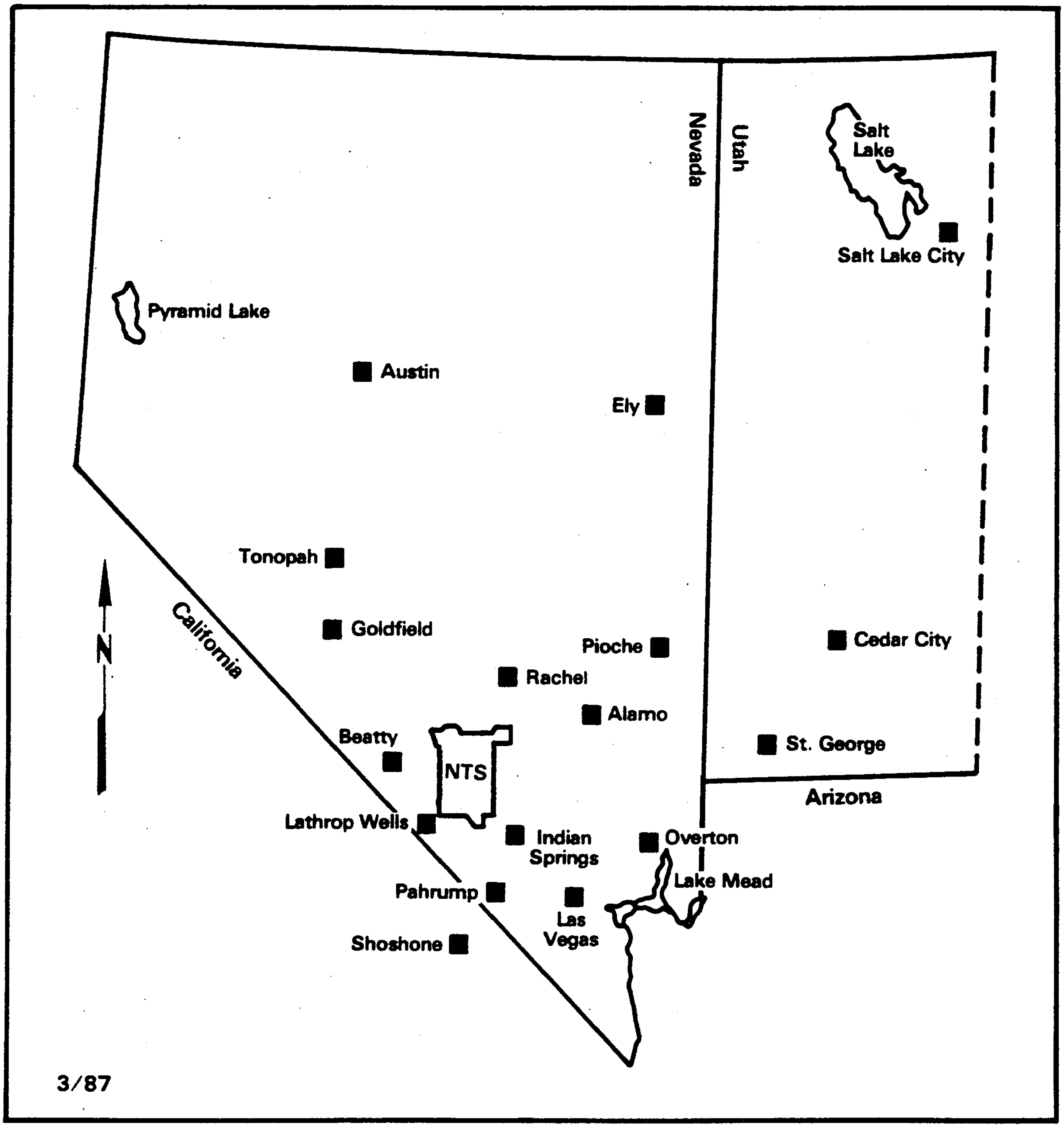

Figure 5. Noble Gas and Tritium Surveillance Network sampling locations.

TABLE 2. ANNUAL AVERAGE KRYPTON-85 CONCENTRATIONS IN AIR, 1976-1986***

Sampling Locations	Kr-85 Concentrations (pCi/m^3)										
	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
Alamo, NV	--	--	--	--	--	27	24	25	24	24	24
Austin, NV	--	--	--	--	--	--	24	25	23	25	25
Beatty, NV	20	20	20	19	21	24	25	24	23	25	26
Diablo and Rachel, NV**	19	19	20	19	21	24	26	24	22	24	25
Ely, NV	--	--	--	--	--	--	24	25	22	24	26
Goldfield, NV	--	--	--	--	--	--	25	24	24	24	25
Hiko, NV*	17	19	20	19	21	24	26	--	--	--	--
Indian Springs, NV	20	20	20	19	21	24	24	25	22	24	26
NTS, Mercury, NV*	19	20	20	19	21	23	--	--	--	--	--
NTS, Groom Lake, NV*	20	19	20	19	21	24	--	--	--	--	--
NTS, BJY, NV*	20	21	22	21	23	26	--	--	--	--	--
NTS, Area 12, NV*	20	19	20	19	21	24	--	--	--	--	--
Tonopah, NV	19	19	20	18	21	25	24	25	23	25	25
Las Vegas, NV	18	20	20	--	--	24	24	24	23	25	25
Death Valley Jct., CA*	20	20	20	19	--	--	--	--	--	--	--
NTS, Area 15, NV*	--	--	--	19	21	25	--	--	--	--	--
NTS, Area 400, NV*	--	--	--	18	21	23	--	--	--	--	--
Lathrop Wells, NV	--	--	--	19	22	24	24	26	22	24	25
Pahrump, NV	--	--	--	--	--	23	24	24	23	25	25
Overton, Nev.	--	--	--	--	--	26	24	25	23	24	25
Cedar City, Ut.	--	--	--	--	--	--	25	24	22	24	24
St. George, Ut.	--	--	--	--	--	--	24	25	23	24	24
Salt Lake City, Ut.*	--	--	--	--	--	--	25	25	25	25	--
Shoshone, CA	--	--	--	--	--	--	25	25	23	24	25
NETWORK AVERAGE	19	20	20	19	21	24	24	25	23	24	25

*Stations discontinued
**Station at Diablo was moved to Rachel in March 1979.
***Note changes in 1984 and 1985 values due to new calibration, see text.

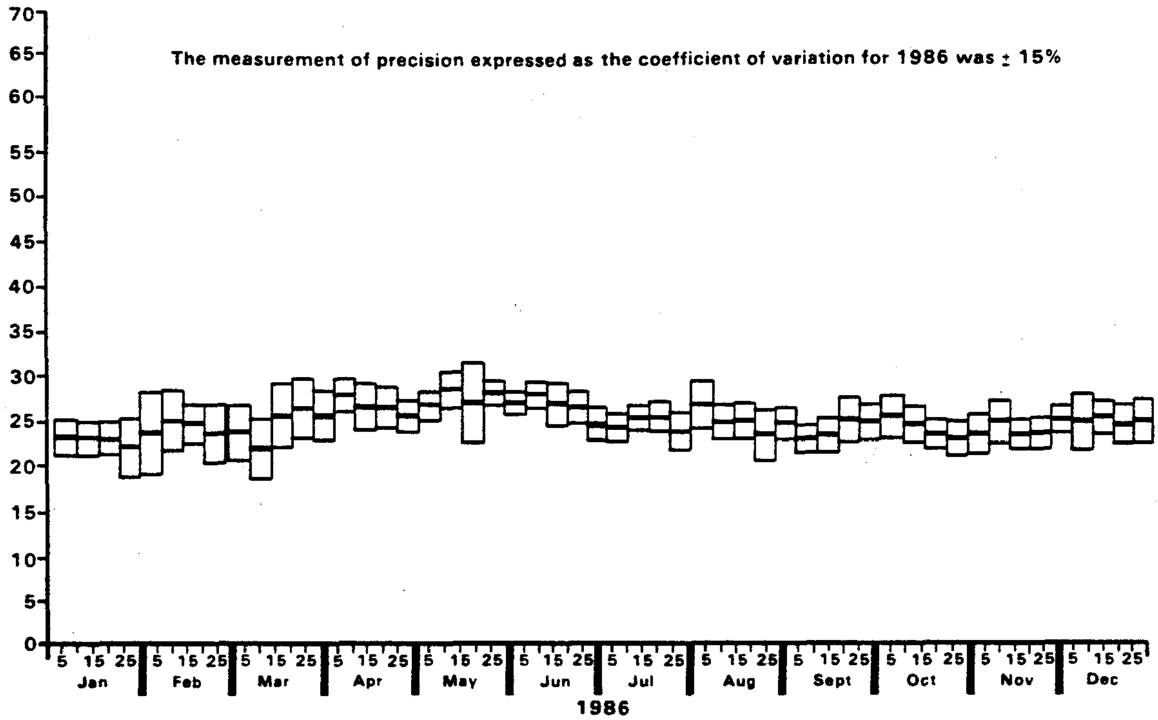

Figure 6. Weekly average krypton-85 concentration in air, 1986 data.

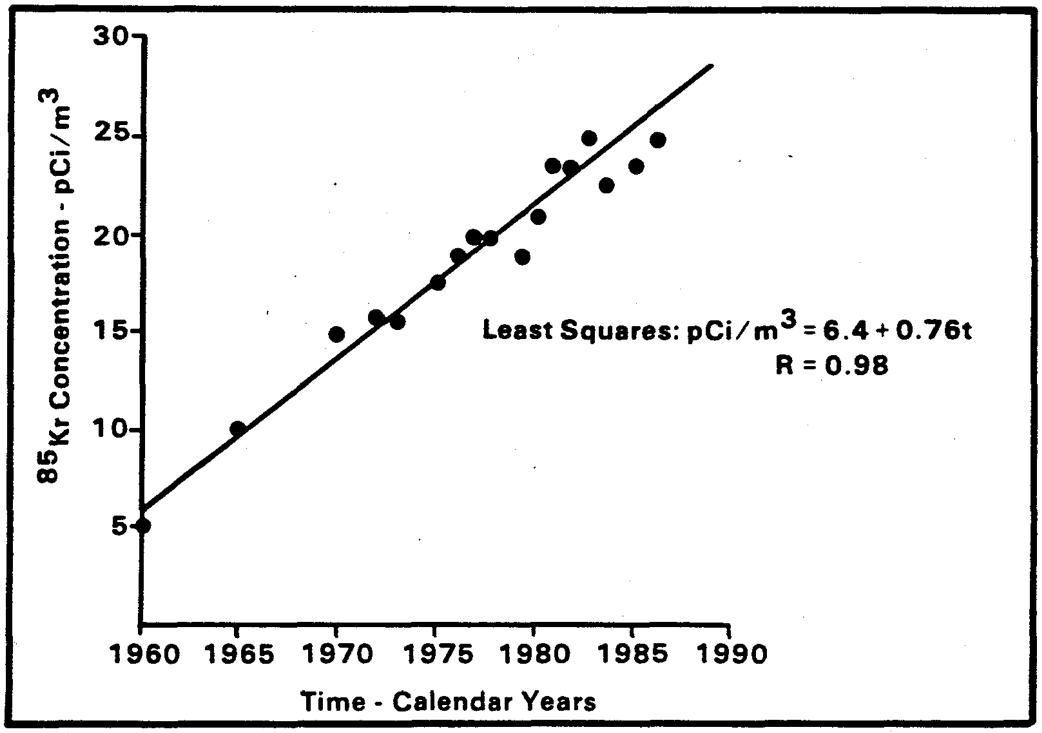

Figure 7. Trend in annual average krypton-85 concentration.

Detectable levels of xenon-133 were found on three occasions: following a drillback on the NTS in March, following the Mighty Oak tunnel purging in late April, and following the April accident at Chernobyl in the USSR. Table E-12 lists when and where each sample was collected, the xenon-133 concentration for each sample, and the percent of the concentration guide.

As in the past, tritium concentrations in atmospheric moisture samples from the off-NTS stations were generally below the minimum detectable concentration (MDC) of about 400 pCi/L water (Appendix Table E-5). The tritium concentrations observed at off-NTS stations were considered to be representative of environmental background. The mean of the tritium concentrations for all off-site stations was 0.45 pCi/m^3 (17 m Bq/m^3) of air. Only 11 of the 870 collected samples were above the MDC.

Long-Term Hydrological Monitoring Program

Network Design--

A major pathway for the transport of radionuclides to individuals is via potable water. This program monitors possible radioactive contamination of potable water sources. The design is for a system to monitor the aquifers underlying, and surface waters on or near, sites where nuclear explosions have occurred. For aquifers, monitoring is limited by the availability of wells that tap those sources. For the sites considered herein, a suitable number of wells is present so that representative monitoring data are obtained.

The monitored locations for the NTS and nearby off-site areas are shown in Figures 8 and 9. For Projects Cannikin, Long Shot and Milrow in Alaska; for Projects Rio Blanco and Rulison in Colorado; for Project Dribble in Mississippi; for Projects Faultless and Shoal in Nevada; and for Projects Gasbuggy and Gnome in New Mexico, the sampling locations are shown in Figures E-1 through E-12 in Appendix E.

Methods--

At each sampling location, four samples are collected. Two samples are collected in 500-mL glass bottles; one is used for tritium analysis and the other stored for use as a duplicate sample or to replace the original sample if it is lost in analysis. The remaining two samples are collected in 3.5-L cubitainers; one for gamma spectrometry analysis and the other is stored. This procedure was modified for the locations around the NTS which had been sampled semi-annually and annually. At these locations, the sampling frequency was changed to monthly and the above sampling procedure was used only twice a year. During the other months, only a 3.5-L sample was collected for analysis by gamma spectrometry.

The tritium and gamma spectrometric analyses are described in Appendix B. If the tritium concentration detected by the conventional analysis is less than 700 pCi/L (26 Bq/L) then the sample is reanalyzed using the enrichment method.

Results--

Table 3 lists the locations at which water samples were found to contain man-made radioactivity. Radioactivity in samples collected at these locations has been reported in previous years. The data for all samples analyzed are

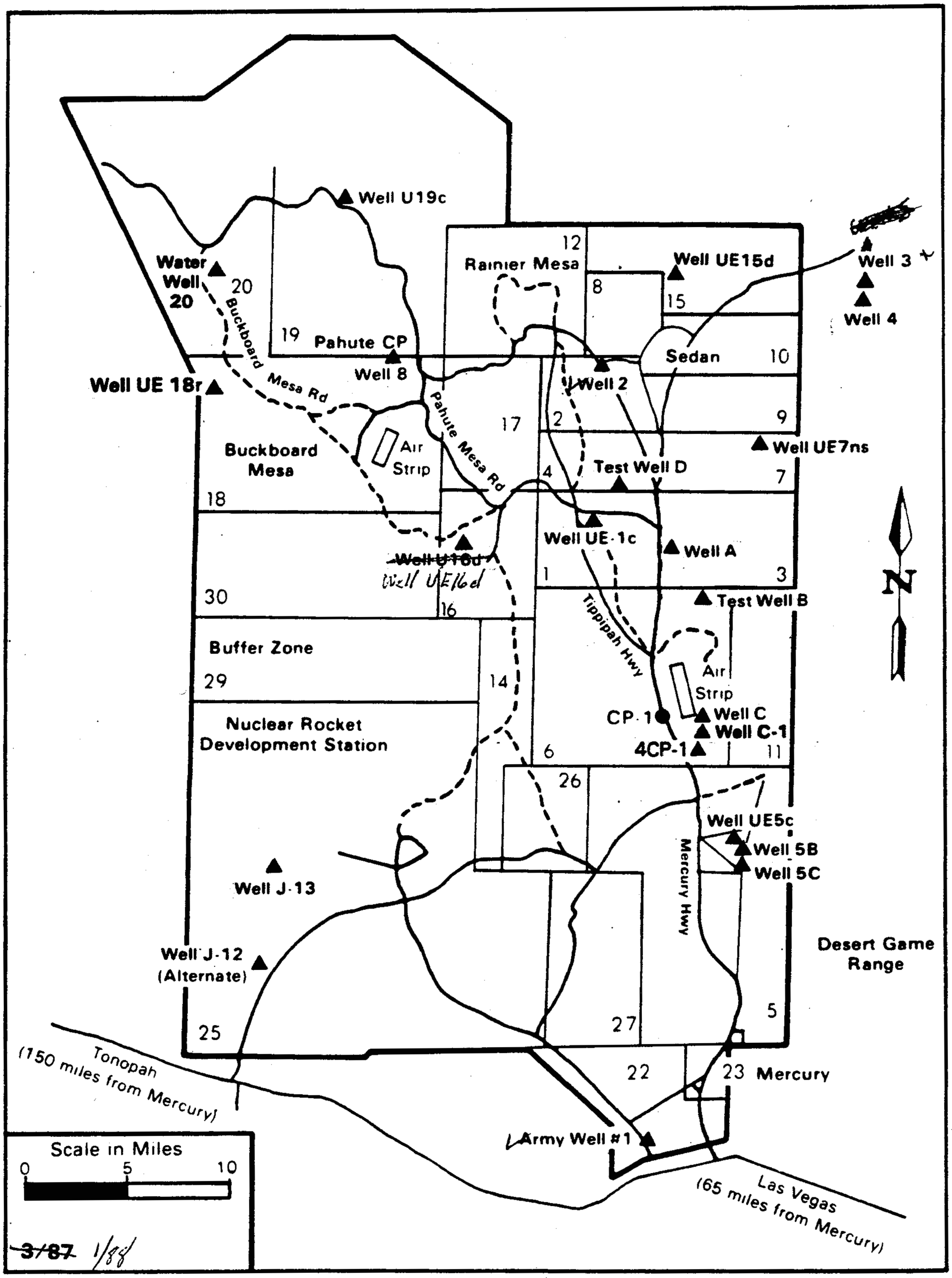

Figure 8. LTHMP sampling locations on the NTS.

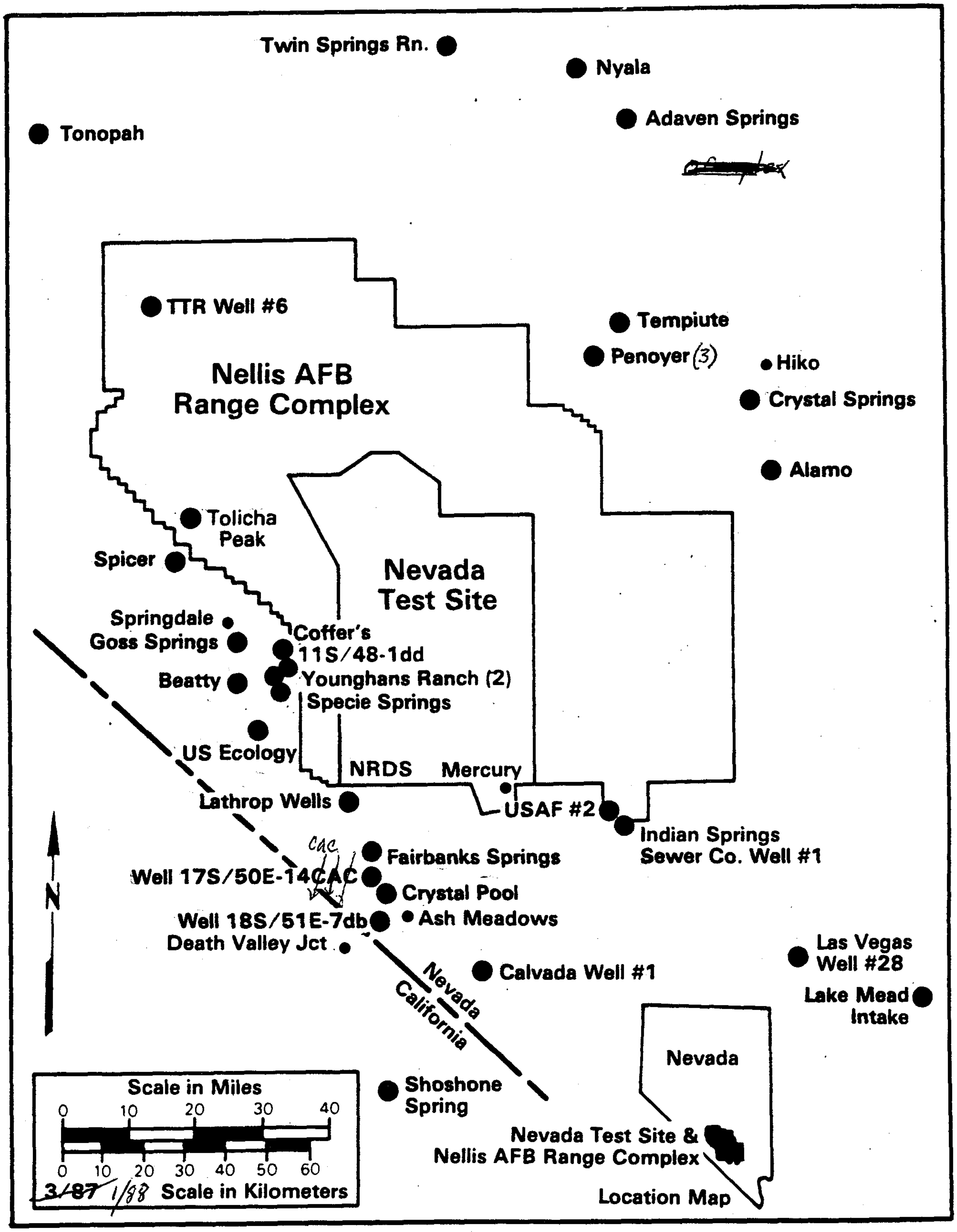

Figure 9. LTHMP sampling locations near the NTS.

compiled in Appendix Tables E-6 and E-7 together with the percent of the relevant concentration guide listed in Appendix D. Radiochemical analyses of water samples from 5 new stations indicate only normal concentrations of uranium and radium.

None of the radionuclide concentrations found at the locations listed in Table 3 are expected to result in measurable radiation exposures to residents in the areas where the samples were collected. Well UE7NS and Test Well B are located on the NTS, and are not used as sources of domestic water.

USGS Wells 4 and 8, which were contaminated with the reported nuclides during tracer studies years ago, are on private land at the Project Gnome site in New Mexico and are closed and locked to prevent their use. Well LRL-7 was used for the disposal of contaminated soil and salt so this well is expected to produce contaminated water.

The Project Dribble wells in Mississippi are about 1 mile from the nearest residence and are not sources of drinking water.

The shallow wells at the Project Long Shot site on Amchitka Island in Alaska are in an isolated location and are not sources of drinking water.

Milk Surveillance Network (MSN)

Network Design--

An important pathway for transport of radionuclides to humans is the air-forage-cow-milk chain. This pathway is monitored by EMSL-LV through analysis of milk. The design of the network is based on collections from areas likely to be affected by accidental releases from the NTS as well as from areas unlikely to be so affected. Additional considerations are: 1) a complete ring of stations to cover any NTS release, and 2) samples from major milksheds as well as from family cows. The availability of milk cows or goats sometimes restricts sample collection in certain areas.

Methods--

The network consists of two major portions, the MSN at locations within 300 km of the NTS from which samples are collected monthly (Figure 10) and the standby network (SMSN) at locations in all major milksheds west of the Mississippi River (Figure 11) from which samples are collected annually. One exception to the latter portion of the network is Texas; the State Health Department performs the surveillance of the milksheds in that State.

The monthly raw milk samples are collected by EPA monitors in 4-liter plastic containers (cubitainers) and preserved with formaldehyde. The annual milk samples are also collected in cubitainers and preserved with formaldehyde but they are collected by contacting State Food and Drug Administration Representatives, after notification of the Regional EPA offices, who arrange for the samples to be mailed to EMSL-LV.

All the milk samples are analyzed first for gamma-emitting nuclides by high-resolution gamma spectrometry and periodically for strontium-89 and strontium-90 by the methods outlined in Appendix B, after a portion of milk

TABLE 3. WATER SAMPLING LOCATIONS WHERE SAMPLES CONTAINED MAN-MADE RADIOACTIVITY - 1986

Sampling Location	Type of Radioactivity	Concentration (pCi/L)
NTS, NV		
Test Well B	Hydrogen-3	130-320
Well UE7NS	Hydrogen-3	2300-3200
PROJECT GNOME, NM		
USGS Well 4	Hydrogen-3	220,000
	Strontium-90	13,000
USGS Well 8	Hydrogen-3	160,000
	Strontium-90	10
	Cesium-137	62
Well LRL-7	Hydrogen-3	16,000
	Strontium-90	10
	Cesium-137	210
PROJECT DRIBBLE, MS		
Well HMH-1 through 11	Hydrogen-3	22-18,000
Well HM-S	Hydrogen-3	14,000
Well HM-L	Hydrogen-3	1,400-1,800
REECo Pit Drainage-B	Hydrogen-3	2,800
Half Moon Creek Overflow	Hydrogen-3	800-840
PROJECT LONG SHOT, AK		
Well EPA-1	Hydrogen-3	270
Well WL-2	Hydrogen-3	320
Well GZ, No. 1	Hydrogen-3	2,300
Well GZ, No. 2	Hydrogen-3	150
Mud Pit No. 1	Hydrogen-3	310-540
Mud Pit No. 2	Hydrogen-3	410
Mud Pit No. 3	Hydrogen-3	590-870

is set aside for tritium analysis. Occasionally a milk sample will sour, thus preventing its passage through the ion exchange column and its subsequent strontium analysis; however, the other analyses can generally be performed satisfactorily. For the SMSN, two locations in each State are selected for tritium and strontium analyses.

Results--

The analytical results from the 1986 MSN samples are summarized in Appendix Table E-8 where the maximum, minimum, and average concentrations of tritium,

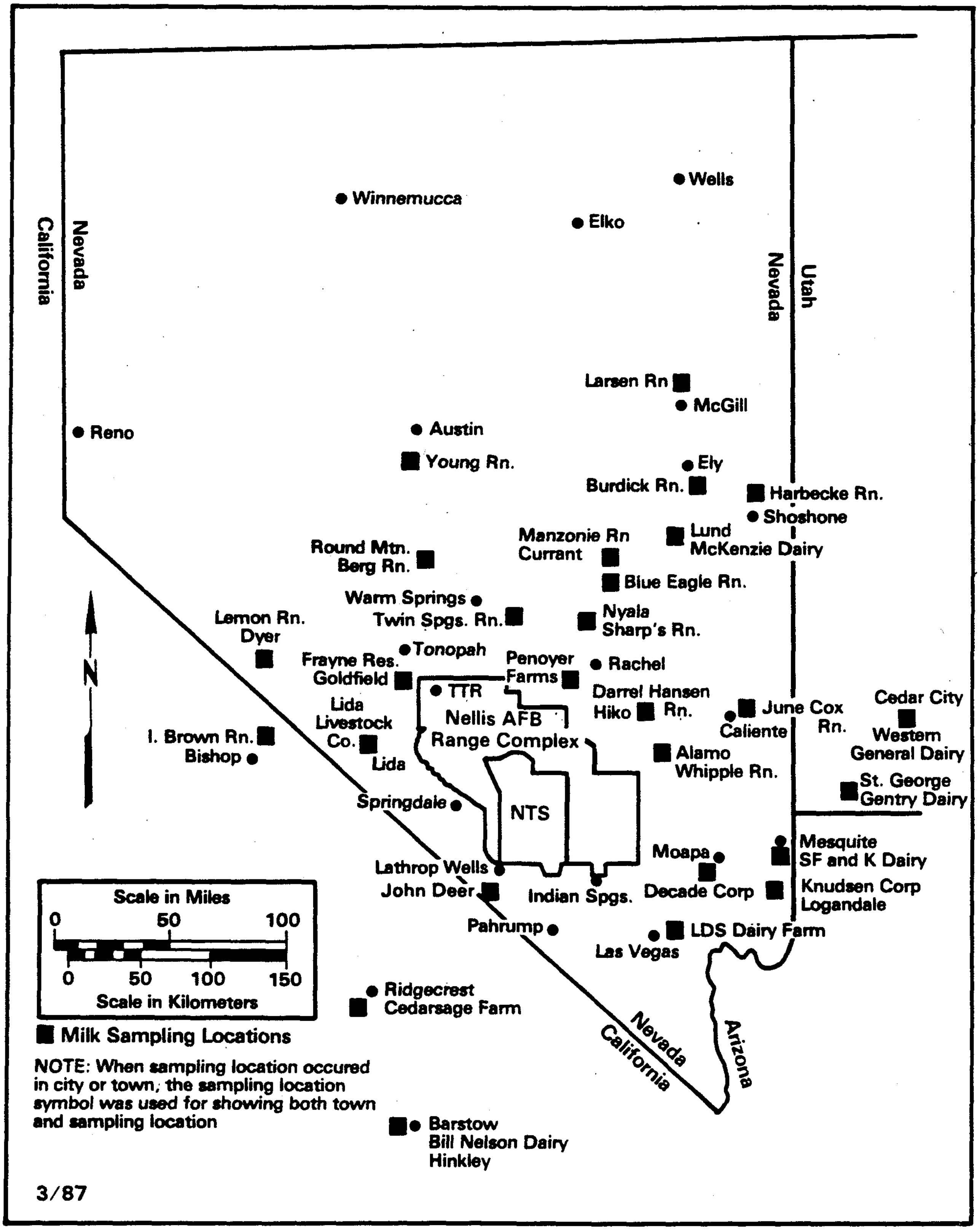

Figure 10. Milk sampling locations within 300 km of the NTS.

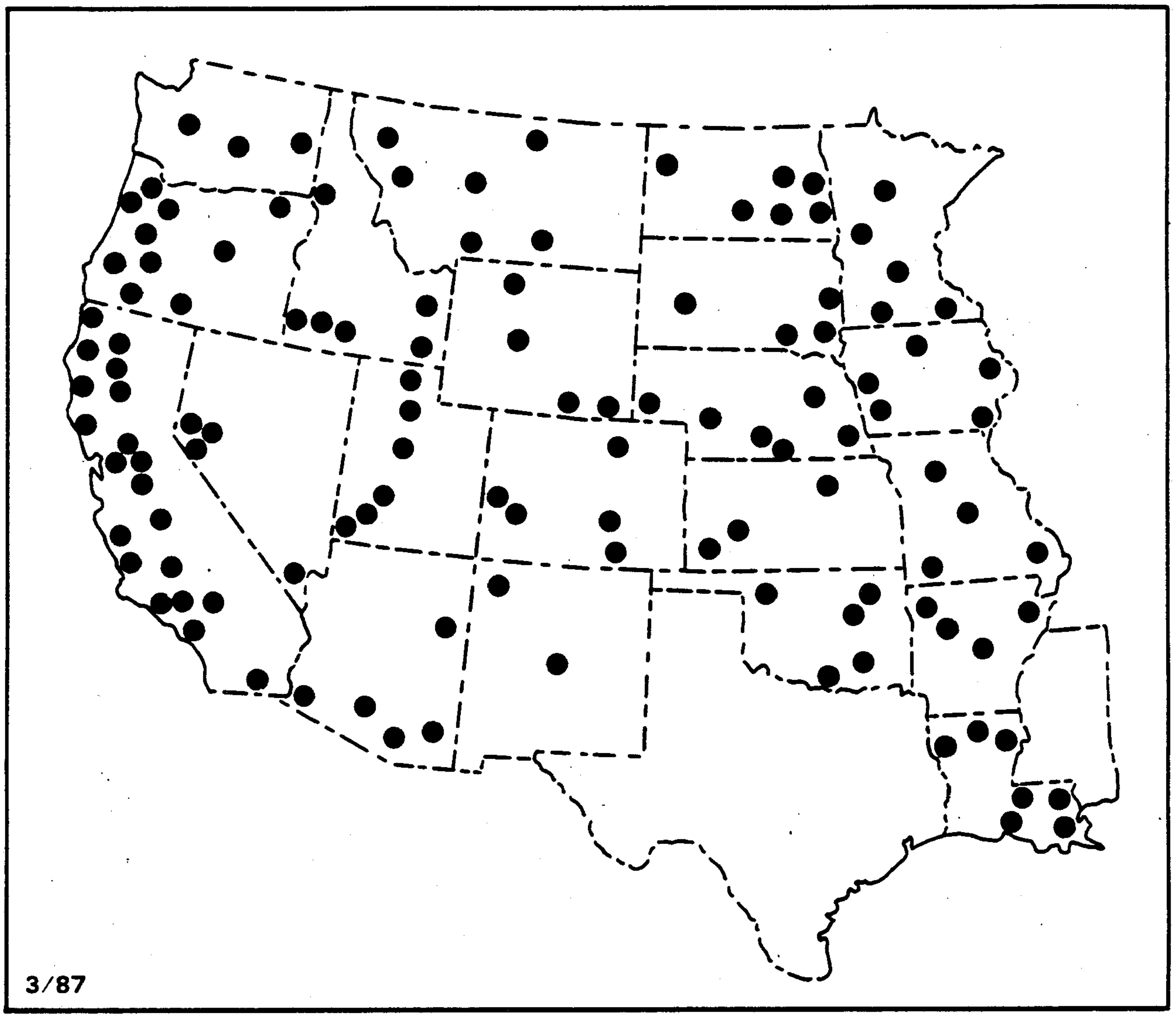

Figure 11. Standby milk surveillance network stations.

strontium-89 and strontium-90 are shown for each sampling location. As shown in Table 4, the average concentrations of tritium and strontium-90 for the whole network are similar to the network averages for previous years. The results obtained from the standby network are listed in Table E-9.

Other than naturally occurring potassium-40, only Cs-137 was detected (2 samples, standby network) by gamma spectrometry in milk samples (Table E-9). No radionuclides from the Chernobyl accident were detected in milk from the networks. A trace amount of iodine was detected in a special milk sample from Las Vegas.

TABLE 4. NETWORK ANNUAL AVERAGE CONCENTRATIONS OF TRITIUM AND STRONTIUM-90 IN MILK, 1975-1986

	Average Concentrations - pCi/L	
Year	H-3	Sr-90
1975	<400	<3
1976	<400	<2
1977	<400	<2
1978	<400	1.2
1979	<400	<3
1980	<400	<2
1981	<400	1.9
1982	<400	1.2
1983	<400	0.8
1984	<400	0.5
1985	<400	0.7
1986	<400	0.6

The tritium and strontium-90 concentrations for the whole milk network were plotted versus probits. The tendency of the data to fit one straight line indicates that the data represent a single source, which appears to be atmospheric deposition. These results are consistent with the results obtained for the Pasteurized Milk Network, operated by the Eastern Environmental Radiation Facility in Montogmery, Alabama, shown in Figure 12. The consistently higher results from New Orleans reflect the higher rainfall in that area.

Biomonitoring Program

Objective--

The pathways for transport of radionuclides to man include air, water, and food. Monitoring of air, water, and milk are discussed above. Locally raised meat is a food component that may be a potential route of exposure to off-site residents.

Methods--

Samples of muscle, lung, liver, kidney, blood, and bone are collected periodically from cattle purchased from commercial herds that graze areas northeast of the NTS. These samples are analyzed for gamma-emitters, tritium, strontium, and plutonium. Each November and December, bone and kidney samples from desert bighorn sheep collected throughout southern Nevada (see Figure 13) are donated by licensed hunters and are analyzed. These kinds of samples have been collected and analyzed for up to 29 years to determine long term trends. During 1986, following the Mighty Oak test, four NTS mule deer were collected and sampled in the same manner as the cattle.

Results--

Analytical data from bones and kidneys collected from desert bighorn sheep

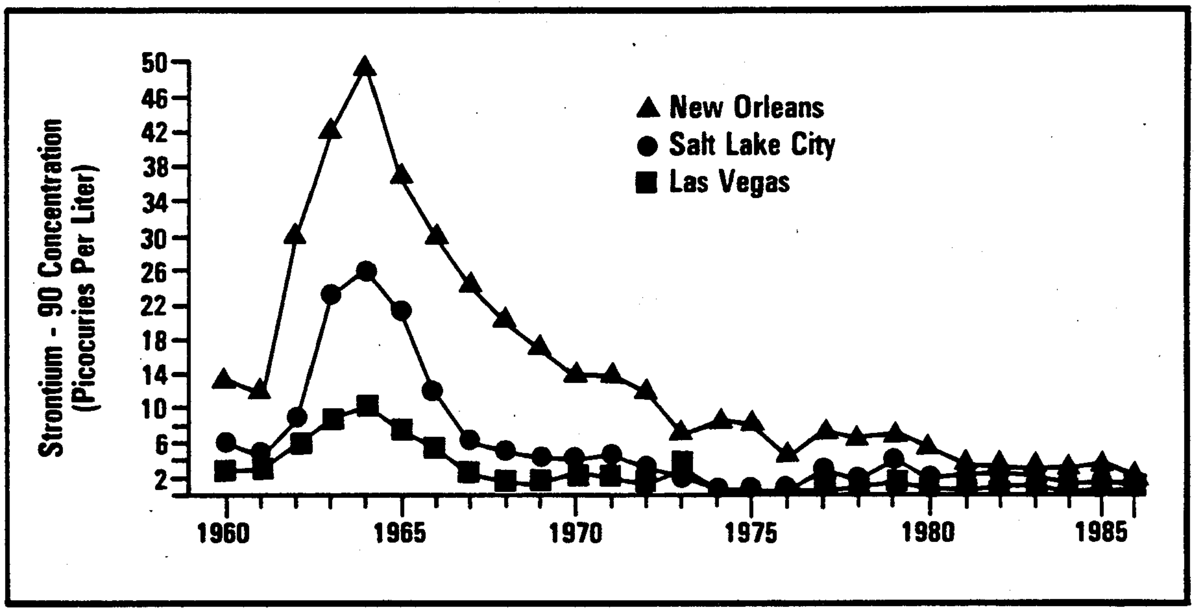

Figure 12. Strontium-90 concentration in Pasteurized Milk Network samples.

during the late Fall of 1985 are presented in Table 5. Tritium and gamma-emitting radionuclides, other than the naturally occurring potassium-40, were not detected in any of the kidneys. Strontium-90 levels in the bones (average 3.2 pCi/g ash, 118 Bq/kg) are consistent with those reported in recent years (Figure 14). Counting errors exceeded the reported concentrations of plutonium-238 in all but five samples of bone ash. These five values ranged from 2.1 to 4.1 fCi per gram of bone ash. Plutonium-239 concentrations in the ash ranged from -1.7 to 6.7 fCi/g, however, seven values exceeded the MDC and ranged from 1.9 to 6.7 fCi/g ash.

Eight beef cattle were sampled during 1986; four from the D. Agee ranch collected in May, and four from the Steve Medlin ranch collected in October. Iodine-131 (ranging from 1.5 to 27 pCi/g) was detected in the thyroids of all four beef animals sampled in May. The source of this iodine was thought to be the worldwide fallout associated with the Chernobyl reactor accident. The only other gamma-emitting radionuclides detected in soft tissue was naturally occurring potassium-40. Tritium was not detected in any of the blood samples. The cattle bone ash samples averaged 1.2 pCi of strontium-90 per gram of ash. None of the samples contained plutonium-238 concentrations that exceeded the counting errors and only two samples exceeded the counting error for plutonium-239 (14 ± 7 fCi/g ash and 4 ± 3.9 fCi/g ash). The cattle liver samples did not contain detectable concentrations of either plutonium-238 or -239; all were less than 0.06 pCi/kg wet weight.

Following the Mighty Oak test (April 10) it was decided to collect mule deer that drank the waters draining from the T-tunnel complex in Area 12 of the NTS. Deer were collected on June 17, September 9 and October 29. A control deer (No. 3) was collected October 23, in Area 17, well away from the Area 12

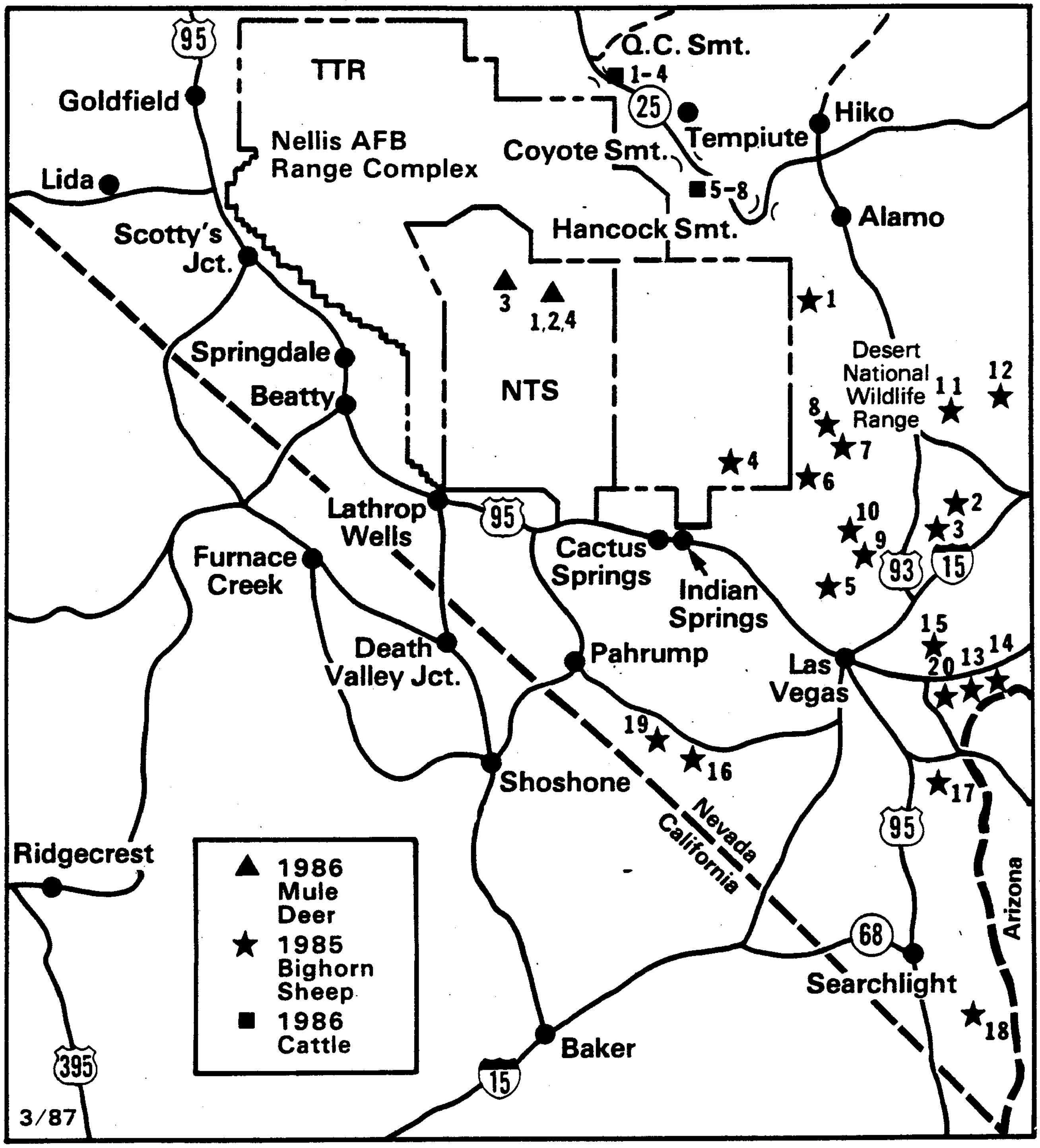

Figure 13. Collection sites for bighorn sheep, deer and cattle samples.

TABLE 5. RADIONUCLIDE CONCENTRATIONS IN DESERT BIGHORN SHEEP SAMPLES - 1985

Bighorn Sheep (Collected Winter 1985)	Bone 90 Sr (pCi/g Ash)	Bone 238 Pu (fCi/g Ash)	Bone 239 Pu (fCi/g Ash)	Kidney K(g/kg)* 3H(pCi/l)†
1	3.1 ± 0.1	3.7 ± 3.3	6.7 ± 0.4	4.1 ± 0.8 NA
2	1.6 ± 0.1	2.1 ± 2.1	4.2 ± 1.0	3.8 ± 0.5 NA
3	2.0 ± 0.1	2.5 ± 2.3	1.9 ± 1.9**	4.0 ± 0.4 NA
4	---------------Ash Sample Lost---------------			3.3 ± 0.4 120 ± 440**
5	1.9 ± 0.1	4.1 ± 5.4**	1.3 ± 2.7**	4.0 ± 0.8 -100 ± 430**
6	2.4 ± 0.1	8.7 ± 17.**	0.3 ± 0.8**	2.2 ± 0.9 -100 ± 430**
7	2.1 ± 0.1	3.1 ± 18.**	0.31 ± 0.9**	4.9 ± 0.7 490 ± 430
8	2.1 ± 0.1	2.3 ± 2.4**	0.7 ± 2.0**	4.1 ± 0.5 NA
9	6.2 ± 0.1	2.7 ± 14.**	2.9 ± 2.4	2.7 ± 0.1 170 ± 440**
10	2.1 ± 0.2	-4.7 ± 16.**	0.5 ± 1.3**	3.7 ± 0.4 150 ± 440**
11	1.5 ± 0.1	-2.3 ± 2.5**	0.3 ± 1.7**	2.5 ± 0.5 230 ± 440**
12	2.8 ± 0.1	1.1 ± 1.3**	2.3 ± 1.9	4.5 ± 0.7 290 ± 440**
13	5.7 ± 0.1	2.7 ± 16**	0 ± 1.6**	2.2 ± 0.5 0 ± 440**
14	1.4 ± 0.1	4.1 ± 3.0	2.7 ± 2.2	4.7 ± 0.7 -140 ± 440**
15	9.6 ± 0.1	1.3 ± 2.1**	0.3 ± 1.1**	2.6 ± 0.9 150 ± 440**

(continued)

TABLE 5. Continued

Bighorn Sheep (Collected Winter 1985)	Bone 90 Sr (pCi/g Ash)	Bone 238 Pu (fCi/g Ash)	Bone 239 Pu (fCi/g Ash)	Kidney K(g/kg)* 3H(pCi/l)‡
16	2.0 ± 0.2	3.8 ± 2.7	4.5 ± 2.8	2.9 ± 0.5 290 ± 440**
17	5.5 ± 0.1	-4.9 ± 11**	4.7 ± 2.7	2.9 ± 0.6 260 ± 440**
18	1.0 ± 0.1	3.6 ± 18**	0 ± 2.8**	2.6 ± 0.1 -59 ± 440**
19	6.3 ± 0.1	-4.9 ± 12**	0 ± 0.9**	3.2 ± 0.5 210 ± 440**
20	1.6 ± 0.1	1.7 ± 3.9**	-1.7 ± 1.8*	4.9 ± 0.8 360 ± 440**
Median	2.1	2.7	2.9	3.7 160
Range	1.0 - 9.6	-4.9 - 8.7	-1.7 - 6.7	2.2 - 4.9 -140 - 490

* Wet weight
**Counting error exceeds reported activity
‡Aqueous portion of Kidney Tissue
All concentrations are expressed with either the 2 sigma counting error or, for results less than the value in error term field, ± the MDC.

tunnels. A wide variety of fresh fission products (I-131, Ru-103 and -106, Zr-95, Sr-89, etc.) was detected in the tissue and ingesta samples from the deer drinking from the T-tunnel ponds. The data are presented in Table 6. Iodine-131 was still detectable in the thyroids of deer No. 4, sampled on September 9, some 172 days post-detonation.

EXTERNAL EXPOSURE MONITORING

Thermoluminescent Dosimetry Network

External radiation exposure of people is due primarily to medical sources and to natural sources such as cosmic radiation and naturally occurring radioactivity in soil. Radioactivity from fallout generated by past atmospheric nuclear testing causes approximately 0.6 percent of a person's total contemporary exposure. Until 1965, film badges were used to document external exposure,

TABLE 6. RADIONUCLIDE CONCENTRATION IN TISSUES FROM MULE DEER COLLECTED ON THE NEVADA TEST SITE - 1986

Tissue	131-I (pCi/g)	103-Ru (pCi/g)	137-Cs (pCi/g)	106-Ru (pCi/g)	H_3 (µCi/l)[a]	239 Pu fCi/g/ash	238 Pu fCi/g/ash	90 Sr pCi/g/ash	89 Sr pCi/g/ash
Mule Deer No. 1 Collected 6/17/86									
Thyroid	2.0×10^{6} $\pm3.2\times10^{2}$								
Kidney	110±0.4	9±0.09	0.8±0.04		130±0.3	-1±4[f]	1±4[f]		
Liver	80±0.3	2.6±0.05	0.4±0.3						
Lung	90±0.5	0.5±0.05	0.3±0.04			24±7	2.4±40[f]		
Muscle	16±0.2	0.4±0.03	0.2±0.03						
Blood	90±0.4	0.1±0.02	0.05±0.01		150±0.3	6±2	0±330[f]		
Rumen[b] Contents	110±4.7	8±0.3	0.2±0.03	1.2±0.4		36±7	9±3		
Bone						-0.2±0.2[f]	-2±2[f]	2.8±0.1	
Mule Deer No. 2 Collected 9/9/86									
Thyroid	5300±19	ND		ND					
Kidney[d]	0.18±0.04	1.8±0.04	0.09±0.02	0.9±0.1					
Muscle[e]	ND	0.3±0.02	0.2±0.02	0.2±0.08	100±0.2				
Liver	0.4±0.04	0.9±0.03	0.05±0.003						

(continued)

TABLE 6. (Continued)

Tissue	131-I (pCi/g)	103-Ru (pCi/g)	137-Cs (pCi/g)	106-Ru (pCi/g)	H_3 (µCi/l)[a]	239 Pu fCi/g/ash	238 Pu fCi/g/ash	90 Sr pCi/g/ash	89 Sr pCi/g/ash
Lung	0.04±0.02	0.08±0.01	0.02±0.007						
Rumen[c] Contents	0.1±0.03	0.7±0.02	0.03±0.01	0.4±0.09	90±0.2	0.3±1.1[f]	-1±15[f]		
Bone						-2±1.5	0.3±11[f]	1±0.4	21±0.3
Mule Deer No. 3 Collected 10/23/86									
Thyroid	Gamma Spectrum Negligible								
Kidney	Gamma Spectrum Negligible				0.0009±0.00006				
Liver	Gamma Spectrum Negligible								
Lung	Gamma Spectrum Negligible								
Muscle	Gamma Spectrum Negligible								
Blood	Gamma Spectrum Negligible								
Rumen Contents	Gamma Spectrum Negligible					-4±1.8[f]			
Bone							5.5±4	0.6±0.1	0.1±0.6[f]

(continued)

TABLE 6. (Continued)

Tissue	131-I (pCi/g)	103-Ru (pCi/g)	137-Cs (pCi/g)	106-Ru (pCi/g)	H_3 (μCi/l)[a]	239 Pu fCi/g/ash	238 Pu fCi/g/ash	90 Sr pCi/g/ash	89 Sr pCi/g/ash
Mule Deer No. 4 Collected 10/29/86									
Thyroid	12±1								
Kidney	Gamma Spectrum Negligible								
Muscle	0.1±0.06	0.1±0.03							
Liver[g]	0.7±0.1	0.04±0.02	1.0±0.3						
Rumen[h] Contents	0.06±0.007	0.7±0.03	<0.4						
Blood					180±0.3				
Bone						1.0±2.7[d]	4.4±4.1	1.2±0.4	16±1.8

[a]Aqueous portion of tissue sampled.
[b]Rumen Contents from Mule deer 1 also contained ^{95}Zr (3.6 ± 0.1 pCi/g) and ^{95}Nb (0.14 ± 0.03 pCi/g).
[c]Rumen Contents from Mule deer 2 contained ^{22}Na (0.03 ± 0.01).
[d]Kidney from Mule deer 2 also contained ^{203}Hg (0.09 ± 0.02 pCi/g) and ^{22}Na (0.03 ± 0.02 pCi/g).
[e]Muscle from Mule deer 2 contained ^{203}Hg 90.03 ± 0.01).
[f]Counting error exceeded reported activity.
[g]Liver from Mule deer 4 also contained ^{124}Sb (0.08 ± 0.04 pCi/g) and ^{125}Sb (0.7 ± 0.07 pCi/g).
[h]Rumen Contents for Mule deer 4 also contained ^{124}Sb (6 ± 0.2 pCi/g), ^{125}Sb (0.6 ± 0.1 pCi/g) and ^{95}N (0.4 ± 0.1).

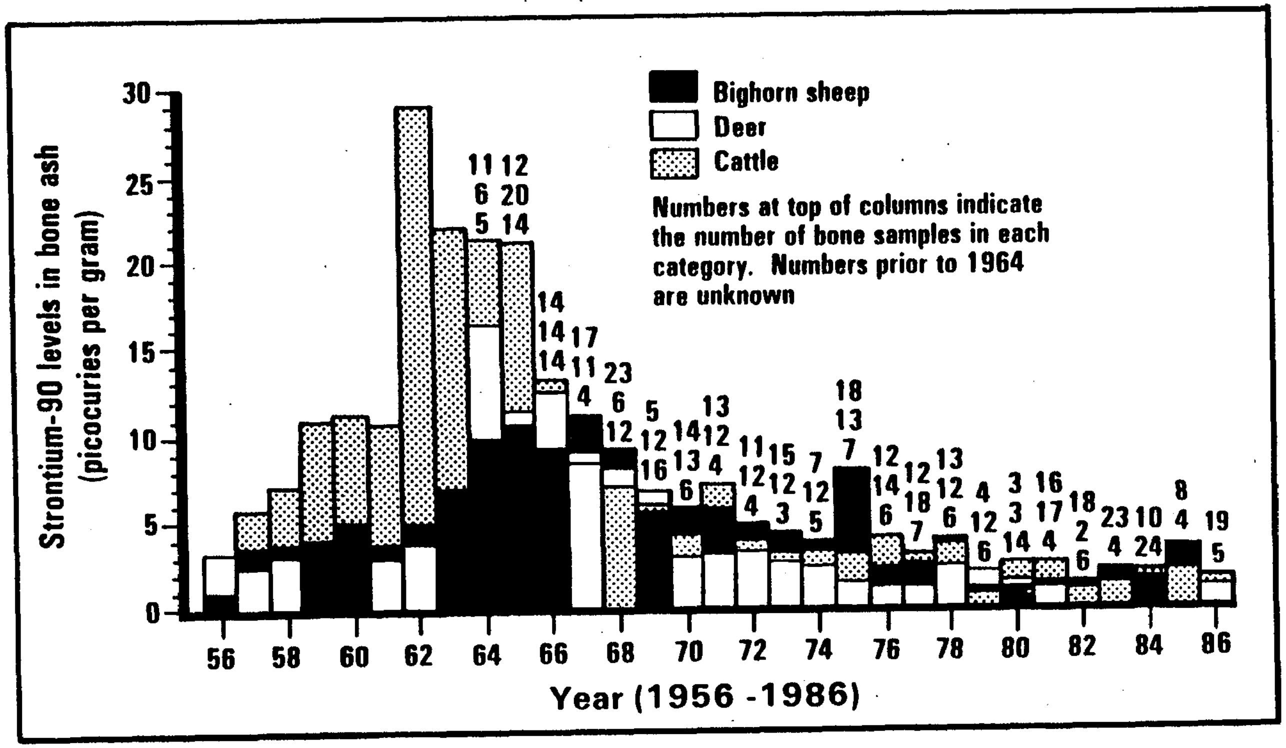

Figure 14. Average strontium-90 concentration in animal bone.

but thermoluminescent dosimeters (TLD) gradually replaced film as the measurement instrument because of their greater sensitivity and precision. From 1970 to 1974 the EMSL-LV used the TLD-12 dosimeter but changed to the TLD-200 in 1975. In 1987, a change will be made to use Panasonic TLD's instead of the Harshaw model now used.

Network Design--

The TLD network is designed to measure environmental radiation exposure at a location rather than to an individual because of the many uncertainties associated with personnel monitoring. However, several individuals, some residing within and some residing outside of estimated fallout zones from past nuclear tests at the NTS, have been monitored so that any correlations that may exist between personnel and environmental monitoring could be obtained. The network consists of locations encircling the NTS with some concentration in the area of the estimated fallout zones (Figure 15). This arrangement permits an estimate of average background exposure; yet any increase due to NTS activities can be detected.

Methods--

In 1986 the TLD Network consisted of 129 stations at both inhabited and uninhabited locations within a 500-km radius of the CP-1. Each station was equipped with three Harshaw TLD's to measure gamma exposures resulting from environmental background as well as accidental releases of gamma-emitting radioactivity. Within the area covered by the Network, 53 off-site residents wore dosimeters during 1986. All environmental TLD's were exchanged quarterly, and all personnel TLD's were exchanged monthly.

The Harshaw Model 2271-G2 (TLD-200) dosimeter consists of two small "chips" of dysprosium-activated calcium fluoride mounted in a window of Teflon plastic attached to a small aluminum card. An energy compensation shield of 1.2-mm thick cadmium metal is placed over the card containing the chips, and the shielded card is then sealed in an opaque plastic card holder. Three of these dosimeters are placed in a secured, rugged, plastic housing one meter above ground level at each station to standardize the exposure geometry. One dosimeter is issued to each of 53 off-site residents who are instructed in its proper wearing.

After appropriate corrections were made for exposure accumulated during shipment between the laboratory and the monitoring location, and for fading and the response factor, the six TLD chip readings for each station were averaged. The average value for each station was then compared to the values obtained during the previous four quarters at that station to determine whether the new value was statistically different from the previous values. The result from each of the personnel dosimeters was compared to the average background value measured at the nearest fixed station over the previous four quarters.

The smallest exposure above background radiation that can be determined from these TLD readings depends primarily on the magnitude of variations in the natural background exposure rate at the particular station. Typically, the smallest net exposure detectable at the 99 percent confidence level for a 90-day exposure period would be 1 to 5 mR above background. Depending on

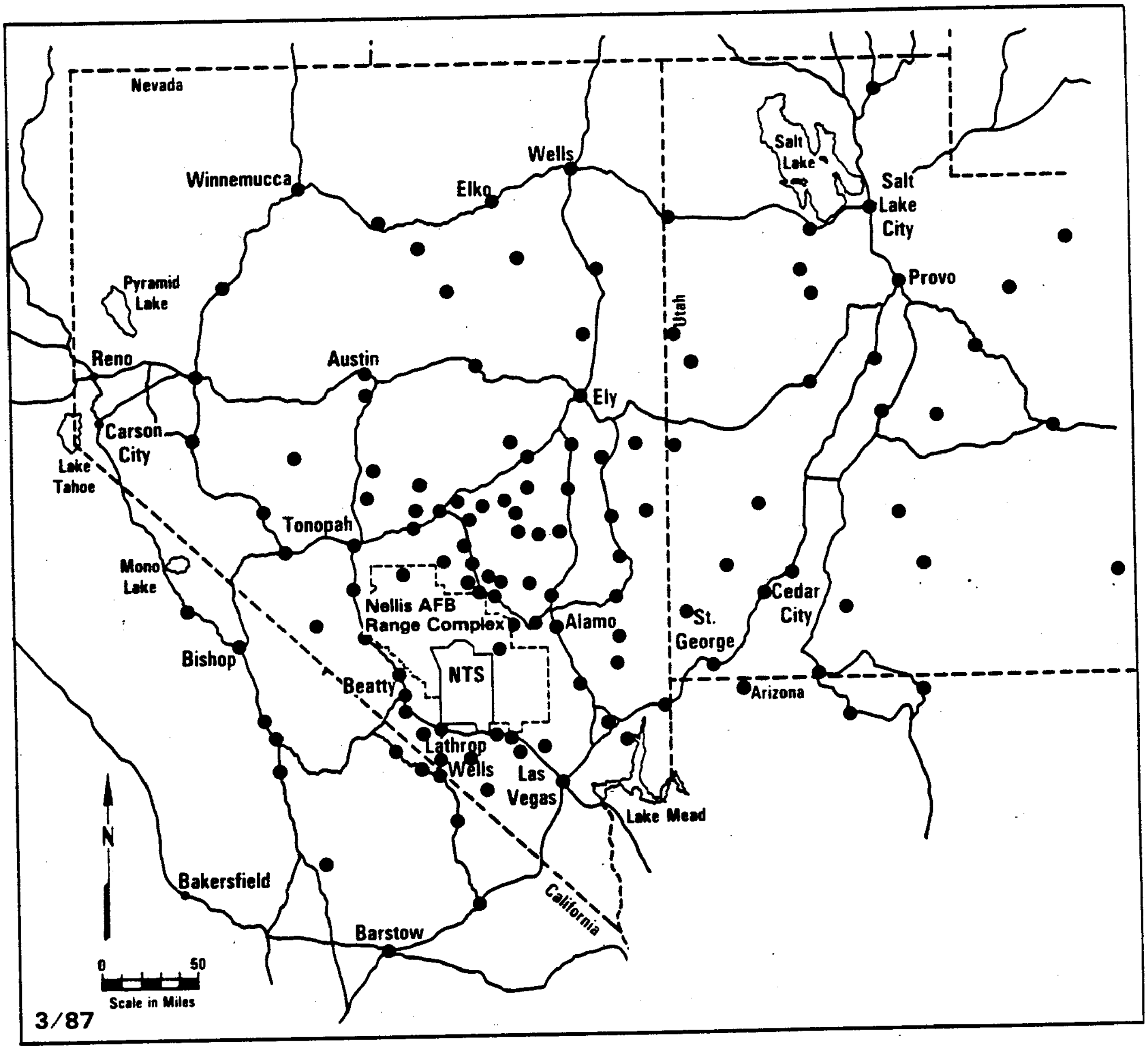

Figure 15. Locations monitored with TLD's.

location, the background ranges from 15 to 35 mR per quarter. The term "background," as used in this context, refers to naturally occurring radioactivity and cosmic rays plus a contribution from residual manmade fission products, such as worldwide fallout.

Results--

Appendix Table E-10 lists the maximum, minimum, and average dose equivalent rate (mrem/day) and the annual adjusted dose equivalent rate (average in mrem/day times the number of days in the year) measured at each station in the Network during 1986. No allowance was made for the small additional exposure due to the neutron component of the cosmic ray spectrum. No station exhibited an exposure in excess of background during 1986.

Appendix Table E-11 lists the personnel number; associated background station; the maximum, minimum, and average dose equivalent rate (mrem/d); and the annual dose equivalent (mrem) measured for each off-site resident monitored during 1986. Twelve dosimeters worn by residents exhibited exposures in excess of background. These exposures are attributed to higher background levels in the residence than at the background station location or to occupational exposure (Nos. 45, 49, 57). Usually, the average dose equivalent rates of the off-site residents is lower than their background stations due to the shielding provided by their homes or places of work.

Table 7 shows that the average annual dose rate for the Dosimetry Network is consistent with the Network average established in 1975. Annual doses decreased from 1971 to 1975 with a leveling trend since 1975, except for a high bias in the 1977 results attributed to mechanical readout problems. The trend shown by the Network average is indicative of the trend exhibited by individual stations, although this average is also affected by the mix of stations at different altitudes (note Figure 16).

Because of the great range in the results, 40 to 135 mrem, an average for the whole area monitored may be inappropriate for estimating individual exposure. This would be particularly true if the exposure of a particular resident were desired. Since environmental radiation exposure can vary markedly with both altitude and the natural radioactivity in the soil, and since the altitude of the TLD station location is relatively easy to obtain, the measured dose rates for 1975 to 1986 were plotted as a function of altitude. As most of Nevada lies between 2,000 and 6,000 feet above mean sea level, this range was split into two sections for plotting purposes. The results, shown in Figure 16, indicate that the average exposure at altitudes between 4,000 and 6,000 feet is about 17 mrem/yr (0.17 mSv/yr) higher than that at altitudes between 2,000 and 4,000 feet, although both curves follow the same trend as the overall averages listed in Table 7. Thus, if an individual does not live near a monitored location, an estimate of exposure could be based on the altitude of his residence rather than on the average for the whole area monitored.

Pressurized Ion Chamber (PIC) Network

These gamma-ray ratemeters are located at the 15 Community Monitoring Stations identified on Figure 2 plus stations at Complex I, Furnace Creek, Nyala, Pioche, Stone Cabin Ranch, Tikaboo Valley, Twin Springs, and Lathrop

Wells. The output of each PIC is displayed on both a paper tape and a digital readout, so the station manager can observe the response. The data is also stored on cassette tapes, which are read into a computer at EMSL-LV each week. The computer output consists of tables containing hourly, daily, and weekly summaries of the maximum, minimum, average, and standard deviation of the gamma exposure rate.

The data for 1986 are displayed in Table 8 as the average μR/hr and annual mR from each station. When these data are compared to the TLD results for the same 23 stations, it is found that the PIC exposure is about 30% higher than the TLD exposure. This is attributed, primarily, to the difference in energy response of the two instruments. No increase in external gamma measurements was found following the Chernobyl accident or the purging of the Mighty Oak tunnel.

INTERNAL EXPOSURE MONITORING

Internal exposure is caused by ingested or inhaled radionuclides that remain in the body either temporarily or for longer times because of storage in tissues. At EMSL-LV two methods are used to detect such body-burdens: whole-body counting and urinalysis.

The whole-body counting facility has been maintained at EMSL-LV since 1966 and is equipped to determine the identity and quantity of gamma-emitting radioactive materials which may have been inhaled or ingested. A single thallium-activated sodium iodide crystal, 28 x 10 centimeters, is used to measure gamma radiation having energies ranging from 0.1 to 2.5 MeV. Two phoswich detectors are available and can be placed on the chest to measure low-energy radiation - for example, 17 KeV x-rays from plutonium-239. The most likely mode of intake for most alpha-emitting radionuclides is inhalation, and the most important of these radionuclides also emit low-energy x-rays which can be detected in the lungs by the phoswich detectors. An additional phoswich detector is used to determine low-energy radionuclide concentrations in bone, by moving the detector around the skull.

To upgrade the facility, a single intrinsic coaxial detector has been installed for use with an adjustable chair to achieve greater resolution and lower background with greater patient comfort in whole-body counting. In addition, two intrinsic planar detectors were installed in special holders designed to allow them to be positioned in various attitudes to facilitate the counting of areas other than the lungs and to allow additional detectors to be mounted as they are obtained. The planars are specially designed for internal dosimetry use and provide low background, high resolution analysis of low energy gamma-emitting radionuclides. With the addition of specially designed software, the ability to identify transuranic radionuclides will be greatly increased.

A Micro-Vax-based gamma spectrometer was installed to process data from both the old and the new detector systems. It facilitates manipulation of data, gives greater storage capacity, and reliability of operation. The old

TABLE 7. DOSIMETRY NETWORK SUMMARY FOR THE YEARS 1971 - 1986

Environmental Radiation Dose Rate (mrem/y)			
Year	Maximum	Minimum	Average
1971	250	102	160
1972	200	84	144
1973	180	80	123
1974	160	62	114
1975	140	51	94
1976	140	51	94
1977	170	60	101
1978	150	50	95
1979	140	49	92
1980	140	51	90
1981	142	40	90
1982	139	42	88
1983	140	42	87
1984	133	35	85
1985	142	40	85
1986	135	40	85

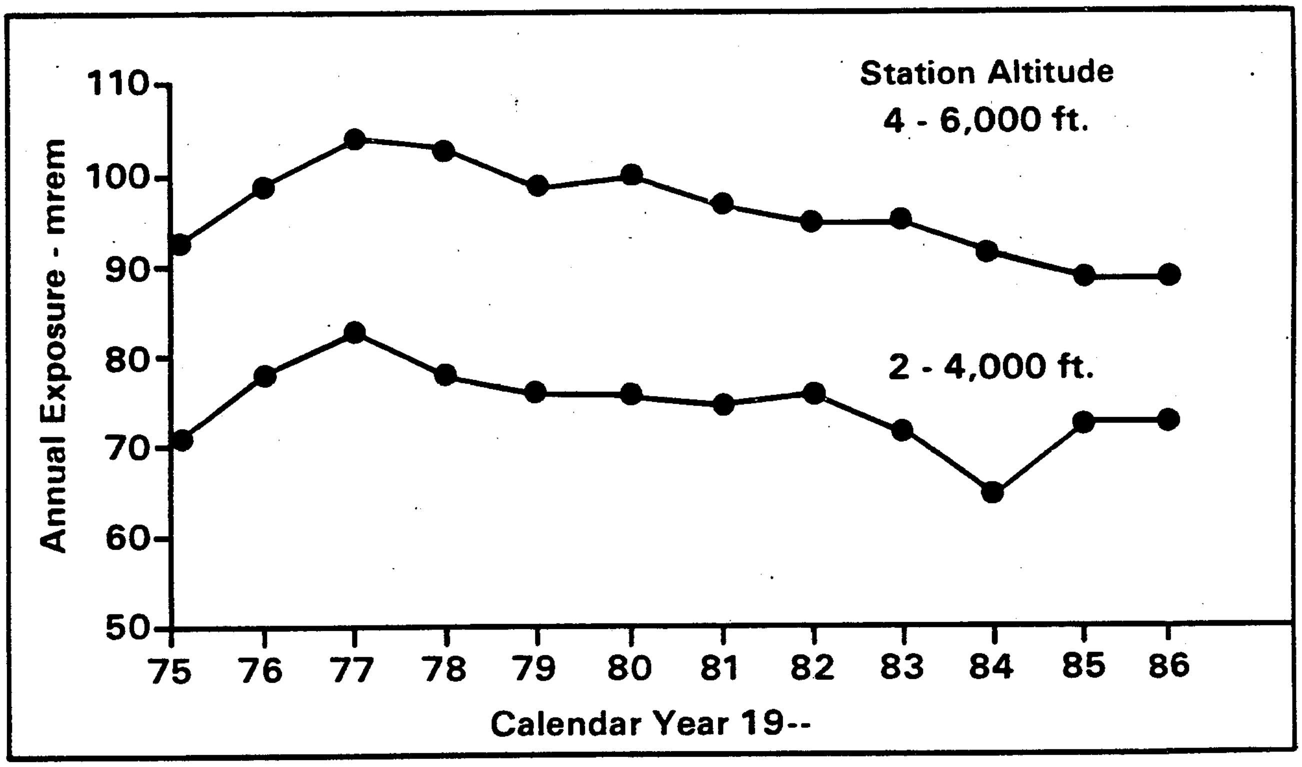

Figure 16. Average annual TLD exposure as a function of station altitude.

TABLE 8. PRESSURIZED ION CHAMBER READINGS - 1986

STATION LOCATION	NO. OF HOURLY VALUES	EXPOSURE RATE, μR/H* MAX	MIN	AVG + 1 SD	MR/YR
ALAMO, NV	8130	16.61	12.39	13.23 ± 0.36	116
AUSTIN, NV	8174	27.42	15.40	19.97 ± 0.87	175
BEATTY, NV	8253	24.23	10.80	16.41 ± 1.05	144
CEDAR CITY, UT	7146	14.51	9.82	10.63 ± 0.43	93
COMPLEX 1, NV	7547	22.33	15.60	17.34 ± 0.58	151
ELY, NV	8072	17.27	11.85	12.57 ± 0.34	110
FURNACE CREEK, CA	7388	16.20	9.20	9.96 ± 0.44	87
GOLDFIELD, NV	7721	21.16	15.20	15.93 ± 0.35	140
INDIAN SPRINGS, NV	8083	14.66	8.39	8.99 ± 0.27	78
LAS VEGAS, NV (UNLV)	8072	10.51	6.06	6.44 ± 0.18	56
LATHROP WELLS, NV	7617	17.92	13.28	14.18 ± 0.27	124
NYALA, NV	7383	17.74	12.30	13.07 ± 0.40	114
OVERTON, NV	8082	11.82	8.00	8.53 ± 0.33	75
PAHRUMP, NV	7596	13.99	7.36	7.81 ± 0.21	68
PIOCHE, NV	7576	17.83	12.12	12.90 ± 0.34	113
RACHEL, NV	7723	20.53	16.08	17.13 ± 0.49	150
SALT LAKE CITY, UT	7782	23.24	7.63	9.73 ± 2.86	85
SHOSHONE, CA	8017	14.71	10.87	11.67 ± 0.34	102
ST. GEORGE, UT	8277	11.98	7.86	8.79 ± 0.46	77
STONE CABIN RNCH, NV	6471	20.98	15.88	17.74 ± 0.79	155
TIKABOO VALLEY, NV	7991	22.46	15.30	16.18 ± 0.30	142
TONOPAH, NV	7882	22.40	16.65	17.63 ± 0.42	154
TWIN SPRGS RANCH, NV	5684	22.42	15.83	17.13 ± 0.56	150

*The MAX and MIN values are obtained from the instantaneous readings.

spectrometer is being retained until data accumulated in past years is converted to the new format.

New quality assurance software obtained with the Micro Vax provides statistical analysis and plots that in the past, required many tedious hours to maintain. Dose calculation software provides organ specific analysis for accurate internal monitoring. Software for internal dose calculation was also obtained for use on a portable computer in the mobile counting van or for other field use. This and two complete counting systems were readied for deployment to areas affected by the Chernobyl accident.

Network Design

This activity consists of two portions, an Off-Site Human Surveillance Program and a Radiological Safety Program. The design for the Off-Site Human Surveillance Program is to measure radionuclide body-burdens in a representative number of families who reside in areas that were subjected to fallout during the early years of nuclear weapons tests. A few families who reside in areas not affected by such fallout were also selected for comparative study. The principal constraint to the program is the cooperation received from the people in the area of study.

The Radiological Safety Program portion requires all employees who may be exposed to radioactive materials in the course of their work to undergo a periodic whole-body count. Some DOE contractor employees are also included in this program.

Methods

The Off-Site Human Surveillance Program was initiated in December 1970 to determine levels of radioactive nuclides in some of the families residing in communities and ranches surrounding the NTS. Biannual counting is performed in the spring and fall. This program started with 34 families (142 individuals). In 1986, 16 of these families (37 individuals) were still active in the program together with 18 families added in recent years. The geographical locations of the families which participated in 1986 are shown in Figure 17. Two additional families were added to the program during 1986.

These persons travel to the EMSL-LV where a whole-body count of each person is made to determine the body burden of gamma-emitting radionuclides. A urine sample is collected for tritium analysis. Results of the whole-body count are available before the families leave the facility and are discussed with the subjects. At 18 month intervals a physical exam, health history and the following are performed: a urinalysis, complete blood count, serology, chest x-ray (3-year intervals), sight screening, audiogram, vital capacity, EKG (over 40 years old), and thyroid panel. The individual is then examined by a physician. The results of the examination can then be requested for use by their family physician.

As reported in previous years, medical examination of the off-site families revealed a generally healthy population. In regard to the hematological examinations and thyroid profiles, no abnormal results were observed which could be attributed to past or present NTS testing operations.

In addition to the above off-site families, counts are performed routinely on EPA and on contractor's employees as a part of the health monitoring programs. Counts on other individuals in the general population from Las Vegas and other cities are used for comparison.

Results

During 1986, a total of 208 NaI(Tl)/Germanium, and 416 phoswich/planar spectra were obtained from individuals, of whom 102 were participants on the Off-Site Human Surveillance Program. Also, about 1,814 spectra for calibrations and background were generated. Cesium-137 is generally the only fission product detected. This year, following the Chernobyl accident, trace amounts of cesium-137, and cobalt-60 were detected in a limited number of individuals, mainly those contractor personnel flown in from California. Several ranchers actively involved in farming also showed a trace of these radionuclides. Time did not allow sufficient data to be collected to accurately quantitate the amounts found. No fission products were detected from counts of individuals

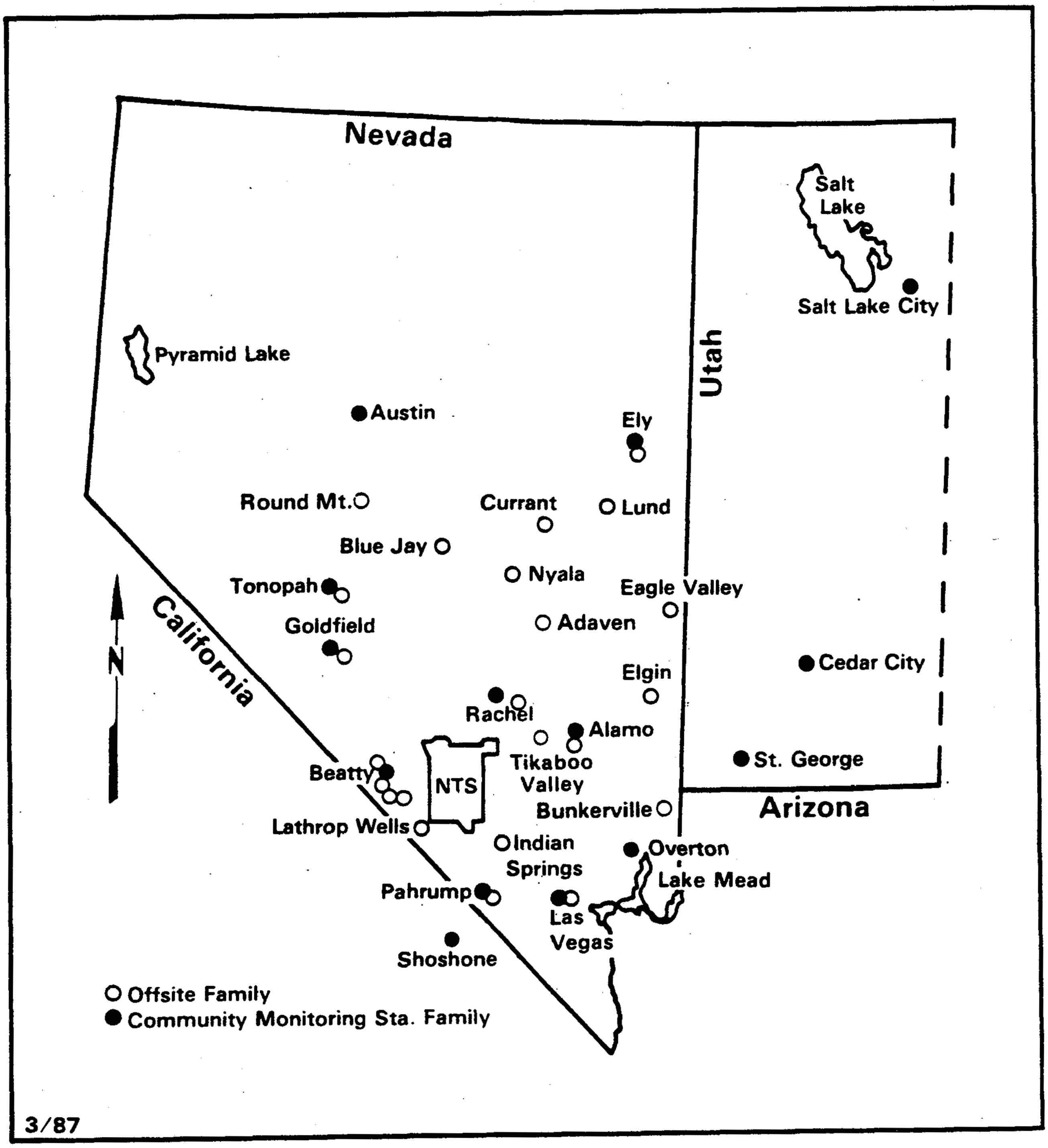

Figure 17. Location of families in the Off-Site Human Surveillance Program.

traveling or living in Europe during the Chernobyl accident when they were counted some time after the incident. Prior to Chernobyl, the spectra were representative of normal background for people and showed only naturally occurring potassium-40. No transuranic nuclides were detected in any lung counting data.

The concentration of tritium in urine samples from the off-site residents varied from 0 to 3,200 pCi/L (118 Bq/L) with an average value of 158 pCi/L (5.8 Bq/L). Nearly all the concentrations measured were in the range of background levels measured in water and reflect only natural exposure. The source for the high value (an Ely, Nevada resident) is unknown but is not attributed to NTS activities. The tritium concentration in urines from EPA employees had a range of 0 to 3,000 pCi/L (111 Bq/L) and an average of 316 pCi/L (11.7 Bq/L). Contractor personnel working at NTS showed tritium levels above background but below maximum permissible body burdens.

COMMUNITY MONITORING STATIONS

In order to increase public knowledge about and participation in radiological surveillance activities as conducted by DOE and EPA; the DOE, through an Interagency Agreement with EPA and contracts with the Desert Research Institute (DRI) of the University of Nevada and the University of Utah, has established a network of 15 Community Monitoring Stations in the off-NTS areas. Each station is operated by a local resident, in most cases a science teacher, who is trained in radiological surveillance methods by the University of Utah. The stations are equipped and maintained, and samples are collected and analyzed by EMSL-LV. DRI provides data interpretation to the communities involved and pays the station operators for their services.

Each station contains one of the samplers for the ASN, NGTSN and Dosimetry networks discussed earlier, plus a pressurized ion chamber (PIC) and recorder for immediate readout of external gamma exposure, and a recording barograph. All of the equipment is mounted on a stand at a convenient location in each community so the residents are aware of the surveillance and, if interested, can have ready access to the data. The station locations are those indicated in Figure 2.

The data from these stations are included in the tables in Appendix E with the other data from the appropriate networks. Table 8 contains a summary of the PIC data.

CLAIMS INVESTIGATIONS

One of the public service functions of the EMSL-LV is to investigate claims of injury allegedly due to radiation originating from NTS activities. A veterinarian, qualified by education and experience in the field of radiobiology, investigates claims of radiation injury for domestic animals to determine whether or not radiation exposure may be involved. In most cases the injuries investigated have been due to common causes such as bacterial infections or unusual events such as feeding on halogeton, a poisonous plant. No such claims were made in 1986.

PUBLIC INFORMATION PROGRAM

An important function of the Off-Site Program has been to create and maintain, to the extent possible, public confidence that all reasonable safeguards are being employed to preserve public health and property from possible hazards resulting from nuclear testing. Much of this responsibility is carried out through personal contact with off-site residents by the radiation monitors who advise the residents of program developments and answer questions about test activities.

For any test where ground motion may be perceptible off site, monitors visit remote locations and active mines beforehand to advise operators of possible problems. They also stand by on test day to advise of schedule changes. Mine operators are reimbursed for time lost due to these activities. After the test, monitors inform all their contacts that the test is over and whether or not any radiation was detected off site. The community monitoring station managers are informed by telephone of all announced test events and of their completion.

In July-August 1986, the EMSL-LV participated with the DOE in a 1-week refresher course for station managers arranged by the University of Utah and the Desert Research Institute. No major changes in the program are anticipated.

The series of "town hall" meetings, initiated during Fiscal Year 1982 near community monitoring stations was continued for CY 1986. The meetings were organized to familiarize the local citizenry with the NTS nuclear testing and related activities, to show how the surveillance networks function, and to answer questions or expressed concerns of the attending public. During CY86, meetings were held according to the following schedule:

Alamo, NV	January 21	Ely, NV	July 16
Pioche, NV	January 22	Lund, NV	July 17
Pahrump, NV	January 23	Tonopah, NV	September 17
Dolan Springs, AZ	March 23	Beatty, NV	September 18
Rachel, NV	May 14	Indian Springs, NV	October 21
Panguich, UT	June 11	Mt. Charleston, NV	October 23
Orderville, UT	June 12	Venyo, UT	November 19
		Santa Clara, UT	November 20

Personnel from the EMSL-LV addressed other citizen groups during CY86 as listed below:

July 8, 1986	Deer migration slides were shown to O.C.C. at NTS. Approximately 30 people from various agencies attended.
August 18, 1986	A slide presentation of the communication aspects of equipment used for the deer migration study was given to

the radio communication section in Mercury during their monthly safety meeting.

August 19, 1986 — Deer migration study slides were shown to personnel at U.S. Ecology outside of Beatty, Nevada. A great deal of interest had been generated because the manager had killed a tagged deer from the NTS the previous fall.

Other activities included arranging NTS tours for businesses and community leaders from Round Mountain, Rachel, Alamo, and Lincoln County, Nevada, and from Kingman, Arizona.

With the continued population growth in the off-site area in recent years and the continuing concern for keeping radiation exposures as low as reasonably achievable, the EMSL-LV realized that it would need local government assistance to implement all protective actions that could be needed to protect close-in population centers should an underground nuclear test accidently vent. The EMSL-LV staff discussed the kinds of assistance needed with the Nevada State Division of Emergency Management, and obtained the State's concurrence with its plan to work with County emergency management officials to develop modifications or additions to their adopted emergency response plans. These changes would specify protective actions and procedures for implementing them and would serve as formal agreements on Federal and local government responsibilities and authorities.

During 1986, an Appendix to the Radiological Defense Annex of the Clark County, Nevada and Inyo County, California emergency plans was prepared. The County plans, with their new appendices, will be annexed to the master plan DOE is developing for off-site emergency response for an accidental venting or seepage at the Nevada Test Site. As part of these plans, 12,000 film badges were distributed to 13 locations in Lincoln and Nye Counties with the objective of providing personal dosimetry for at least one person per family or about two-thirds of the total population in major population centers. Issue of badges will be performed by county or state personnel in the unlikely event of a significant release of radioactive material from the NTS. Film badge locations are being selected for Esmeralda and White Pine Counties (Nevada). It is planned to replace the film badges with TLD's during FY 1987.

To improve it's services to communities in the environs of the Nevada Test Site, to help dispel some of the misunderstanding concerning radiation, and to provide students with some of the knowledge they need to participate in the decision making processes, and to enable them to deal with the nuclear testing and waste storage and disposal problems facing the citizens of Nevada, the NRD staff developed a program of lectures and laboratory exercises for presentation to students.

Beginning in mid-October, 1986, a NRD staff member began teaching basic radiation concepts to students in high school biology, chemistry, physics and general science classes. The instructor spends 4 or 5 days at each school. During this time he presents lecture-demonstrations and conducts laboratory exercises. Although the concepts presented at each school may differ somewhat due to teachers' requests and the grade-level of the students involved, the lecturers deal with such topics as:

Introduction to Radiation Science--An Historical Perspective;

Radioactive Decay Processes;

Biological Effects of Ionizing Radiation;

Monitoring Radiation in the Environment, and

Nuclear Waste Problems.

Several laboratory exercises, designed to introduce students to radiation measurement techniques are included during each school visit. The program was approved by the school boards in both Lincoln and Nye counties, and has been conducted at the schools listed below, the program will be continued at other schools during 1987.

1.	Pahrump High School, Pahrump, Nevada	October 20-24
2.	Gabbs High School, Gabbs, Nevada	October 27-30
3.	Lincoln County High School, Panaca, Nevada	November 03-07
4.	Pahranagat Valley High School, Alamo, Nevada	December 01-05

DOSE ASSESSMENT

During calendar year 1986 there were five sources of possible radiation exposure to the population of Nevada, all of which produced negligible exposure possibilities and one of which was due to an accident in a foreign country. The five sources were:

° Normal seepage of radioactivity from the NTS,

° Purging of radioactivity from the tunnel in which the Mighty Oak test was conducted,

° Radioactivity in migratory deer from drinking in contaminated ponds on the NTS,

° World-wide fallout of strontium in milk, of plutonium in cattle, and krypton-85 in air, and

° Airborne radioactivity from the reactor accident at Chernobyl, USSR.

The dose equivalent estimates from these sources for people living near the Nevada Test Site are calculated separately in the following sections.

Estimated Dose from NTS Activities

The estimate of dose equivalent due to NTS activities is based on the total release of radioactivity from the site as listed in Table 1. Since no significant activity of recent NTS origin was detectable off site by the air, water, milk, TLD or biological monitoring networks, other than as described for Mighty Oak, no significant exposure to the population around the NTS would be expected. To confirm this, a simple atmospheric dispersion calculation, using a gaussian plume model and cumulated meteorological data for the NTS, was performed. The maximum individual dose equivalent was calculated to be 1.4 μrem (0.014 μSv) for the year, and the population dose equivalent to the 6360 people living within 80 km of CP-1 was calculated to be 5.7×10^{-3} person-rem (5.7×10^{-5} person-Sv). When the Table 1 release quantities were tested with the AIRDOS program, the maximum individual dose equivalent became 2.4 μrem (0.024 μSv) and for the population 7.2×10^{-3} persom-rem (7.2×10^{-5} person-Sv).

Estimated Dose from Tunnel Purging

The maximum integrated concentration of xenon-133 during the purging of the tunnel following the Mighty Oak test was 11.5 nCi-hr/m^3 at the Penoyer Farm near Rachel, Nevada. An individual who remained outdoors during the 170 hours of the collection period for the xenon-133 would have received an exposure of 0.27 μrem (2.7×10^{-3} μSv).

Estimated Dose from World-wide Fallout

From the monitoring networks, the following concentrations of radionuclides were found:

Pu-239 - <0.06 pCi/kg in beef liver

Sr-90 - 0.6 pCi/L (22 mBq/L) in milk

Kr-85 - 25 pCi/m^3 (0.92 Bq/m^3) in air

Tritium - 0.45 pCi/m^3 (17 mBq/m^3) in air

To estimate maximum individual dose equivalents from these findings, the following assumptions (from ICRP-23) and dose conversion factors (from ICRP-30) are used.

- Adult breathing rate = 8400 m^3/yr
- Milk intake (10-year old) = 160 L/yr
- Liver consumption = 1 lb/wk = 23.6 kg/yr
- Meat consumption = 248 g/day = 90.5 kg/yr
  subtract liver consumption, balance is 66.9 kg/yr
- Pu-239 - 2.1×10^{-6} Sv/Bq = 7.8×10^{-3} mrem/pCi

° Sr-90 - 1.9×10^{-7} Sv/Bq = 7×10^{-4} mrem/pCi

° H-3 - 9.9×10^{-15} Sv/hr per Bq/m^3 = 3.2×10^{-7} mrem/yr per pCi/m^3

° Kr-85 - 4.7×10^{-11} Sv/hr per Bq/m^3 = 1.5×10^{-3} mrem/yr per pCi/m^3

The dose equivalents can then be estimated by the following calculations:

Pu-239: (Assume concentration = detection limit)
0.06 pCi/kg x 23.6 kg/yr x 7.8×10^{-3} mrem/pCi = 0.011 mrem/yr

Sr-90: 0.6 pCi/L x 160 L/yr x 7×10^{-4} mrem/pCi = 0.067 mrem/yr

Kr-85: 25 pCi/m^3 x 1.5×10^{-3} = 0.038 mrem/yr

H-3: 0.45 pCi/m^3 x 3.2×10^{-7} = 1.4×10^{-7} mrem/yr

These sum to 0.12 mrem/yr (1.2 μSv/yr) compared to the 0.0024 mrem (2.4×10^{-2} μSv) from NTS activities.

Radioactivity in NTS Deer

The tissues collected from the deer that had been drinking from the T-tunnel drainage pond contained the radionuclides I-131 and Cs-137 with the concentrations listed in Table 6. To estimate an off-site exposure based on those findings, some rather broad assumptions must be used.

During the deer migration study at the NTS, it was estimated that 1500 to 2000 deer resided there. Because the herd migrated to lower altitudes after the legal hunting season, few were collected by hunters. Of the deer that were tagged (about 200 by EPA personnel) only 3 were shot by hunters over a 5-year period. This represents about 0.3% per year. Therefore, for the group of 25 or so deer that use the T-tunnel drainage pond, less than one would be collected by a hunter.

If one deer is collected, then a family of four persons would share the 3 lb. of liver and 100 lb. of meat for the year. Assuming the deer with the highest concentration of iodine and cesium was collected, the dose equivalent can be calculated. The dose conversion factors are:

I-131: 4.8×10^{-7} Sv/Bq = 1.8×10^{-6} rem/pCi to thyroid

Cs-137: 1.5×10^{-8} Sv/Bq = 5.6×10^{-8} rem/pCi to muscle

The intake would be 3 lb. = 1.36 kg of liver and 100 lb. = 45.3 kg of meat so the dose to the thyroid would be 1.36 kg x 80 nCi/kg x 1.8×10^{-6} rem/pCi = 196 mrem plus 45.3 kg/365 days x 12 days (T_{avg}) x 16 nCi/kg x 1.8×10^{-6} rem/pCi = 43 mrem for a total of 240 mrem (thyroid) divided among four people. The whole-body dose equivalent from Cs-137 would be (1.36 kg x 400 pCi/kg) + (45.3 kg x 200 pCi/kg) = 9600 pCi and 9600 pCi x 5.6×10^{-8} rem/pCi = 0.54 mrem. With the weighting factors recommended in ICRP-26, the effective dose equivalent would be 7.7 mrem if all was consumed by one person or only 1.9 mrem if shared equally among a family of four.

Estimated Dose from Chernobyl

Of the radionuclides detected by the ASN only I-131 was in concentrations high enough to warrent a dose calculation. Only 5 of the 113 air sampling stations detected no radioiodine. Using the time-integrated concentrations of I-131 at each station, an estimated dose equivalent for infants with a 2-gram thyroid was calculated for each station location as shown in Table 9. With the weighting factor recommended by the ICRP, the calculated effective dose equivalents from Table 9 ranged from about 0.001 mrem to a maximum of slightly more than 0.06 mrem.

Background Radiation

Background radiation in the off-site area is measured by two methods. The TLD's (page 40) measure cumulative exposure, and the PIC's (page 45) measure exposure rate. Both measurement systems show a factor of 3 difference (high vs. low) in dose equivalent depending on the location where the measurement was made. In addition, at any location there can be variations of as much as 1.5 to 2 μrem/hr for 3 to 4 hours when atmospheric low-pressure troughs move through the area. The low pressure allows more of the natural radioactivity to diffuse from the soil to temporarily increase the background radiation. This occurs 5 to 6 times per year at the PIC stations with an excursion up to 2 μR/hr and a duration of 3 to 4 hours. Since the graph of these excursions appears sinusoidal, the exposure delivered by these events can be 5 to 6 μrem each.

Therefore, to put the dose equivalents calculated for NTS activities, world-wide fallout and Chernobyl into perspective, they may be compared to up to 100 mrem/yr dose acquired merely by moving from one location to another or to the 25 to 30 μrem/year added dose of one location due to meteorological effects.

TABLE 9. THYROID INHALATION DOSE EQUIVALENT, MAY AND JUNE 1986

STATION	INFANT THYROID DOSE MREM**	ADULT THYROID DOSE MREM**
GLOBE AZ	0.31	0.19
KINGMAN AZ	0.35	0.21
TUCSON AZ	0.34	0.20
WINSLOW AZ	0.25	0.15
YUMA AZ	0.14	0.084
LITTLE ROCK AR	0.0032	0.0019
ALTURAS CA	0.21	0.12
BAKER CA	0.34	0.20
BISHOP CA	0.49	0.29
CHICO CA	0.31	0.18
DEATH VALLEY JCT CA	0.58	0.34
FURNACE CREEK CA	0.61	0.36
INDIO CA	0.21	0.13
LONE PINE CA	0.066	0.039
NEEDLES CA	0.33	0.20
RIDGECREST CA	0.50	0.30
SANTA ROSA CA	0.14	0.085
SHOSHONE CA	0.38	0.23
CORTEZ CO	0.17	0.10
DENVER CO	0.070	0.042
GRAND JUNCTION CO	0.20	0.12
MOUNTAIN HOME ID	0.30	0.18
NAMPA ID	0.33	0.20

(CONTINUED)

TABLE 9. CONTINUED

STATION	INFANT THYROID DOSE MREM**	ADULT THYROID DOSE MREM**
POCATELLO ID	0.31	0.19
FORT DODGE IA	0.031	0.018
IOWA CITY IA	0.030	0.018
DODGE CITY KS	0.035	0.021
MINNEAPOLIS MN	0.074	0.044
JOPLIN MO	0.016	0.0096
ST JOSEPH MO	0.032	0.019
GREAT FALLS MT	0.16	0.094
KALISPELL MT	0.18	0.11
MILES CITY MT	0.075	0.044
NORTH PLATTE NE	0.050	0.030
ALAMO NV	0.39	0.23
AUSTIN NV	0.55	0.32
BATTLE MOUNTAIN NV	0.31	0.18
BEATTY NV	0.66	0.39
CALIENTE NV	0.39	0.23
STONE CABIN RANCH NV	0.39	0.23
CURRANT NV - BLUE EAGLE RANCH	0.51	0.30
CURRANT NV - ANGLE WORM RANCH	0.40	0.24
CURRIE NV	0.58	0.35
DUCKWATER NV	0.28	0.17
ELKO NV	0.41	0.24
ELY NV	0.58	0.34

(CONTINUED)

TABLE 9. CONTINUED

STATION	INFANT THYROID DOSE MREM**	ADULT THYROID DOSE MREM**
EUREKA NV	0.37	0.22
FALLON NV	0.36	0.21
FRENCHMAN STATION NV	0.57	0.34
GEYSER RANCH NV	0.27	0.16
GOLDFIELD NV	0.80	0.48
GROOM LAKE NV	0.67	0.40
HIKO NV	0.32	0.19
INDIAN SPRINGS NV	0.53	0.31
LAS VEGAS NV	0.54	0.32
LATHROP WELLS NV	0.50	0.30
LOVELOCK NV	0.43	0.25
LUND NV	0.44	0.26
MESQUITE NV	0.24	0.14
NYALA NV	0.16	0.097
OVERTON NV	0.40	0.24
PAHRUMP NV	0.60	0.36
PIOCHE NV	0.41	0.25
RENO NV	0.60	0.36
ROUND MOUNTAIN NV	0.69	0.41
SCOTTY'S JCT NV	0.69	0.41
SUNNYSIDE NV	0.36	0.22
RACHEL NV - ROBINSON TRAILER PARK	0.37	0.22
RACHEL NV - PENOYER FARM CRIS CASTLETON	0.012	0.0070

(CONTINUED)

TABLE 9. CONTINUED

STATION	INFANT THYROID DOSE MREM**	ADULT THYROID DOSE MREM**
TONOPAH NV	0.73	0.44
TTR NV	0.66	0.40
FALLINI'S (TWIN SPGS) RANCH NV	0.55	0.33
WELLS NV	0.46	0.28
WINNEMUCCA NV	0.30	0.18
ALBUQUERQUE NM	0.062	0.037
CARLSBAD NM	0.17	0.10
SHIPROCK NM	0.20	0.12
BISMARK ND	0.13	0.077
FARGO ND	0.15	0.088
WILLISTON ND	0.12	0.074
MUSKOGEE OK	0.0094	0.0056
MEDFORD OR	0.16	0.094
BURNS OR	0.34	0.20
RAPID CITY SD	0.040	0.024
AMARILLO TX	0.022	0.013
MIDLAND TX	0.0093	0.0055
BRYCE CANYON UT	0.23	0.14
CEDAR CITY UT	0.24	0.14
DELTA UT	0.29	0.17
ENTERPRISE UT	0.28	0.17
GARRISON UT	0.22	0.13
LOGAN UT	0.19	0.11

(CONTINUED)

TABLE 9. CONTINUED

STATION	INFANT THYROID DOSE MREM**	ADULT THYROID DOSE MREM**
MILFORD UT	0.31	0.18
PAROWAN UT	0.16	0.098
ST GEORGE UT	0.30	0.18
SALT LAKE CITY UT	0.32	0.19
VERNAL UT	0.17	0.10
WENDOVER UT	0.13	0.075
SEATTLE WA	0.061	0.036
SPOKANE WA	0.20	0.12
ROCK SPRINGS WY	0.27	0.16
WORLAND WY	0.17	0.10

*NO RADIOIODINE WAS DETECTED IN SAMPLES COLLECTED AT MONROE, LA, MINNEAPOLIS, MN, ADAVEN, NV, MEDLIN RANCH, NV, AND TYLER, TX.
**CALCULATED FROM RADIOIODINE ON PARTICULATE FILTERS ONLY.

REFERENCE

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ICRP-30 FOR DOSE CONVERSION FACTORS AND EFFECTIVE ENERGY PER DISINTEGRATION.

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SECTION 6

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APPENDIX A

SITE DATA

SITE DESCRIPTION

A summary of the uses of the NTS and its immediate environs is included in Section 3 of this report. More detailed data and descriptive maps are contained in this Appendix.

Location

The NTS is located in Nye County, Nevada, with its southeast corner about 90 km northwest of Las Vegas (Figure 1 in main report). It has an area of about 3,500 square km and varies from 40 to 56 km in width (east-west) and from 64 to 88 km in length (north-south). This area consists of large basins or flats about 900 to 1,200 m above mean sea level (MSL) surrounded by mountain ranges rising 1,800 to 2,300 m above MSL.

The NTS is surrounded on three sides by exclusion areas, collectively named the Nellis Air Force Range, which provide a buffer zone between the test areas and public lands. This buffer zone varies from 24 to 104 km between the test area and land that is open to the public. Depending upon wind speed and direction, from 2 to more than 6 hours will elapse before any release of airborne radioactivity could pass over public lands.

Climate

The climate of the NTS and surrounding area is variable, due to its variations in altitude and its rugged terrain. Generally, the climate is referred to as continental arid. Throughout the year, there is insufficient water to support the growth of common food crops without irrigation.

Climate may be classified by the types of vegetation indigenous to an area. According to Houghton et al. (Ho75), this method of classification of dry condition, developed by Doppen, is further subdivided on the basis of temperature and severity of drought. Table A-1 (Ho75) summarizes the characteristics of climatic types for Nevada.

According to Quiring (Qu68), the NTS average annual precipitation ranges from about 10 cm at the lower elevations to around 25 cm on the higher elevations. During the winter months, the plateaus may be snow-covered for a period 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 50°F (25°F) in

TABLE A-1. CHARACTERISTICS OF CLIMATIC TYPES IN NEVADA
(from Houghton et al. 1975)

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

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

January and 95°F (55°F) in July, with extremes of 120°F and -15°F. Corresponding temperatures on the plateaus are 35°F (25°F) in January and 80°F (65°F) in July with extremes of 115°F and -30°F.

The wind direction, as measured on a 30 m tower at an observation station about 9 km NNW of Yucca Lake, is predominantly northerly except during the months of May through August when winds from the south-southwest predominate (Qu68). Because of the prevalent mountain/valley winds in the basins, south to southwest winds predominate during daylight hours of 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.

Geology and Hydrology

Two major hydrologic systems shown in Figure A-1 exist on the NTS (ERDA77). Ground water in the northwestern part of the NTS or in the Pahute Mesa area flows at a rate of 2 m to 180 m per year to the south and southwest toward the Ash Meadows Discharge Area in the Amargosa Desert. Ground water to the east of the NTS moves from north to south at a rate of not less than 2 m nor greater than 220 m per year. Carbon-14 analyses of this eastern ground water indicate that the lower velocity is nearer the true value. At Mercury Valley in the extreme southern part of the NTS, the eastern ground water flow shifts southwestward toward the Ash Meadows Discharge Area.

Land Use of NTS Environs

Figure A-2 is a map of the off-NTS area showing a wide variety of land uses, such as farming, mining, grazing, camping, fishing, and hunting within a 300-km radius of the NTS. For example, west of the NTS, elevations range from 85 m below MSL in Death Valley to 4,420 m above MSL in the Sierra Nevada Range. Parts of two major agricultural valleys (the Owens and San Joaquin) are included. The areas south of the NTS are more uniform since the Mojave Desert ecosystem (mid-latitude desert) comprises most of this portion of Nevada, California, and Arizona. The areas east of the NTS are primarily mid-latitude steppe with some of the older river valleys, such as the Virgin River Valley and Moapa Valley, supporting irrigation for small-scale but intensive farming of a variety of crops. Grazing is also common in this area, particularly to the northeast. The area north of the NTS is also mid-latitude steppe, where the major agricultural activity is grazing of cattle and sheep. Minor agriculture, primarily the growing of alfalfa hay, is found in this portion of the State within 300 km of the NTS Control Point-1 (CP-1). Many of the residents grow or have access to locally grown fruits and vegetables.

Many recreational areas, in all directions around the NTS (Figure A-2) are used for such activities as hunting, fishing, and camping. In general, the camping and fishing sites to the northwest, north, and northeast of the NTS are utilized throughout the year except for the winter months. Camping and fishing locations to the southeast, south, and southwest are utilized throughout the year. The hunting season is from September through January.

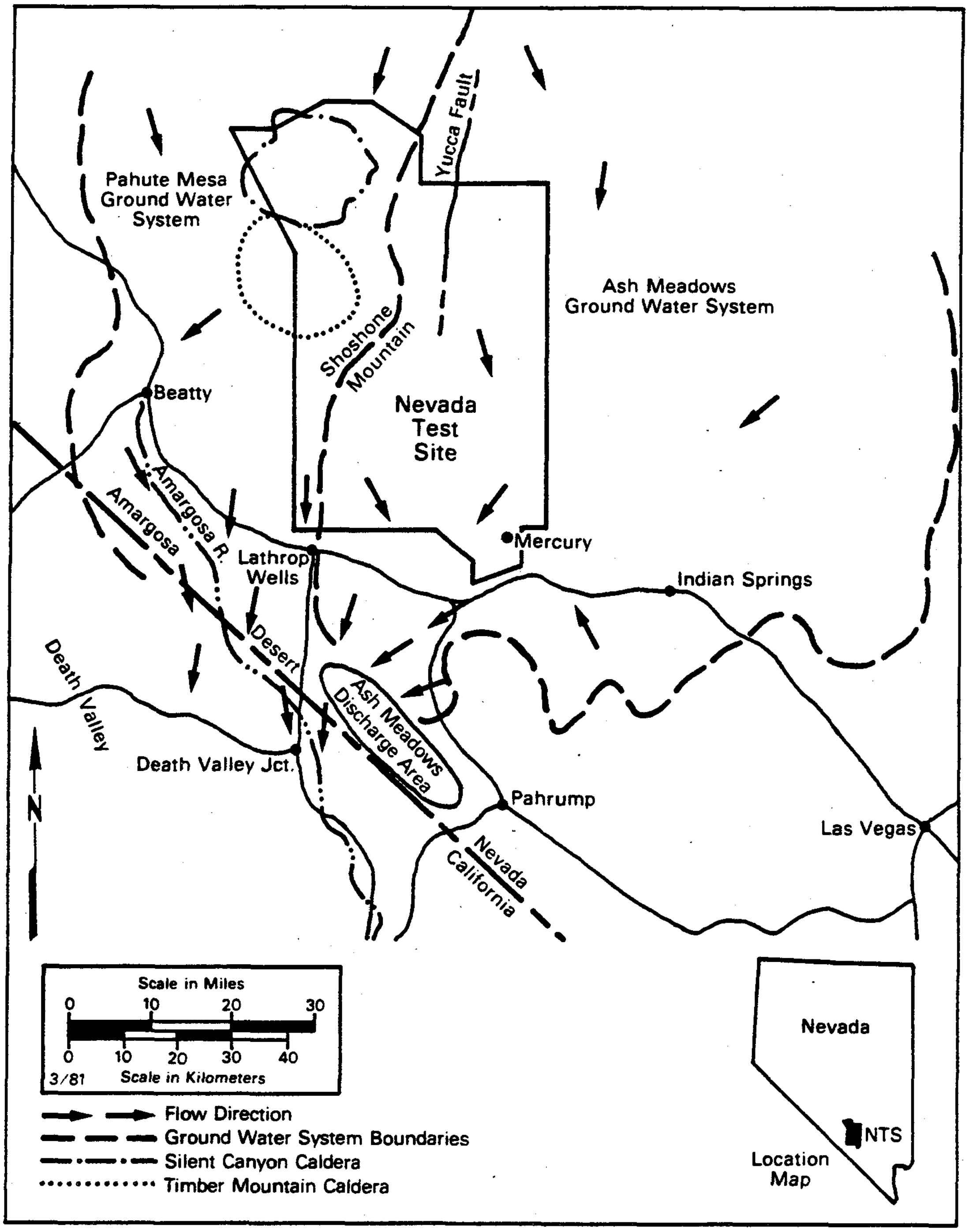

Figure A-1. Ground-water flow systems around the Nevada Test Site.

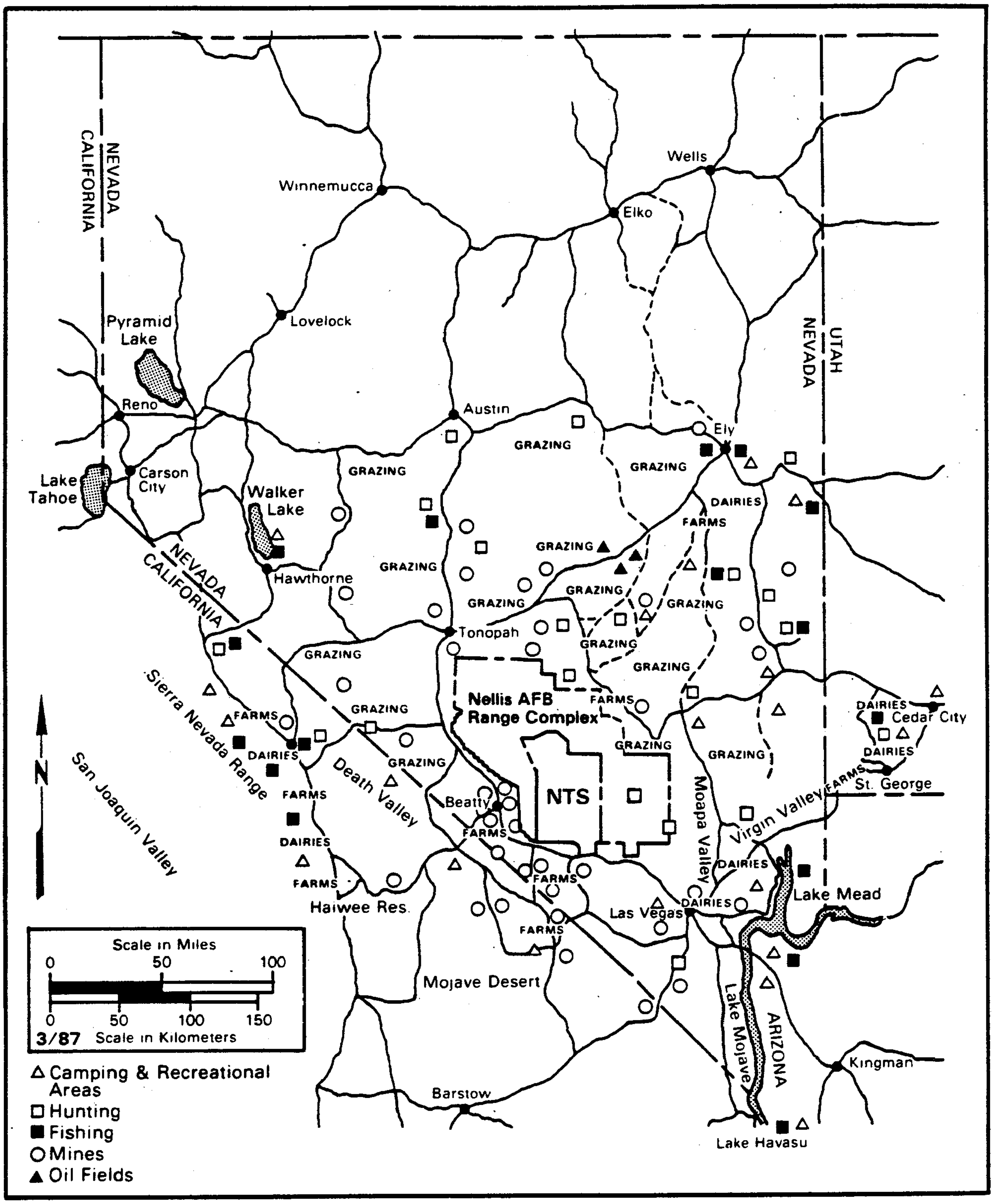

Figure A-2. General land use within 300 km of the Nevada Test Site.

Population Distribution

Figure A-3 shows the current population of counties surrounding the NTS based on 1980 census figures. Excluding Clark County, the major population center (approximately 536,000 in 1984), the population density within a 150 km radius of the NTS is about 0.5 persons per square kilometer. For comparison, the 48 contiguous states (1980 census) had a population density of approximately 29 persons per square kilometer. The estimated average population density for Nevada in 1980 was 2.8 persons per square kilometer.

The off-site area within 80 km of the NTS (the area in which the dose commitment must be determined for the purpose of this report) is predominantly rural. Several small communities are located in the area, the largest being in the Pahrump Valley. This growing rural community, with an estimated population of about 5,500, is located about 72 km south of the NTS CP-1. The Amargosa Farm Area, which has a population of about 1,200, is located about 50 km southwest of CP-1. The largest town in the near-offsite area is Beatty, which has a population of about 900 and is located approximately 65 km to the west of CP-1. A report by Smith and Coogan was published in 1984 which summarizes the population distribution within selected rural areas out to 200 kilometers from the Control Point on the NTS.

The Mojave Desert of California, which includes Death Valley National Monument, lies along the southwestern border of Nevada. The National Park Service (NPS80) estimated that the population within the Monument boundaries ranges from a minimum of 200 permanent residents during the summer months to as many as 5,000 tourists and campers on any particular day during the major holiday periods in the winter months, and as many as 30,000 during "Death Valley Days" in the month of November. The largest town and contiguous populated area (about 40 square miles) in the Mojave Desert is Barstow, located 265 km south-southwest of the NTS, with a 1983 population of about 36,000. The next largest populated area is the Ridgecrest-China Lake area, which has a current population of about 25,000 and is located about 190 km southwest of the NTS. The Owens Valley, where numerous small towns are located, lies about 50 km west of Death Valley. The largest town in Owens Valley is Bishop, located 225 km west-northwest of the NTS, with a population of about 5,300 including contiguous populated areas.

The extreme southwestern region of Utah is more developed than the adjacent part of Nevada. The largest community is St. George, located 220 km east of the NTS, with a population of 11,300. The next largest town, Cedar City, with a population of 10,900, is located 280 km east northeast of the NTS.

The extreme northwestern region of Arizona is mostly range land except for that portion in the Lake Mead Recreation Area. In addition, several small communities lie along the Colorado River. The largest town in the area is Kingman, located 280 km southeast of the NTS, with a population of about 9,300. Figures A-4 through A-7 show the domestic animal populations in the counties near the NTS.

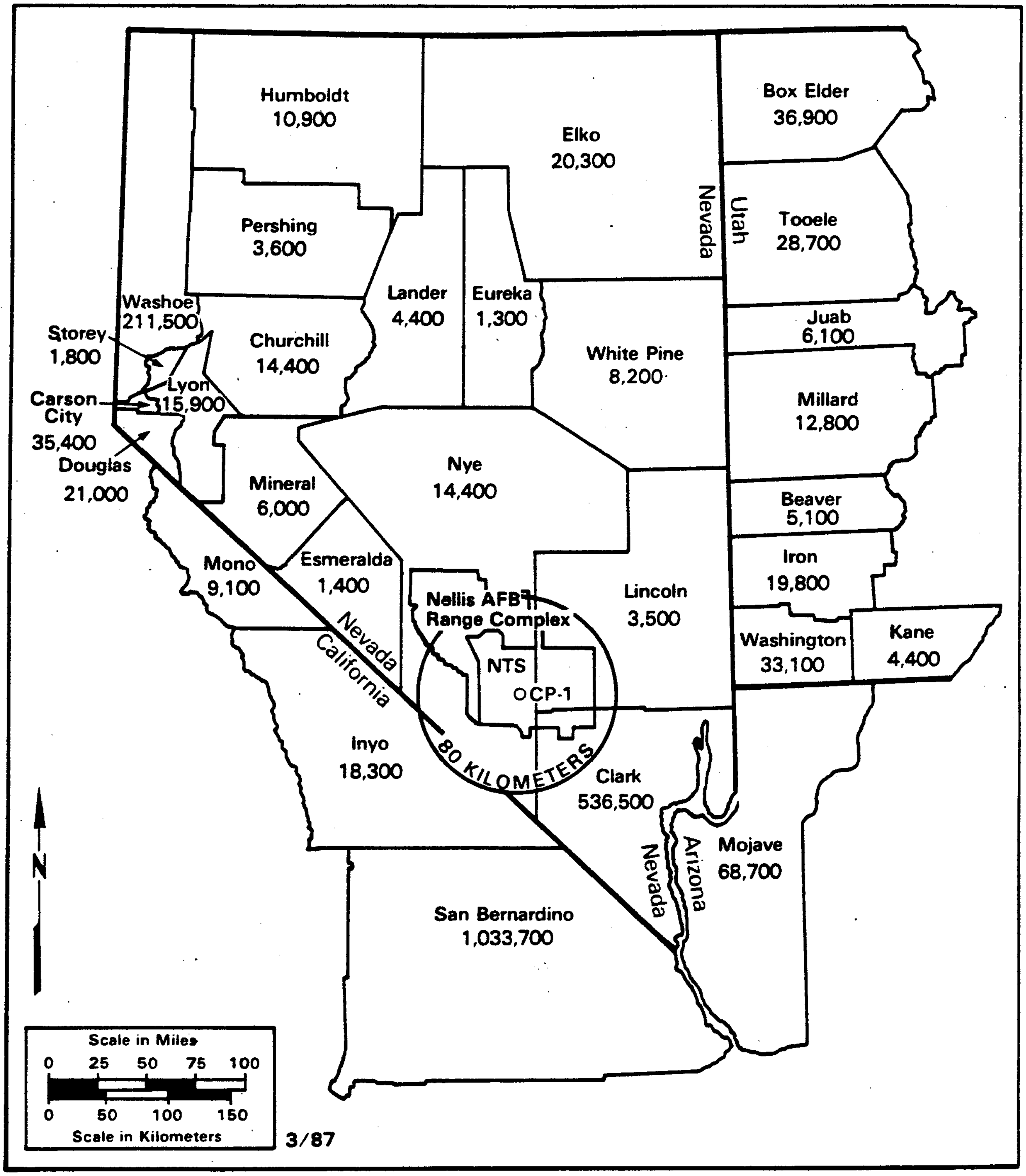

Figure A-3. Population of Arizona, California, Nevada, and Utah Counties near the Nevada Test Site (1985).

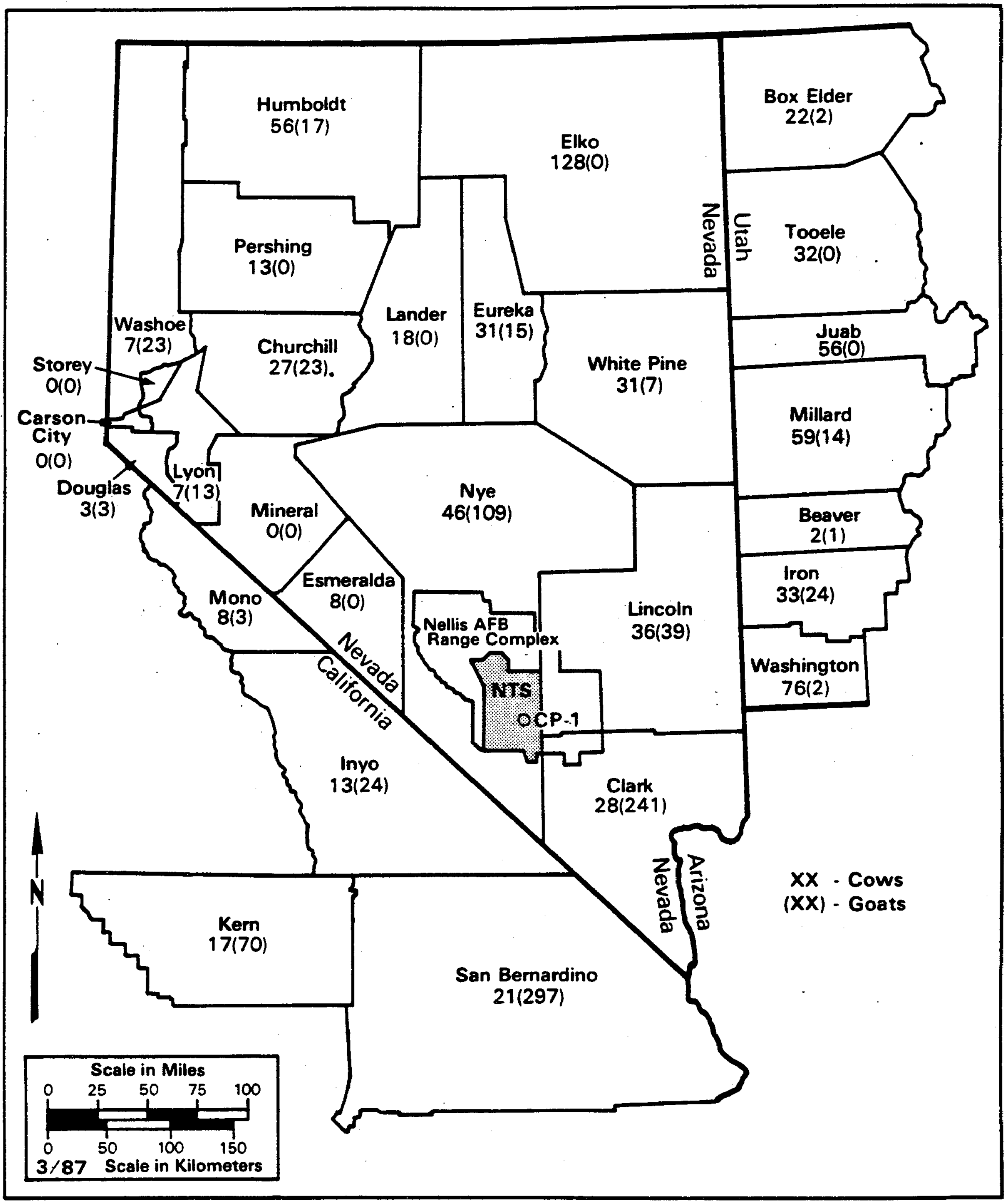

Figure A-4. Distribution of family milk cows and goats, by county (1986).

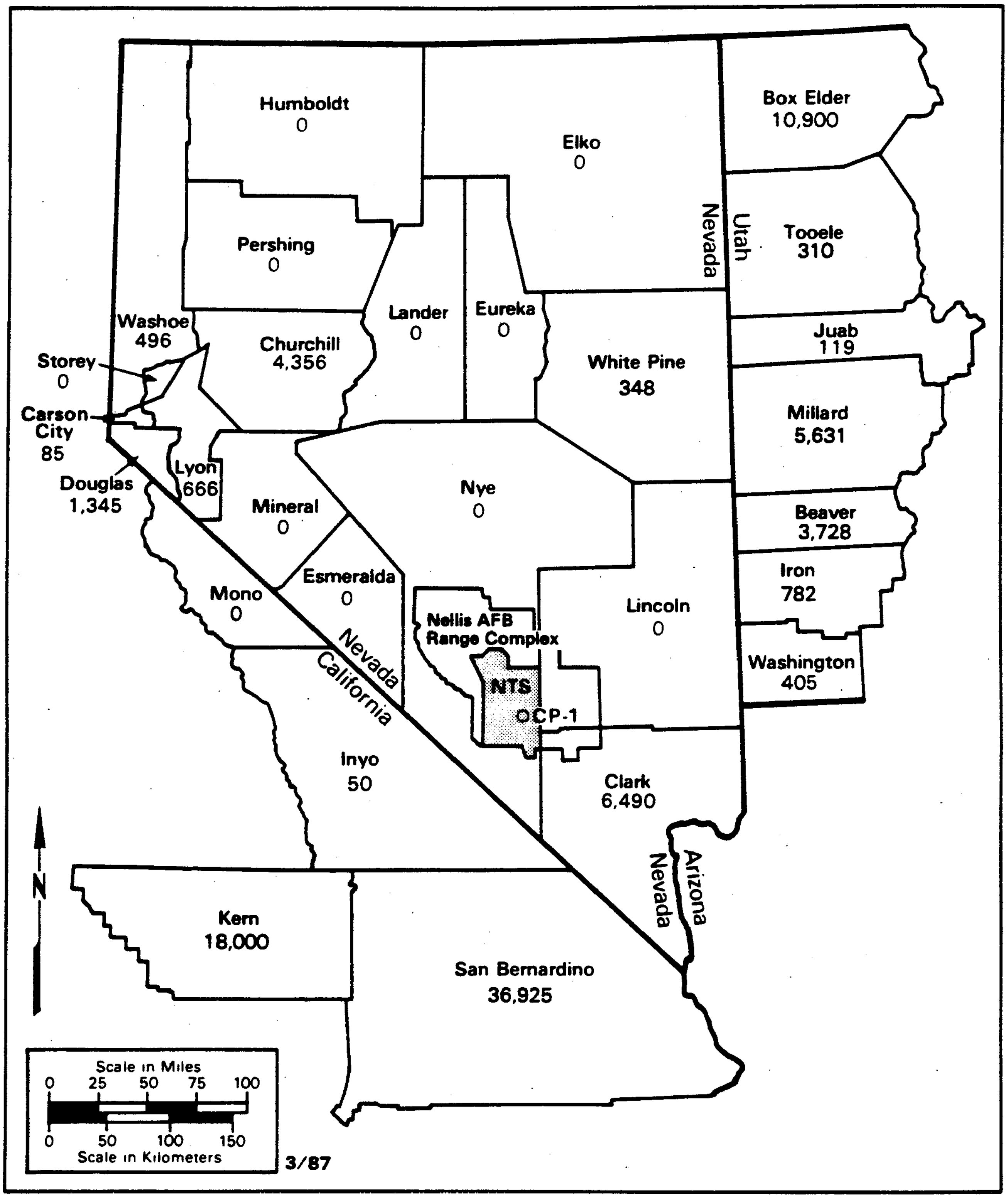

Figure A-5. Distribution of dairy cows, by county (1986).

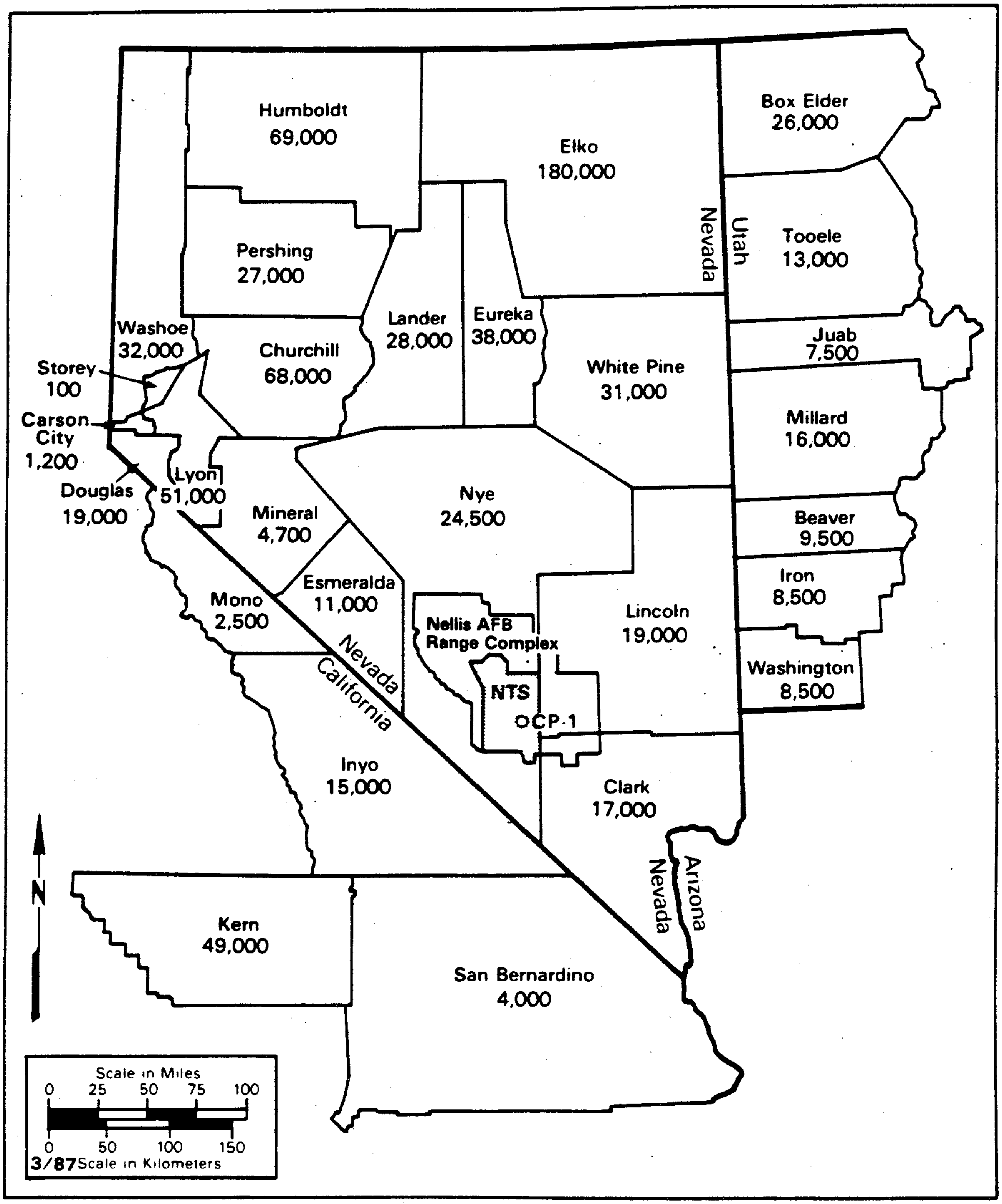

Figure A-6. Distribution of beef cattle, by county (1986).

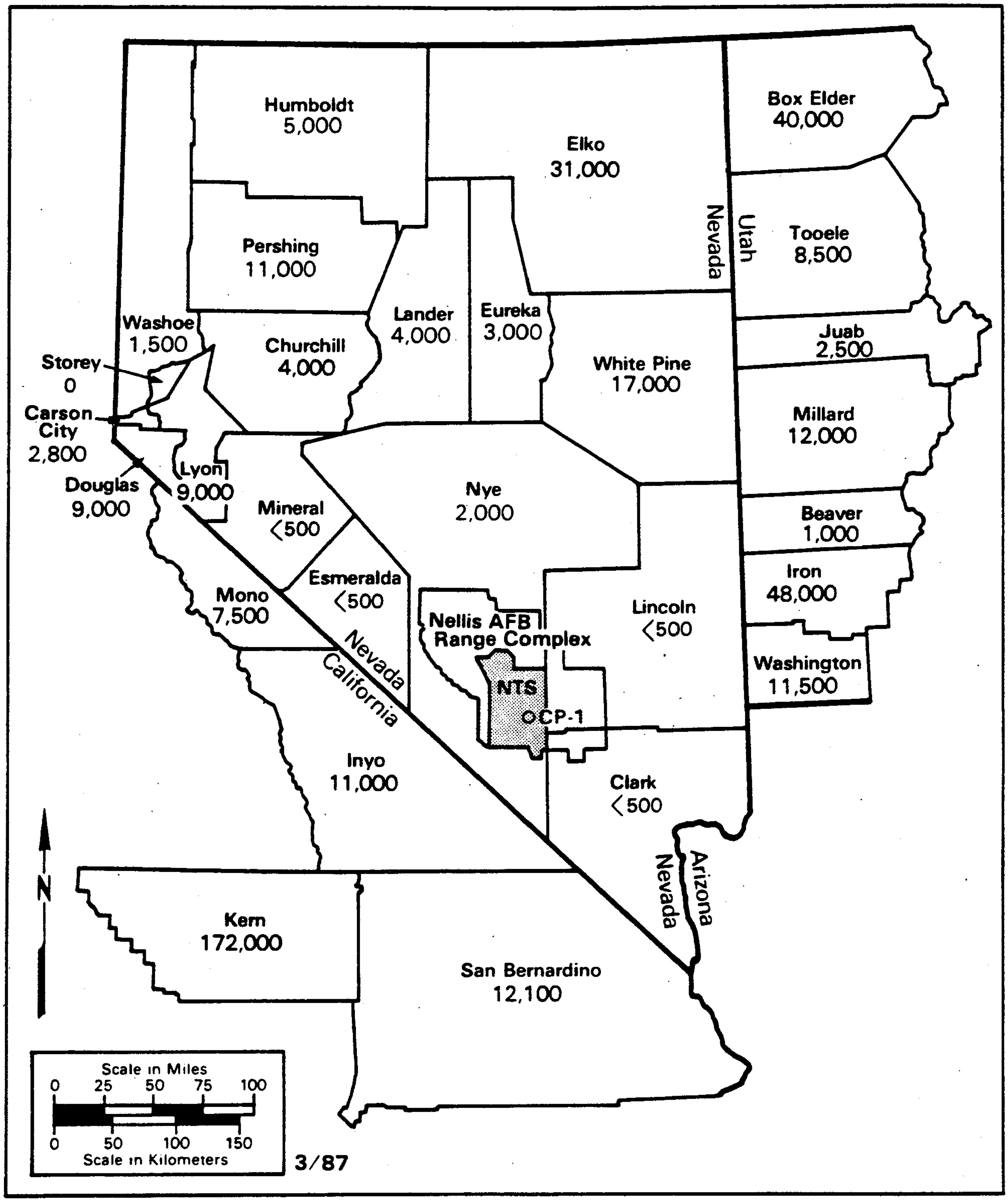

Figure A-7. Distribution of sheep, by county (1986).

APPENDIX B

SAMPLE ANALYSIS PROCEDURES

ANALYTICAL PROCEDURES

The procedures for analyzing samples collected for offsite surveillance are described by Johns et al. in "Radiochemical Analytical Procedures for Analyses of Environmental Samples" (EMSL-LV-0539-17, 1979) and are summarized in Table B-1.

TABLE B-1. SUMMARY OF ANALYTICAL PROCEDURES

Type of Analysis	Analytical Equipment	Counting Period (min)	Analytical Procedures	Sample Size	Approximate Detection Limit*
IG Ge(Li) Gamma Spectrometry**	IG or Ge(Li) detector calibrated at 0.5 keV/ channel (0.04 to 2 MeV range) individual detector efficiencies ranging from 15% to 35%.	Air charcoal cartridges and individual air filters, 30 min; air filter composites, 1200 min. 100 min for milk, water, suspended solids.	Radionuclide concentration quantified from gamma spectral data by on-line computer program. Radionuclides in air filter composite samples are identified only.	120-370 m^3 for air filters; and charcoal cartridges; 3-1/2 liters for milk and water.	For routine milk and water generally, 5 pCi/L for most common fallout radionuclides in a simple spectrum. Filters for LTHMP suspended solids, 6 pCi/L. Air filters and charcoal cartridges, 0.04 pCi/m^3.
Gross beta on air filters	Low-level end window, gas flow proportional counter with a 12.7 cm diameter window (80 $\mu g/cm^2$)	30	Samples are counted after decay of naturally-occuring radionuclides and, if necessary, extrapolated to midpoint of collection in accordance with $t^{-1.2}$ decay or an experimentally-derived decay.	120-370 m^3	0.5 pCi/sample.

(continued)

TABLE B-1. (Continued)

Type of Analysis	Analytical Equipment	Counting Period (min)	Analytical Procedures	Sample Size	Approximate Detection Limit*
Sr-89-90	Low-background thin-window, gas-flow proportional counter.	50	Chemical separation by ion exchange. Separated sample counted successively; activity calculated by simultaneous solution of equations.	1.0 liter for milk or water. 0.1-1 kg for tissue.	Sr-89 = 5 pCi/L Sr-90 = 2 pCi/L.
H-3	Automatic liquid scintillation counter with output printer.	200	Sample prepared by distillation.	4 ml for water	400 pCi/L.
H-3 Enrichment (Long-Term Hydrological Samples)	Automatic scintillation counter with output printer.	200	Sample concentrated by electrolysis followed by distillation.	250 ml for water	10 pCi/L.
Pu-238,239	Alpha spectrometer with 450 mm, 300-um depletion depth, silicon surface barrier detectors operated in vacuum chambers.	1000-1400	Water sample or acid-digested filter or tissue samples separated by ion exchange, electro-plated on stainless steel planchet.	1.0 liter for water; 0.1-1 kg for tissue; 5,000-10,000 m^3 for air.	Pu-238 = 0.08 pCi/L Pu-239 = 0.04 pCi/L for water. For tissue samples, 0.04 pCi per total sample for all isotopes; 5-10 aCi/m^3 for plutonium on air filters.
Kr-85, Xe-133, Xe-135	Automatic liquid scintillation counter with output printer.	200	Separation by gas chromatography; disolved in toluene "cocktail" for counting	0.4-1.0 m^3 for air	Kr-85, Xe-133, Xe-135 = 4 pCi/m^3.

*The detection limit is defined as 3.29 sigma where sigma equals the counting error of the sample and Type I error = Type II error = 5 percent. (J. P. Corley, D. H. Denham, R. E. Jaquish, D. E. Michels, A. R. Olsen, D. A. Waite, A Guide for Environmental Radiological Surveillance at U.S. Dept. of Energy Installations, July 1981, Office of Operational Safety Report DOE/EP-0023, U.S. DOE, Washington, D. C.)

**Gamma Spectrometry using either an intrinsic germanium (IG), or lithium-drifted germanium diode (Ge(Li)) detector.

APPENDIX C

QUALITY ASSURANCE PROCEDURES

PRECISION OF ANALYSIS

The duplicate sampling program was initiated for the purpose of routinely assessing the errors due to sampling, analysis, and counting of samples obtained from the surveillance networks maintained by the EMSL-LV.

The program consists of the analysis of duplicate or replicate samples from the ASN, the NGTSN, the LTHMP, and the Dosimetry Network. As the radioactivity concentration in samples collected from the LTHMP and the MSN are below detection levels, most duplicate samples for these networks are prepared from spiked solutions. The NGTSN samples are generally split for analysis.

At least 30 duplicate samples from each network are normally collected and analyzed over the report period. Since three TLD cards consisting of two TLD chips each are used at each station of the Dosimetry Network, no additional samples were necessary. Table C-1 summarizes the sampling information for each surveillance network.

To estimate the precision of a methodology, the standard deviation of replicate results is needed. Thus, for example, the variance, s^2, of each set of replicate TLD results (n=6) was estimated from the results by the standard expression,

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

where k = number of sets of replicates.

Since duplicate samples were collected for all other sample types, the variances, s^2, for these types were calculated from $s^2 = (0.886R)^2$, where R is the absolute difference between the duplicate sample results. For small sample sizes, this estimate of the variance is statistically efficient* and certainly more convenient to calculate than the standard expression. The standard deviation is obtained by taking the square root.

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*Snedecor, G. W., and W. G. Cochran. Statistical Methods. The Iowa State University Press, Ames, Iowa, 6th Ed. 1967, pp. 39-47.

TABLE C-1. SAMPLES AND ANALYSES FOR DUPLICATE SAMPLING PROGRAM - 1986

Surveillance Network	Number of Sampling Locations	Samples Collected This Year	Sets of Duplicate Samples Collected	Number Per Set	Sample Analysis
ASN	113	6,791	159	2	Gross beta, γ Spectrometry
NGTSN	17	880 (NG) 870 (H3)	107 97	2	Kr-85, H-3, H_2O, HTO
Dosimetry	146	604	604	4-6	Effective dose from gamma
MSN	26	260	42	2	K-40, Sr-89, Sr-90, H-3
LTHMP	196	342	149	2	H-3

The principle that the variances of random samples collected from a normal population follow a chi-square distribution (χ^2) was then used to estimate the expected population standard deviation for each type of sample analysis. The expression used is as follows:*

$$s = \left[\sum_{i=1}^{k} (n_i - 1)s_i^2 / \sum_{i=1}^{k} (n_i - 1) \right]^{1/2}$$

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

s_i^2 = the expected variance of the ith replicate sample

s = the best estimate of sample standard deviation derived from the variance estimates of all replicate samples (the expected value of s^2 is σ^2).

For expressing the precision of measurement in common units, the coefficient of variation ($s/\bar{x}$) was calculated for each sample type. These are displayed in Table C-2 for those analyses for which there were adequate data.

To estimate the precision of counting, approximately 10 percent of all samples are counted a second time. These are unknown to the analyst. Since all such replicate counting gave results within the counting error, the precision data in Table C-2 represents errors principally in analysis.

*Freund, J. E. Mathematical Statistics. Prentice Hall, Englewood, New Jersey, 1962, pp 189-235.

TABLE C-2. SAMPLING AND ANALYTICAL PRECISION - 1986

Surveillance Network	Analysis	Sets of Replicate Samples Evaluated	Coefficient of Variation (%)
ASN	Gross β	28	32
	Ru-103	29	27
	I-131	8	57
	Cs-137	19	29
NGTSN	Kr-85	50	15
	HTO	*	50
	H_2O	53	49
Dosimetry	TLD	387	6.0
MSN	K-40	31	11
	Sr-89 (1985)	33	17
	Sr-90	22	15
LTHMP	H-3	35	11
	$H\text{-}3^+$	51	80

*Estimate of precision was calculated from the errors in the H-3 conventional analysis and the measurement of atmospheric moisture (H_2O).

ACCURACY OF ANALYSIS

Data from the analysis of intercomparison samples are statistically analyzed and compared to known values and values obtained from other participating laboratories. A summary of the statistical analysis is given in Table C-3, which compares the mean of three replicate analyses with the known value. The normalized deviation is a measure of the accuracy of the analysis when compared to the known concentration. The determination of this parameter is explained in detail separately (Ja81). If the value of this parameter (in multiples of standard normal deviate, unitless) lies between control limits of -3 and +3, the precision or accuracy of the analysis is within normal statistical variation. However, if the parameters exceed these limits, one must suspect that there is some cause other than normal statistical variations that contributed to the difference between the measured values and the known value. As shown by this table, all of the analyses were within the control limit.

The analytical methods were further checked on by Laboratory participation in the semiannual Department of Energy Quality Assessment Program conducted by the Environmental Measurements Laboratory, New York, N.Y. The results from these tests (Table C-4) indicate that this Laboratory's results were of acceptable quality.

TABLE C-3. EPA QUALITY ASSURANCE INTERCOMPARISON RESULTS - 1986

Analysis	Month	Mean of Replicate Analyses (pCi/L)	Known Value (pCi/L)	Normalized Deviation from Known Concentration
H-3	February	5077	5227	-0.4
in water	June	2837	3125	-1.3
	October	5775	5973	-0.5
H-3	April	4538	4423	0.4
in urine	November	5295	5257	0.1
Pu-239	January	6.5	7.1	-1.3
in water	August	9.4	10.1	-1.1
Sr-90	June	14.3	16	-1.9
in milk	October	<2	0	N/A
Sr-89	June	<5	0	N/A
in milk	October	9	9	0.0
I-131	February	9.8	9.0	0.2
in milk	June	45.0	41.0	1.1
	October	52.3	49.0	0.9
I-131	April	10.0	9.0	1.9
in water	August	44.0	45.0	-0.2
Cs-137	June	36.0	31.0	1.7
in milk	October	44.0	39.0	1.7
Cr-51	June	0.0	0.0	0.0
in water	October	57.7	59.0	-0.5
Co-60	June	65.0	66.0	-0.3
in water	October	32.0	31.0	0.3
Zn-65	June	81.3	86.0	-1.6
in water	October	87.3	85.0	0.8
Ru-106	June	50.3	50.0	0.1
in water	October	71.7	74.0	0.8
Cs-134	June	44.0	49.0	-1.7
in water	October	27.7	28.0	-0.1
Cs-137	June	11.0	10.0	0.3
in water	October	45.3	44.0	0.5

TABLE C-4. QUALITY ASSURANCE RESULTS FROM DOE PROGRAM - 1986

Analysis	Month	EMSL-LV Results	EML Results	Ratio EPA/EML
K-40 in soil	June	27.1	20.4	1.33
Cs-137 in soil	June	1.02	.810	1.26
Pu-239 in soil	June	.0111	.0100	1.11
K-40 in tissue	June	1.99	2.10	0.95
K-40 in vegetation	June	11.4	9.80	1.16
Cs-137 in vegetation	June	1.71	1.39	1.23
Pu-239 in vegetation	June	.0219	.0170	1.29
H-3 in water	June	21.5	21.8	0.99
Mn-54 in water	June	2.35	2.30	1.02
Co-60 in water	June	2.32	2.30	1.01
Sr-90 in water	June	.312	.430	0.73
Cs-137 in water	June	2.44	2.43	1.00
Pu-239 in water	June	.0559	.0560	1.00

To measure the performance of the contractor laboratory for analysis of animal tissues, a known amount of activity was added to several samples. The reported activity is compared to the known amount in Table C-5. The average bias for Sr-90 was -57 percent and for Pu-239 was -26 percent. The precision was 65 percent for Pu-239 and 11 percent for Sr-90 analyses.

In addition to calibration of the TLD's with a Cs-137 source traceable to NBS, the accuracy of the results obtained from the Dosimetry Network is affirmed by participation in the International Intercomparison of Environmental Dosimeters Program operated by the Idaho Operations Office of the DOE. The results of the eighth such comparison study are given in Table C-6.

For personal dosimeters, this Laboratory was accredited in 1985 under the National Voluntary Laboratory Accreditation Program operated by the National Bureau of Standards. For both personal and environmental dosimeters, the TLD measurements are performed according to standards proposed by the American National Standards Institute (ANSI75).

TABLE C-5. QUALITY ASSURANCE RESULTS FOR THE BIOENVIRONMENTAL PROGRAM - 1986

Sample Type and Shipment Number	Nuclide	Activity Added pCi/g Bone Ash	Activity Reported pCi/g Bone Ash	% Bias+ or Precision‡
		Spiked Samples		
Bone Ash				
Ash 1	239Pu	0	0**	
72	90Sr	10.4	8.8	-38
Ash 2	239Pu	0.18	0.13	-28
72	90Sr	0	2.5	
Ash 3	239Pu	0	0.0008**	
72	90Sr	0	2.3	
Ash 4	239Pu	0	-0.0003**	
72	90Sr	0	2.3	
Ash F	239Pu	0.073	0.05	-32
73	90Sr	10.1	12	-5
Ash G	239Pu	0.073	0.06	-18
73	90Sr	10.1	4.8	-75
Ash H	239Pu	0	0.002**	
73	90Sr	0	2.5	
Ash I	239Pu	0	0**	
73	90Sr	0	2.3	
Duplicate Samples				
Bov-1	239Pu		-0.004**	0.59
	90Sr		2.5	0
Bov-1 Dup	239Pu		-0.002**	0.59
	90Sr		2.5	0
Bov-2	239Pu		0.0005**	0.20
	90Sr		2.5	0.07
Bov-2 Dup	239Pu		-0.0004**	0.20
	90Sr		2.7	0.07

(continued)

TABLE C-5. CONTINUED

Sample Type and Shipment Number	Nuclide	Activity Added pCi/g Bone Ash	Activity Reported pCi/g Bone Ash	% Bias+ or Precision‡
		Spiked Samples		
Duplicate Samples				
Bov-5	239Pu		0.002**	0.35
	90Sr		0.5	0
Bov-5 Dup	239Pu		0.003**	0.35
	90Sr		0.5	0
Bov-6	239Pu		0.01	1.45
	90Sr		0.2	0.35
Bov-6 Dup	239Pu		0.001**	1.45
	90Sr		0.3	0.35

+ Bias (B) = Recovery -1; where recovery is $\frac{x_1}{u}$

and x_1 = net activity reported
u = activity added

‡ Precision (C_v) $= 2\left(\frac{x_1 - x_2}{x_1 + x_2}\right) \times \frac{1}{1.128}$ where x_1 = first value
x_2 = second value

**Counting error exceeds reported activity

TABLE C-6. SUMMARY RESULTS OF THE EIGHTH INTERNATIONAL INTERCOMPARISON OF ENVIRONMENTAL DOSIMETERS

Quantity	Mean	Standard Deviation	Comments
Summary of Field Site No. 1 Results (mR):			
EMSL-LV dosimeters	23.1	1.9	EMSL-LV results 20% lower than all domimeters and 22% lower than the calculated exposure.
ALL dosimeters	28.9	6.2	
Calculated exposure	29.7	1.5	
Summary of Field Site No. 2 Results (mR):			
EMSL-LV dosimeters	7.8	0.8	EMSL-LV results 23% lower than all domimeters and 25% lower than the calculated exposure.
ALL dosimeters	10.1	4.5	
Calculated exposure	10.4	0.5	
Summary of Laboratory Results (mR):			
EMSL-LV dosimeters	14.1	1.1	EMSL-LV results 13% lower than all domimeters and 18% lower than the calculated exposure.
ALL dosimeters	16.2	3.4	
Calculated exposure	17.2	0.9	

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APPENDIX D

RADIATION PROTECTION STANDARDS FOR EXTERNAL AND INTERNAL EXPOSURE

DOE EQUIVALENT COMMITMENT

For stochastic effects in members of the public, the following limits are used:

	Effective Dose Equivalent*	
	mrem/yr	mSv/yr
Occasional annual exposures**	500	5
Prolonged period of exposure	100	1

*Includes both effective dose equivalent from external radiation and committed effective dose equivalent from ingested and inhaled radionuclides.

**Occasional exposure implies exposure over a few years with the proviso that over a lifetime the average exposure does not exceed 100 mrem (1 mSv) per year (ICRP-39).

CONCENTRATION GUIDES

ICRP-30 lists Derived Air Concentrations (DAC) and Annual Limits of Intake (ALI). The ALI is the secondary limit and can be used with assumed breathing rates and ingested volumes to calculate concentration guides. The concentration guides (CG's) in Table D-1 were derived in this manner and yield the committed effective dose equivalent (50 year) of 100 mrem/yr for members of the public.

EPA DRINKING WATER GUIDE

In 40 CFR 141 the EPA set allowable concentrations for continuous controlled releases of radionuclides to drinking water sources. Any single or combination of beta and gamma emitters should not lead to exposures exceeding 4 mrem/yr. For tritium this is 20,000 pCi/L (740 Bq/L) and for strontium is 8 pCi/L (0.3 Bq/L).

TABLE D-1. ROUTINE MONITORING FREQUENCY, SAMPLE SIZE, MDC AND CONCENTRATION GUIDES

Nuclide	Sampling Frequency	Locations	Sample Size	Count Time	Concentration Guide*		MDC	MDC as % CG
Air Surveillance Network			m^3	minutes	Bq/m^3	nCi/m^3	mBq/m^3	
Be-7	3/wk	all	160-240	30	2000	50	17	8E-4
Zr-95	3/wk	all	160-240	30	20	0.6	4.1	2E-2
Nb-95	3/wk	all	160-240	30	100	3	1.8	2E-3
Mo-99	3/wk	all	160-240	30	100	3	1.5	2E-3
Ru-103	3/wk	all	160-240	30	60	2	1.8	3E-3
I-131	3/wk	all	160-240	30	4	0.1	1.8	4E-2
Te-132	3/wk	all	160-240	30	18	0.5	1.8	1E-2
Cs-137	3/wk	all	160-240	30	10	0.4	1.8	2E-2
Ba-140	3/wk	all	160-240	30	100	3	4.8	5E-3
La-140	3/wk	all	160-240	30	100	3	2.6	3E-3
Ce-141	3/wk	all	160-240	30	50	1	3.0	6E-3
Ce-144	3/wk	all	160-240	30	1	0.03	12	1.2
Pu-239	3/wk	all	1120	1000	9E-4	2E-5	1.48E-3	2E-1
Gross Beta	3/wk	all	160-240	30	2E-2	0.4E-4	0.11	6E-1

(continued)

TABLE D-1. Continued

Nuclide	Sampling Frequency	Locations	Sample Size	Count Time	Concentration Guide*		MDC	MDC as % CG
Noble Gas Tritium in Air			m^3	Minutes	Bq/m^3	nCi/m^3	mBq/m^3	
H-3	1/wk	17	5	200	7000	190	148	2E-3
Kr-85	1/wk	17	0.4	200	1E5	3000	148	2E-4
Xe-133	1/wk	17	0.4	200	2E4	480	148	7E-4
Xe-135	1/wk	17	0.4	200	2E3	60	148	7E-3
Water Surveillance Network (LTHMP)			Liters	Minutes	Bq/L	pCi/L	Bq/L	
H-3	1/mo	all	1	200	7E2	2E4	12	1.7
H-3 (Enrich)	1/mo	all	0.1	200	7E2	2E4	0.37	5E-2
Sr-89	1st time	all	1	50	600	2E4	0.18	0.03
Sr-90	1st time	all	1	50	0.3	8	0.074	25
Cs-137	1/mo	all	1	100	160	3E3	0.33	0.3
Ra-226	1st time	all	1	1000	5	100	NA	
U-234	1st time	all	1	1000	20	500	NA	
U-235	1st time	all	1	1000	20	600	NA	
U-238	1st time	all	1	1000	20	600	NA	
Pu-238	1st time	all	1	1000	10	400	0.003	0.03

(continued)

TABLE D-1. Continued

Nuclide	Sampling Frequency	Locations	Sample Size	Count Time	Concentration Guide*		MDC	MDC as % CG
Water Surveillance Network (LTHMP)			Liters	Minutes	Bq/L	pCi/L	Bq/L	
Pu-239	1st time	all	1	1000	10	300	0.002	0.02
Gamma	1/mo	all	3.5	30	--	--	0.18	<0.2
Milk Surveillance Network								
H-3	1/mo	all	3.5	200	8E4	2E6	12	2E-2
Cs-137	1/mo	all	3.5	100	100	3E3	0.33	0.3
Sr-89	1/mo	all	3.5	50	600	2E4	0.18	3E-2
Sr-90	1/mo	all	3.5	50	40	1E3	0.074	0.2
Gamma	1/mo	all	3.5	50	--	--	0.18	<0.2
Dosimetry Network			Number		Exposure Guide		MDA	
TLD (Personnel)	1/mo	50	2	--	100mR		2mR	2
TLD (Station)	1/qtr	130	6	--	--		2mR	--
Ion Chamber	weekly	23	2016	--	--		2μR/hr	--

Na - Not Available
*ALI and DAC values from ICRP-30 modified to 1 mSv annual effective dose equivalent for continuous exposure. Te and I data corrected to 2 g thyroid, greater milk intake, and smaller volume of air breathed annually (1 year-old infant).

APPENDIX E

DATA SUMMARY FOR THE MONITORING NETWORKS

TABLE E-1. SUMMARY OF ANALYTICAL RESULTS FOR AIR SURVEILLANCE NETWORK CONTINUOUSLY OPERATING STATIONS - 1986

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
DEATH VALLEY JCT CA	26.7/300.1	7BE	0.71	0.20	0.033
	14.0/300.1	103RU	0.81	0.021	0.011
	14.8/300.1	131I	4.6	0.045	0.043
	3.0/300.1	132TE	0.97	0.14	0.0042
	5.0/300.1	134CS	0.18	0.083	0.0023
	8.8/300.1	137CS	0.49	0.088	0.0063
FURNACE CREEK CA	30.7/355.0	7BE	0.97	0.26	0.033
	13.1/355.0	103RU	0.45	0.11	0.011
	1.0/355.0	106RU	0.24	0.24	0.00064
	16.6/355.0	131I	1.9	0.15	0.040
	8.7/355.0	134CS	0.22	0.045	0.0029
	11.5/355.0	137CS	0.43	0.055	0.0069
	1.0/355.0	140LA	0.61	0.61	0.0016
SHOSHONE CA	62.5/353.7	7BE	0.65	0.16	0.051
	12.2/353.7	103RU	0.37	0.10	0.0075
	14.6/353.7	131I	2.2	0.14	0.031
	4.3/353.7	134CS	0.12	0.072	0.0012
	9.4/353.7	137CS	0.27	0.11	0.0043
ALAMO NV	32.8/358.9	7BE	0.72	0.23	0.036
	16.1/358.9	103RU	0.45	0.089	0.0097
	13.3/358.9	131I	2.3	0.24	0.040
	4.2/358.9	134CS	0.13	0.11	0.0015
	8.2/358.9	137CS	0.29	0.057	0.0045
AUSTIN NV	27.7/364.7	7BE	0.45	0.19	0.021
	16.9/364.7	103RU	0.94	0.056	0.012
	17.9/364.7	131I	4.1	0.071	0.061
	1.1/364.7	132TE	0.47	0.47	0.0014

(continued)

TABLE E-1. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
AUSTIN NV (CONT)	12.9/364.7	134CS	0.35	0.012	0.0033
	15.0/364.7	137CS	0.52	0.029	0.0065
BEATTY NV	31.9/366.0	7BE	0.36	0.21	0.026
	10.9/366.0	103RU	0.42	0.074	0.0082
	18.1/366.0	131I	3.0	0.082	0.043
	2.1/366.0	132TE	0.37	0.14	0.0015
	9.2/366.0	134CS	0.29	0.022	0.0027
	12.1/366.0	137CS	0.44	0.040	0.0078
STONE CABIN RANCH NV	14.0/348.4	7BE	0.50	0.19	0.012
	10.0/350.4	103RU	0.48	0.12	0.0079
	12.0/350.4	131I	3.3	0.089	0.033
	1.0/350.4	132TE	0.21	0.21	0.00059
	4.0/350.4	134CS	0.20	0.10	0.0017
	5.0/350.4	137CS	0.29	0.091	0.0029
CURRANT NV - BLUE EAGLE RANCH	7.0/352.3	7BE	0.56	0.21	0.0073
	13.0/352.3	103RU	0.62	0.012	0.011
	14.0/352.3	131I	2.6	0.080	0.037
	4.0/352.3	134CS	0.20	0.13	0.0019
	9.0/352.3	137CS	0.44	0.066	0.0059
ELY NV	10.2/357.1	7BE	0.53	0.27	0.011
	15.0/357.1	103RU	0.66	0.047	0.011
	19.0/357.1	131I	4.2	0.065	0.061
	8.2/357.1	134CS	0.22	0.012	0.0026
	12.0/357.1	137CS	0.62	0.026	0.0068
GOLDFIELD NV	24.8/360.8	7BE	0.96	0.13	0.027
	13.5/360.8	103RU	0.83	0.064	0.011
	17.3/360.8	131I	4.8	0.14	0.053
	1.0/360.8	132TE	0.33	0.33	0.00093
	4.1/360.8	134CS	0.42	0.097	0.0026
	13.4/360.8	137CS	0.69	0.048	0.0083
GROOM LAKE NV	21.0/333.8	7BE	0.45	0.22	0.020
	15.0/333.8	103RU	0.61	0.037	0.0061
	19.0/333.8	131I	1.5	0.069	0.022
	1.0/333.8	132TE	0.13	0.13	0.00039
	1.0/333.8	134CS	0.24	0.24	0.00072
	3.0/333.8	137CS	0.40	0.20	0.0024

(continued)

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
HIKO NV	38.1/356.9	7BE	0.82	0.22	0.039
	6.0/356.9	103RU	0.33	0.078	0.0032
	12.0/356.9	131I	0.85	0.11	0.0099
	5.0/356.9	137CS	0.22	0.090	0.0018
INDIAN SPRINGS NV	35.2/363.2	7BE	0.58	0.19	0.032
	14.2/363.2	103RU	0.64	0.097	0.0091
	16.8/363.2	131I	2.3	0.14	0.038
	2.2/363.2	132TE	0.20	0.18	0.0011
	2.4/363.2	134CS	0.17	0.14	0.0010
	12.0/363.2	137CS	0.46	0.053	0.0055
LAS VEGAS NV	25.1/357.9	7BE	1.1	0.20	0.025
	13.3/361.0	103RU	0.47	0.085	0.0091
	16.1/361.0	131I	2.8	0.094	0.044
	4.1/361.0	132TE	0.18	0.085	0.0015
	2.0/361.0	134CS	0.17	0.10	0.00076
	7.1/361.0	137CS	0.22	0.099	0.0033
LATHROP WELLS NV	7.8/355.5	7BE	0.47	0.23	0.0067
	11.1/355.5	103RU	0.58	0.064	0.0076
	14.0/355.5	131I	2.8	0.18	0.039
	1.1/355.5	132TE	0.24	0.24	0.00072
	3.0/355.5	134CS	0.22	0.12	0.0016
	8.3/355.5	137CS	0.28	0.052	0.0038
NYALA NV	43.0/362.9	7BE	0.60	0.21	0.042
	8.0/362.9	103RU	0.25	0.037	0.0035
	7.0/362.9	131I	2.0	0.094	0.020
	3.0/362.9	132TE	0.070	0.070	0.00058
	5.0/362.9	134CS	0.095	0.078	0.0012
	5.0/362.9	137CS	0.17	0.13	0.0020
OVERTON NV	31.8/350.3	7BE	0.48	0.25	0.033
	8.1/353.3	103RU	0.38	0.20	0.0065
	11.8/353.3	131I	4.0	0.39	0.037
	6.2/353.3	134CS	0.14	0.12	0.0022
	10.9/353.3	137CS	0.30	0.12	0.0059
PAHRUMP NV	43.0/351.7	7BE	0.51	0.25	0.049
	17.0/351.7	103RU	0.51	0.057	0.010
	17.8/351.7	131I	2.6	0.13	0.044

(continued)

TABLE E-1. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
PAHRUMP NV (CONT)	3.1/351.7	134CS	0.19	0.10	0.0012
	10.1/351.7	137CS	0.38	0.050	0.0061
PIOCHE NV	49.1/362.8	7BE	0.61	0.24	0.053
	13.0/362.8	103RU	0.57	0.081	0.0085
	16.0/362.8	131I	3.6	0.074	0.035
	6.4/362.8	134CS	0.14	0.034	0.0011
	9.7/362.8	137CS	0.33	0.049	0.0038
SCOTTY'S JCT NV	21.0/355.4	7BE	0.60	0.20	0.023
	17.0/358.4	103RU	0.55	0.077	0.014
	17.0/358.4	131I	3.3	0.12	0.048
	4.0/358.4	132TE	0.13	0.13	0.0014
	7.0/358.4	134CS	0.26	0.15	0.0034
	12.0/358.4	137CS	0.45	0.085	0.0084
	4.0/358.4	140LA	0.32	0.32	0.0036
SUNNYSIDE NV	40.4/346.9	7BE	0.70	0.17	0.040
	15.1/346.9	103RU	0.65	0.055	0.0083
	15.1/346.9	131I	2.4	0.091	0.035
	3.8/346.9	134CS	0.22	0.10	0.0015
	9.7/346.9	137CS	0.37	0.034	0.0045
RACHEL NV - ROBINSON TRAILER PARK	27.2/361.4	7BE	0.41	0.22	0.024
	13.7/361.4	103RU	0.52	0.061	0.0078
	15.7/361.4	131I	1.5	0.086	0.025
	6.3/361.4	134CS	0.37	0.030	0.0026
	8.6/361.4	137CS	0.34	0.095	0.0046
TONOPAH NV	23.1/365.7	7BE	0.42	0.19	0.020
	13.1/365.7	103RU	0.91	0.078	0.011
	14.8/365.7	131I	5.1	0.11	0.047
	.8/365.7	132TE	0.46	0.46	0.0010
	7.8/365.7	134CS	0.34	0.033	0.0032
	7.0/365.7	137CS	0.61	0.070	0.0053
TTR NV	104.2/328.3	7BE	0.47	0.044	0.066
	23.7/328.3	103RU	0.75	0.0081	0.015
	25.0/328.3	131I	1.9	0.0063	0.040
	3.8/328.3	132TE	0.18	0.18	0.0021
	12.8/328.3	134CS	0.26	0.065	0.0050
	23.7/328.3	137CS	0.44	0.0062	0.0097
	3.8/328.3	140LA	0.53	0.53	0.0061

(continued)

TABLE E-1. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
FALLINI'S (TWIN SPGS) RANCH NV	35.5/362.4	7BE	0.52	0.17	0.032
	14.0/362.4	103RU	0.59	0.056	0.0083
	16.0/362.4	131I	5.2	0.12	0.034
	3.0/362.4	134CS	0.24	0.18	0.0017
	11.0/362.4	137CS	0.39	0.072	0.0054
CEDAR CITY UT	13.2/354.8	7BE	0.44	0.23	0.010
	11.0/358.8	103RU	0.29	0.085	0.0057
	15.0/358.8	131I	1.4	0.17	0.025
	5.8/358.8	134CS	0.10	0.046	0.00097
	7.0/358.8	137CS	0.20	0.15	0.0033
DELTA UT	16.6/298.2	7BE	0.40	0.22	0.017
	8.7/302.3	103RU	0.36	0.12	0.0065
	17.6/302.3	131I	1.7	0.074	0.028
	3.2/302.3	134CS	0.16	0.096	0.0012
	6.1/302.3	137CS	0.27	0.094	0.0035
	1.1/302.3	140LA	0.47	0.47	0.0018
MILFORD UT	41.8/359.1	7BE	0.67	0.17	0.035
	10.9/359.1	103RU	0.71	0.093	0.0069
	17.5/359.1	131I	1.2	0.085	0.017
	4.9/359.1	134CS	0.47	0.052	0.0024
	5.9/359.1	137CS	0.67	0.058	0.0036
ST GEORGE UT	19.0/364.1	7BE	0.52	0.32	0.021
	9.0/364.1	103RU	0.33	0.095	0.0046
	12.0/364.1	131I	1.5	0.15	0.022
	5.0/364.1	137CS	0.27	0.12	0.0022
SALT LAKE CITY UT	71.8/360.1	7BE	0.60	0.16	0.056
	15.4/360.1	103RU	0.61	0.074	0.0087
	16.5/360.1	131I	3.1	0.19	0.027
	1.0/360.1	132TE	0.24	0.24	0.00068
	11.4/360.1	134CS	0.20	0.024	0.0024
	9.4/360.1	137CS	0.59	0.099	0.0054

*AVG MEANS TIME-WEIGHTED AVERAGE OVER THE SAMPLING TIME.

NOTE: ALL RADIOISOTOPES, OTHER THAN 7BE, WERE DETECTED AS THE DEBRIS FROM CHERNOBYL ENTERED THE U.S.

TABLE E-2. SUMMARY OF ANALYTICAL RESULTS FOR AIR SURVEILLANCE NETWORK STANDBY STATIONS OPERATED 1 OR 2 WEEKS PER QUARTER - 1986

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
GLOBE AZ	5.0/52.2	7BE	0.36	0.22	0.026
	12.8/52.2	103RU	0.34	0.034	0.027
	16.1/52.2	131I	1.6	0.071	0.11
	2.9/52.2	134CS	0.11	0.066	0.0045
	10.9/52.2	137CS	0.89	0.025	0.032
KINGMAN AZ	5.0/56.2	7BE	0.25	0.19	0.019
	13.1/56.2	103RU	0.46	0.050	0.037
	14.1/56.2	131I	1.9	0.086	0.12
	1.0/56.2	134CS	0.10	0.10	0.0019
	5.0/56.2	137CS	0.31	0.054	0.011
TUCSON AZ	6.7/57.3	7BE	0.28	0.27	0.032
	16.8/57.3	103RU	0.26	0.019	0.033
	21.0/57.3	131I	0.99	0.046	0.11
	7.0/57.3	137CS	0.12	0.070	0.011
WINSLOW AZ	5.0/58.0	7BE	0.65	0.22	0.029
	5.0/58.0	103RU	0.30	0.11	0.016
	11.0/58.0	131I	0.95	0.071	0.094
YUMA AZ	3.0/65.6	7BE	0.33	0.33	0.015
	11.3/65.6	103RU	0.88	0.089	0.040
	14.1/65.6	131I	1.5	0.13	0.11
	6.5/65.6	137CS	0.24	0.050	0.012
LITTLE ROCK AR	6.9/52.8	7BE	0.23	0.18	0.027
	3.0/52.8	103RU	0.026	0.026	0.0015
	1.0/52.8	131I	0.062	0.062	0.0012
ALTURAS CA	10.0/56.5	103RU	0.28	0.067	0.018
	12.0/56.5	131I	1.1	0.091	0.071
	1.0/56.5	134CS	0.19	0.19	0.0034
	8.6/56.5	137CS	0.41	0.039	0.022
BAKER CA	3.1/44.4	7BE	0.40	0.40	0.028
	11.0/44.4	103RU	0.35	0.031	0.041
	14.9/44.4	131I	2.4	0.049	0.27
	4.1/44.4	134CS	0.25	0.12	0.017
	11.1/44.4	137CS	0.35	0.023	0.035
	2.1/44.4	140LA	1.1	1.1	0.052

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO- NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
BISHOP CA	9.0/58.0	7BE	0.74	0.42	0.090
	16.0/58.0	103RU	0.71	0.092	0.078
	18.0/58.0	131I	1.9	0.095	0.22
	7.0/58.0	134CS	0.19	0.075	0.017
	17.0/58.0	137CS	0.42	0.062	0.052
	3.0/58.0	140LA	1.8	1.8	0.092
CHICO CA	16.0/58.0	103RU	0.52	0.097	0.058
	18.0/58.0	131I	4.2	0.010	0.24
	1.0/58.0	132TE	0.16	0.16	0.0028
	8.0/58.0	134CS	0.24	0.068	0.017
	17.0/58.0	137CS	0.53	0.048	0.044
INDIO CA	4.0/51.4	7BE	0.40	0.29	0.027
	15.9/51.4	103RU	0.61	0.044	0.048
	13.9/51.4	131I	7.7	0.062	0.26
	3.9/51.4	134CS	0.29	0.081	0.012
	11.9/51.4	137CS	0.41	0.036	0.035
LONE PINE CA	7.1/56.8	7BE	0.46	0.20	0.036
	4.9/56.8	103RU	0.13	0.066	0.0078
	7.9/56.8	131I	0.33	0.13	0.028
NEEDLES CA	13.0/61.0	7BE	0.51	0.24	0.073
	15.0/61.0	103RU	0.40	0.079	0.046
	15.0/61.0	131I	1.5	0.16	0.18
	3.0/61.0	134CS	0.21	0.090	0.0067
	12.0/61.0	137CS	0.28	0.056	0.027
RIDGECREST CA	16.9/54.5	7BE	0.31	0.22	0.088
	16.9/54.5	103RU	0.75	0.037	0.082
	18.8/54.5	131I	5.8	0.10	0.39
	3.0/54.5	132TE	0.35	0.22	0.017
	8.0/54.5	134CS	0.27	0.055	0.022
	13.0/54.5	137CS	0.49	0.049	0.052
SANTA ROSA CA	8.9/51.9	103RU	0.37	0.098	0.042
	9.1/51.9	131I	3.1	0.11	0.15
	5.1/51.9	134CS	0.36	0.080	0.017
	7.1/51.9	137CS	0.68	0.091	0.036

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
CORTEZ CO	7.0/58.4	7BE	0.36	0.28	0.040
	10.0/58.4	103RU	0.19	0.060	0.018
	13.9/58.4	131I	1.3	0.10	0.10
	3.0/58.4	134CS	0.087	0.023	0.0022
	7.1/58.4	137CS	0.13	0.035	0.0088
DENVER CO	3.0/57.1	7BE	0.40	0.20	0.017
	6.0/57.1	103RU	0.26	0.054	0.013
	10.0/57.1	131I	0.33	0.059	0.033
	1.0/57.1	134CS	0.050	0.050	0.00087
	5.0/57.1	137CS	0.13	0.053	0.0074
GRAND JUNCTION CO	15.0/46.7	7BE	0.39	0.27	0.10
	11.0/46.7	103RU	0.39	0.063	0.033
	17.9/46.7	131I	1.6	0.17	0.20
	2.3/46.7	134CS	0.11	0.10	0.0051
	5.2/46.7	137CS	1.5	0.088	0.042
MOUNTAIN HOME ID	3.2/60.7	7BE	0.37	0.37	0.019
	10.4/60.7	103RU	0.55	0.087	0.036
	14.6/60.7	131I	4.6	0.098	0.18
	2.0/60.7	134CS	0.41	0.20	0.010
	9.4/60.7	137CS	1.0	0.045	0.036
NAMPA ID	12.0/57.3	7BE	0.42	0.27	0.073
	19.0/57.3	103RU	0.64	0.025	0.049
	18.9/57.3	131I	4.2	0.039	0.22
	2.0/57.3	132TE	0.43	0.17	0.011
	9.1/57.3	134CS	0.55	0.013	0.017
	12.1/57.3	137CS	0.24	0.022	0.024
POCATELLO ID	8.6/57.2	7BE	0.37	0.25	0.046
	15.0/57.2	103RU	0.34	0.085	0.049
	17.0/57.2	131I	3.1	0.080	0.29
	3.0/57.2	134CS	0.13	0.11	0.0062
	13.6/57.2	137CS	0.47	0.030	0.038
FORT DODGE IA	8.0/50.1	103RU	0.20	0.027	0.015
	7.0/50.1	131I	1.5	0.045	0.080
	3.0/50.1	137CS	0.23	0.11	0.010

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
IOWA CITY IA	3.7/61.0	7BE	0.18	0.18	0.011
	4.9/61.0	103RU	0.24	0.11	0.016
	8.0/61.0	131I	0.20	0.075	0.019
	3.9/61.0	137CS	0.10	0.080	0.0058
DODGE CITY KS	9.0/58.0	103RU	0.26	0.040	0.014
	8.0/58.0	131I	0.29	0.13	0.023
	3.0/58.0	137CS	0.19	0.12	0.0076
MINNEAPOLIS MN	5.0/57.5	7BE	0.33	0.22	0.023
	12.7/57.5	103RU	0.33	0.025	0.033
	2.0/57.5	106RU	0.15	0.15	0.0050
	9.9/57.5	131I	2.3	0.10	0.088
	.7/57.5	132TE	0.043	0.043	0.00055
	3.7/57.5	134CS	0.11	0.067	0.0056
	5.7/57.5	137CS	0.30	0.11	0.018
CLAYTON MO	2.0/50.0	103RU	0.099	0.099	0.0039
JOPLIN MO	4.0/51.0	7BE	0.21	0.066	0.011
	1.0/51.0	103RU	0.17	0.17	0.0034
	1.0/51.0	131I	0.31	0.31	0.0061
	3.0/51.0	137CS	0.043	0.043	0.0025
ST JOSEPH MO	4.6/51.5	7BE	0.20	0.091	0.014
	10.9/51.5	103RU	0.20	0.024	0.014
	11.3/51.5	131I	1.5	0.045	0.046
	.9/51.5	134CS	0.11	0.11	0.0019
	4.8/51.5	137CS	0.22	0.014	0.0085
GREAT FALLS MT	7.0/39.0	103RU	0.41	0.096	0.036
	8.0/39.0	131I	2.9	0.093	0.19
	2.0/39.0	134CS	0.15	0.092	0.0062
	5.0/39.0	137CS	0.34	0.10	0.031
KALISPELL MT	3.0/52.5	7BE	0.28	0.28	0.016
	13.2/52.5	103RU	0.44	0.030	0.038
	14.2/52.5	131I	4.2	0.0092	0.15
	5.3/52.5	134CS	0.30	0.018	0.011
	13.2/52.5	137CS	0.70	0.0086	0.034

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
MILES CITY MT	9.0/49.0	103RU	0.37	0.022	0.020
	10.0/49.0	131I	1.2	0.074	0.083
	2.0/49.0	134CS	0.15	0.080	0.0046
	2.0/49.0	137CS	0.28	0.15	0.0088
NORTH PLATTE NE	5.5/41.1	103RU	0.14	0.12	0.017
	6.5/41.1	131I	1.3	0.13	0.075
	1.5/41.1	134CS	0.060	0.060	0.0022
	4.5/41.1	137CS	0.15	0.089	0.012
ADAVEN (CANFIELD'S RANCH) NV	5.8/53.9	7BE	0.28	0.23	0.028
BATTLE MOUNTAIN NV	6.6/43.9	7BE	0.19	0.16	0.028
	13.7/43.9	103RU	0.52	0.049	0.061
	14.6/43.9	131I	4.0	0.043	0.30
	2.0/43.9	132TE	0.15	0.15	0.0068
	4.9/43.9	134CS	0.15	0.051	0.013
	12.6/43.9	137CS	0.33	0.038	0.042
	2.0/43.9	140LA	0.61	0.61	0.027
CALIENTE NV	14.0/51.0	103RU	0.89	0.066	0.067
	23.9/51.0	131I	2.0	0.040	0.23
	1.1/51.0	132TE	0.34	0.34	0.0069
	3.1/51.0	134CS	0.22	0.12	0.0095
	12.0/51.0	137CS	0.45	0.053	0.037
CURRANT NV - ANGLE WORM RANCH	8.0/50.4	7BE	0.34	0.28	0.049
	12.0/50.4	103RU	0.50	0.076	0.045
	16.9/50.4	131I	3.1	0.052	0.24
	1.0/50.4	132TE	0.16	0.16	0.0030
	3.9/50.4	134CS	0.20	0.060	0.011
	10.9/50.4	137CS	0.34	0.039	0.038
CURRIE NV	4.1/57.9	7BE	0.33	0.30	0.023
	14.1/57.9	103RU	0.87	0.074	0.074
	17.0/57.9	131I	3.9	0.077	0.28
	4.0/57.9	132TE	0.36	0.19	0.017
	6.0/57.9	134CS	0.29	0.093	0.019
	12.1/57.9	137CS	0.48	0.049	0.039
DUCKWATER NV	2.0/25.6	7BE	0.36	0.36	0.028
	9.8/25.6	103RU	0.46	0.046	0.075
	10.9/25.6	131I	4.4	0.15	0.93

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO- NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
DUCKWATER NV (CONT)	1.4/25.6	132TE	0.16	0.16	0.0084
	2.5/25.6	134CS	0.18	0.13	0.015
	5.5/25.6	137CS	0.39	0.042	0.042
ELKO NV	9.0/29.0	103RU	0.92	0.13	0.13
	10.0/29.0	131I	1.8	0.11	0.31
	2.0/29.0	132TE	0.22	0.16	0.013
	6.0/29.0	134CS	0.30	0.10	0.039
	7.0/29.0	137CS	0.71	0.17	0.084
EUREKA NV	2.0/44.3	7BE	0.28	0.28	0.012
	9.1/44.3	103RU	0.59	0.12	0.063
	11.1/44.3	131I	1.1	0.32	0.19
	2.2/44.3	132TE	0.14	0.14	0.0069
	4.3/44.3	134CS	0.16	0.15	0.015
	8.6/44.3	137CS	0.33	0.070	0.040
	2.2/44.3	140LA	0.87	0.87	0.043
FALLON NV	14.5/43.6	103RU	0.50	0.038	0.062
	15.5/43.6	131I	3.6	0.055	0.21
	4.0/43.6	134CS	0.20	0.093	0.014
	8.0/43.6	137CS	0.45	0.074	0.036
FRENCHMAN STATION NV	7.0/29.0	103RU	0.75	0.085	0.12
	10.0/29.0	131I	5.1	0.21	0.67
	1.0/29.0	132TE	0.41	0.41	0.015
	5.0/29.0	134CS	0.40	0.16	0.040
	7.0/29.0	137CS	0.62	0.13	0.095
GEYSER RANCH NV	6.0/49.8	7BE	0.26	0.15	0.026
	10.0/49.8	103RU	0.38	0.054	0.032
	17.9/49.8	131I	1.4	0.0051	0.14
	2.0/49.8	134CS	0.15	0.033	0.0036
	8.0/49.8	137CS	0.21	0.031	0.014
LOVELOCK NV	4.0/38.4	7BE	1.1	0.35	0.074
	15.0/40.5	103RU	0.75	0.045	0.074
	16.0/40.5	131I	3.1	0.076	0.26
	.9/40.5	132TE	0.23	0.23	0.0050
	8.0/40.5	134CS	0.30	0.025	0.023
	9.1/40.5	137CS	0.54	0.043	0.050

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
LUND NV	3.0/47.7	7BE	0.39	0.39	0.025
	11.9/47.7	103RU	0.64	0.10	0.072
	11.9/47.7	131I	3.5	0.11	0.23
	2.0/47.7	132TE	0.35	0.30	0.014
	3.0/47.7	134CS	0.24	0.085	0.011
	9.9/47.7	137CS	0.47	0.046	0.040
MESQUITE NV	2.0/52.4	7BE	0.28	0.28	0.011
	13.0/52.4	103RU	0.48	0.019	0.040
	14.0/52.4	131I	2.3	0.016	0.18
	1.0/52.4	134CS	0.12	0.12	0.0022
	11.0/52.4	137CS	0.20	0.021	0.020
RENO NV	10.0/36.2	7BE	0.81	0.41	0.16
	17.2/36.2	103RU	1.0	0.030	0.14
	17.2/36.2	131I	8.9	0.17	0.55
	4.0/36.2	132TE	0.45	0.21	0.035
	5.1/36.2	134CS	0.46	0.095	0.040
	15.2/36.2	137CS	0.96	0.055	0.11
ROUND MOUNTAIN NV	3.0/49.0	7BE	0.30	0.30	0.019
	15.0/49.0	103RU	0.79	0.12	0.084
	18.0/49.0	131I	3.6	0.044	0.29
	1.0/49.0	132TE	0.19	0.19	0.0038
	5.2/49.0	134CS	0.26	0.12	0.018
	12.0/49.0	137CS	0.56	0.049	0.048
WELLS NV	15.2/51.7	103RU	0.80	0.026	0.070
	17.0/51.7	131I	3.9	0.10	0.25
	6.0/51.7	134CS	0.25	0.094	0.021
	8.0/51.7	137CS	0.44	0.14	0.042
WINNEMUCCA NV	4.2/45.7	7BE	0.37	0.37	0.034
	17.0/45.7	103RU	0.35	0.056	0.065
	18.0/45.7	131I	1.8	0.080	0.16
	2.9/45.7	132TE	0.093	0.093	0.0060
	14.0/45.7	134CS	0.17	0.019	0.024
	14.1/45.7	137CS	0.32	0.040	0.050
ALBUQUERQUE NM	3.2/51.2	7BE	0.18	0.18	0.011
	1.8/51.2	103RU	0.058	0.058	0.0021
	5.0/51.2	131I	0.88	0.16	0.035

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
CARLSBAD NM	8.1/50.3	7BE	0.40	0.16	0.037
	6.7/50.3	103RU	0.12	0.022	0.0077
	15.0/50.3	131I	1.1	0.0068	0.089
	3.0/50.3	134CS	0.0083	0.0083	0.00050
	7.1/50.3	137CS	0.12	0.014	0.0059
SHIPROCK NM	6.9/50.9	7BE	0.48	0.33	0.053
	14.0/50.9	103RU	0.22	0.062	0.028
	16.9/50.9	131I	0.73	0.15	0.14
	2.9/50.9	134CS	0.029	0.029	0.0016
	14.0/50.9	137CS	0.14	0.034	0.016
BISMARK ND	8.4/51.9	7BE	0.30	0.22	0.044
	14.5/51.9	103RU	0.32	0.040	0.036
	15.6/51.9	131I	1.1	0.085	0.087
	3.0/51.9	134CS	0.094	0.067	0.0044
	16.3/51.9	137CS	0.31	0.019	0.037
FARGO ND	6.0/45.0	103RU	0.52	0.18	0.042
	10.0/45.0	131I	1.5	0.18	0.097
	2.0/45.0	134CS	0.18	0.17	0.0078
	7.0/45.0	137CS	0.34	0.14	0.035
WILLISTON ND	10.0/53.9	7BE	0.18	0.15	0.030
	16.0/53.9	103RU	0.35	0.029	0.034
	12.0/53.9	131I	0.83	0.12	0.072
	2.0/53.9	132TE	0.10	0.10	0.0039
	.9/53.9	134CS	0.24	0.24	0.0041
	12.1/53.9	137CS	0.31	0.026	0.031
MUSKOGEE OK	8.0/66.0	7BE	0.21	0.14	0.021
	11.0/66.0	103RU	0.15	0.013	0.0074
	5.0/66.0	131I	0.89	0.18	0.057
	4.0/66.0	134CS	0.0030	0.0030	0.00018
	8.0/66.0	137CS	0.098	0.0090	0.0059
MEDFORD OR	3.0/48.8	7BE	0.20	0.20	0.012
	4.0/48.8	103RU	0.29	0.071	0.016
	6.0/48.8	131I	2.4	0.20	0.083
	1.0/48.8	132TE	0.20	0.20	0.0041
	2.0/48.8	134CS	0.21	0.17	0.0076
	3.0/48.8	137CS	0.53	0.064	0.017

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
BURNS OR	4.9/49.9	7BE	0.28	0.26	0.027
	13.9/49.9	103RU	0.38	0.067	0.053
	16.9/49.9	131I	2.5	0.063	0.20
	3.9/49.9	134CS	0.37	0.017	0.0099
	8.9/49.9	137CS	0.56	0.030	0.028
RAPID CITY SD	6.0/50.6	103RU	0.16	0.022	0.0056
	5.0/50.6	131I	1.1	0.12	0.037
	2.0/50.6	137CS	0.095	0.095	0.0037
AMARILLO TX	3.7/49.5	103RU	0.078	0.078	0.0058
	5.7/49.5	131I	0.17	0.047	0.0085
	3.7/49.5	137CS	0.092	0.092	0.0069
AUSTIN TX	1.0/47.0	131I	1.6	1.6	0.033
	1.1/47.0	137CS	0.065	0.065	0.0015
MIDLAND TX	2.2/51.2	103RU	0.027	0.027	0.0011
	1.1/51.2	131I	0.16	0.16	0.0035
	2.2/51.2	137CS	0.038	0.038	0.0016
TYLER TX	8.9/41.9	103RU	0.11	0.018	0.0083
BRYCE CANYON UT	10.9/48.2	7BE	0.33	0.19	0.050
	13.8/48.2	103RU	0.35	0.038	0.037
	14.7/46.2	131I	0.76	0.067	0.095
	2.8/48.2	134CS	0.16	0.046	0.0050
	5.8/48.2	137CS	0.21	0.093	0.016
ENTERPRISE UT	8.0/58.0	7BE	0.69	0.27	0.065
	15.0/58.0	103RU	0.29	0.084	0.042
	15.0/58.0	131I	1.9	0.086	0.13
	1.0/58.0	132TE	0.10	0.10	0.0017
	2.0/58.0	134CS	0.16	0.088	0.0043
	10.0/58.0	137CS	0.33	0.035	0.021
GARRISON UT	11.3/54.5	7BE	0.29	0.16	0.041
	15.2/54.5	103RU	0.32	0.092	0.040
	15.0/54.5	131I	2.7	0.096	0.14
	1.8/54.5	132TE	0.13	0.13	0.0043
	11.8/54.5	134CS	0.12	0.026	0.011
	13.0/54.5	137CS	0.27	0.073	0.028

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
LOGAN UT	8.4/51.4	103RU	0.33	0.060	0.025
	13.6/51.4	131I	3.2	0.028	0.18
	3.0/51.4	134CS	0.15	0.13	0.0080
	11.2/51.4	137CS	0.32	0.044	0.033
PAROWAN UT	3.0/41.1	7BE	0.47	0.25	0.029
	9.0/41.1	103RU	0.35	0.044	0.037
	10.0/41.1	131I	0.85	0.073	0.087
	4.0/41.1	134CS	0.10	0.019	0.0068
	6.0/41.1	137CS	0.23	0.047	0.018
VERNAL UT	3.1/43.6	7BE	0.30	0.30	0.021
	9.4/43.6	103RU	0.23	0.050	0.029
	14.1/43.6	131I	1.7	0.091	0.17
	3.5/43.6	134CS	0.090	0.068	0.0066
	4.5/43.6	137CS	0.37	0.081	0.021
WENDOVER UT	2.0/28.0	95NB	0.11	0.11	0.0077
	5.0/28.0	103RU	0.62	0.15	0.053
	7.0/28.0	131I	2.3	0.40	0.21
	3.0/28.0	134CS	0.16	0.049	0.0092
	6.0/28.0	137CS	0.47	0.075	0.039
	2.0/28.0	141CE	0.058	0.058	0.0042
SEATTLE WA	3.9/53.9	103RU	0.56	0.089	0.015
	5.0/53.9	131I	0.97	0.12	0.046
	1.0/53.9	134CS	0.097	0.097	0.0018
	6.9/53.9	137CS	0.19	0.090	0.017
SPOKANE WA	5.0/50.0	7BE	0.25	0.22	0.024
	10.0/50.0	103RU	0.39	0.031	0.034
	11.0/50.0	131I	2.4	0.12	0.14
	2.0/50.0	132TE	0.28	0.14	0.0084
	3.0/50.0	134CS	0.27	0.13	0.011
	10.0/50.0	137CS	0.64	0.028	0.032
ROCK SPRINGS WY	8.0/51.0	103RU	0.59	0.080	0.038
	10.0/51.0	131I	1.3	0.17	0.16
	2.0/51.0	134CS	0.28	0.12	0.0079
	6.0/51.0	137CS	0.54	0.12	0.027

(continued)

TABLE E-2. Continued

SAMPLING LOCATION	NO. DAYS DETECTED /SAMPLED	RADIO- NUCLIDE	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG*
WORLAND WY	8.0/57.7	7BE	0.37	0.18	0.035
	10.0/57.7	103RU	0.32	0.034	0.024
	13.0/57.7	131I	3.1	0.081	0.13
	5.0/57.7	134CS	0.16	0.056	0.0082
	9.0/57.7	137CS	0.25	0.043	0.020

*AVG MEANS TIME-WEIGHTED AVERAGE OVER THE SAMPLING TIME.

NOTE: ALL RADIOISOTOPES OTHER THAN 7BE, WERE DETECTED AS THE DEBRIS FROM CHERNOBYL ENTERED THE U.S.

THE FOLLOWING STATIONS HAD NEGLIGIBLE GAMMA-SPECTRA:

MONROE LA
BLUE JAY NV
DESERT OASIS RESORT NV

TABLE E-3. SUMMARY OF GROSS BETA ANALYSES FOR AIR SURVEILLANCE NETWORK - 1986

SAMPLING LOCATION	NO. DAYS SAMPLED	RADIOACTIVITY CONC. (PCI/M3) MAX	MIN	AVG
SHOSHONE CA	352.9	0.70	-0.0057	0.022
LAS VEGAS NV	358.8	0.73	0.0013	0.026
DELTA UT	302.3	1.1	0.0	0.029
MILFORD UT	359.1	0.83	0.0014	0.025
ST GEORGE UT	364.1	0.62	0.0018	0.021

TABLE E-4. PLUTONIUM-239 CONCENTRATION IN COMPOSITED AIR SAMPLES* - 1986

SAMPLING LOCATION	FIRST QUARTER	SECOND QUARTER	THIRD QUARTER	FOURTH QUARTER	ANNUAL AVERAGE
WINSLOW/TUCSON, AZ	-96	-2.2	-	-	-63
BISHOP/RIDGECREST, CA	-3.4	-0.91	-	1.4	-.31
DENVER AND CORTEZ, CO	370	2.1	-	-	170
MT HOME/NAMPA, ID	5.1	-0.47	-	-6.1	-1.5
JOPLIN/CLAYTON, MO	-49	-2.1	-	-26	-16
GREAT FALLS/MILES CITY, MT	160	-1.5	-	140	40
LAS VEGAS, NV	4.1	3.7	-21	2.8	-2.6
LATHROP WELLS, NV	4	2.4	78	2.9	18
RACHEL, NV	7.7	6.8	-51	-27	-8.5
BISMARCK/FARGO, ND	46	-1.6	-	1.2	4.8
ALBUQUERQUE/CARLSBAD, NM	-	0.17	-	-	.17
MEDFORD/BURNS, OR	6.5	-16	-	13	-6.0
AUSTIN/AMARILLO, TX	1.4	-	-	-4.1	-1.9
VERNAL/LOGAN, UT	-8.4	-2.7	-	5.2	-1.5
SALT LAKE CITY, UT	8.9	2.5	-3.3	2.4	3.2
SEATTLE/SPOKANE, WA	7.8	-0.91	-	-11	-.89
WORLAND/ROCK SPRINGS, WY	12	-1.8	-	11	9.5

*ALL DATA ARE EXPRESSED IN ACI/M^3 AND ARE LESS THAN THE MDC WHICH VARIED FROM 2 TO 500 ACI/M^3. ALL PLUTONIUM-238 RESULTS WERE ALSO LESS THAN MDC.

TABLE E-5. SUMMARY OF ANALYTICAL RESULTS FOR THE NOBLE GAS AND TRITIUM SURVEILLANCE NETWORK - 1986

SAMPLING LOCATION	NUMBER SAMPLES ANALYZED/ LOST	RADIONUCLIDE	RADIOACTIVITY CONC. (PCI/M3)* MAX	MIN	AVG	PERCENT CONC. GUIDE+
SHOSHONE,	43/9	85KR	33	17	25	<0.01
CALIF.	44/8	133XE	29	-4.5	3.0	<0.01
	51/0	3H IN ATM. M.*	0.69	-0.57	0.070	-
	51/0	3H AS HTO IN AIR	4.2	-4.1	0.29	<0.01
ALAMO,	49/2	85KR	31	16	24	<0.01
NEV.	47/4	133XE	40	-8.7	3.5	<0.01
	52/0	3H IN ATM. M.*	0.63	-0.56	0.022	-
	52/0	3H AS HTO IN AIR	5.6	-5.1	0.074	<0.01
AUSTIN,	51/1	85KR	30	20	25	<0.01
NEV.	48/4	133XE	54	-5.8	3.7	<0.01
	52/0	3H IN ATM. M.*	0.74	-0.68	0.024	-
	52/0	3H AS HTO IN AIR	4.1	-3.7	0.26	<0.01
BEATTY,	41/10	85KR	37	19	26	<0.01
NEV.	37/14	133XE	52	-6.9	6.4	<0.01
	52/0	3H IN ATM. M.*	0.77	-0.78	0.083	-
	52/0	3H AS HTO IN AIR	9.6	-4.7	0.51	<0.01
ELY,	52/0	85KR	31	19	25	<0.01
NEV.	52/0	133XE	36	-7.7	3.2	<0.01
	52/0	3H IN ATM. M.*	0.59	-0.51	-0.0041	-
	52/0	3H AS HTO IN AIR	7.5	-3.7	0.11	<0.01
GOLDFIELD,	49/2	85KR	31	17	25	<0.01
NEV.	44/7	133XE	45	-13	3.4	<0.01
	51/1	3H IN ATM. M.*	0.62	-0.72	0.0080	-
	51/1	3H AS HTO IN AIR	1.7	-1.4	0.11	<0.01
INDIAN SPRINGS,	44/7	85KR	30	21	26	<0.01
NEV.	46/5	133XE	43	-14	3.3	<0.01
	50/2	3H IN ATM. M.*	0.49	-0.60	0.054	-
	50/2	3H AS HTO IN AIR	2.9	-2.9	0.37	<0.01
LAS VEGAS,	46/5	85KR	33	18	25	<0.01
NEV.	46/5	133XE	67	-15	3.3	<0.01
	50/1	3H IN ATM. M.*	2.3	-0.65	0.22	-
	50/1	3H AS HTO IN AIR	21	-8.1	2.3	<0.01

(continued)

TABLE E-5. Continued

SAMPLING LOCATION	NUMBER SAMPLES POSITIVE/ NEGATIVE	RADIONUCLIDE	RADIOACTIVITY CONC. (PCI/M3)* MAX	MIN	AVG	PERCENT CONC. GUIDE+
LATHROP WELLS, NEV.	51/1	85KR	32	19	25	<0.01
	48/4	133XE	84	-5.8	5.3	<0.01
	51/0	3H IN ATM. M.*	1.5	-0.44	0.22	-
	51/0	3H AS HTO IN AIR	18	-4.3	1.5	<0.01
OVERTON, NEV.	49/3	85KR	32	17	25	<0.01
	47/5	133XE	31	-11	2.4	<0.01
	50/2	3H IN ATM. M.*	0.63	-0.69	0.025	-
	50/2	3H AS HTO IN AIR	5.3	-5.2	0.17	<0.01
PAHRUMP, NEV.	48/4	85KR	30	19	25	<0.01
	47/5	133XE	24	-9.2	2.2	<0.01
	51/0	3H IN ATM. M.*	0.68	-0.57	0.041	-
	51/0	3H AS HTO IN AIR	5.9	-4.7	0.28	<0.01
PIOCHE, NEV.	13/1	85KR	30	21	26	<0.01
	12/2	133XE	9.4	-3.2	2.4	<0.01
	52/0	3H IN ATM. M.*	0.68	-0.74	-0.059	-
	52/0	3H AS HTO IN AIR	2.7	-6.4	-0.57	<0.01
RACHEL, NEV.	50/2	85KR	31	19	25	<0.01
	48/4	133XE	45	-7.6	3.5	<0.01
	52/0	3H IN ATM. M.*	1.0	-0.38	0.14	-
	52/0	3H AS HTO IN AIR	14	-1.9	1.3	<0.01
TONOPAH, NEV.	48/4	85KR	30	18	25	<0.01
	47/5	133XE	57	-5.6	4.4	<0.01
	52/0	3H IN ATM. M.*	0.57	-0.78	0.010	-
	52/0	3H AS HTO IN AIR	4.4	-4.5	0.032	<0.01
CEDAR CITY, UTAH	44/8	85KR	30	19	24	<0.01
	39/13	133XE	33	-4.9	3.9	<0.01
	52/0	3H IN ATM. M.*	0.99	-0.47	0.034	-
	52/0	3H AS HTO IN AIR	5.9	-5.9	0.16	<0.01
ST GEORGE, UTAH	40/12	85KR	30	19	24	<0.01
	41/11	133XE	16	-16	2.9	<0.01
	50/2	3H IN ATM. M.*	0.43	-0.58	-0.0083	-
	50/2	3H AS HTO IN AIR	7.2	-10	-0.18	<0.01

(continued)

TABLE E-5. Continued

SAMPLING LOCATION	NUMBER SAMPLES POSITIVE/ NEGATIVE	RADIONUCLIDE	RADIOACTIVITY CONC. (PCI/M3)* MAX	MIN	AVG	PERCENT CONC. GUIDE+
SALT LAKE CITY,	50/2	3H IN ATM. M.*	0.91	-0.28	0.14	-
UTAH	50/2	3H AS HTO IN AIR	8.7	-3.2	1.0	<0.01

* CONCENTRATIONS OF TRITIUM IN ATMOSPHERIC MOISTURE (ATM. M.) ARE EXPRESSED AS PCI PER ML OF WATER COLLECTED.

\+ CONCENTRATION GUIDES USED ARE FOR EXPOSURE TO A SUITABLE SAMPLE OF THE POPULATION IN AN UNCONTROLLED AREA.

TABLE E-6. SUMMARY OF TRITIUM RESULTS FOR THE NTS NETWORK LONG-TERM HYDROLOGICAL MONITORING PROGRAM - 1986

SAMPLING LOCATION	NO. SAMPLES	TRITIUM CONCENTRATION (PCI/L) MAX	MIN	AVG	PERCENT CONC. GUIDE
WELL 1 ARMY	12	3.7	-3.5	-0.99	<0.01
WELL 2	12	150	-7.1	12	0.06
WELL 3	11	7.4	-4.9	0.99	<0.01
WELL 4	11	7.8	-28	-4.8	<0.01
WELL 4 CP-1	9	7.0	-3.5	-0.54	<0.01
WELL 5C	11	4.3	-5.8	-0.94	<0.01
WELL 8	12	160	-6.4	14	0.07
WELL 20	11	6.1	-7.4	1.2	<0.01
WELL A	11	19	4.1	11	0.06
WELL B TEST	10	320	130	160	0.8
WELL C	11	58	0.13	25	0.1
WELL J-13	11	5.5	-8.5	-1.7	<0.01
WELL U19C	12	5.8	-7.4	-0.54	<0.01
WELL UE7NS	4	3200	2300	2500	10
WELL UE18R	8	23	-1.0	5.8	0.03

TABLE E-7. TRITIUM RESULTS FOR THE LONG-TERM HYDROLOGICAL MONITORING PROGRAM - 1986

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
NEVADA TEST SITE NETWORK			
SHOSHONE CA			
SHOSHONE SPRING	01/15	-86 ± 200*	<0.01
	06/03	9.7 ± 8.1*	0.05
ADAVEN NV			
ADAVEN SPRING	05/02	39 ± 8	0.2
	10/07	12 ± 250*	0.06
ALAMO NV			
WELL 4 CITY	04/01	9.3 ± 7.5*	0.05
	09/09	-75 ± 140*	<0.01
ASH MEADOWS NV			
CRYSTAL POOL	02/04	7.5 ± 8.5*	0.04
	07/02	22 ± 230*	0.1
FAIRBANKS SPRINGS	03/12	0.11 ± 7.9*	<0.01
	08/06	-22 ± 140*	<0.01
WELL 17S-50E-14CAC	02/04	0.93 ± 8.6*	<0.01
	07/02	110 ± 230*	0.5
WELL 18S-51E-7DB	02/04	6.5 ± 8.5*	0.03
	07/02	110 ± 230*	0.5
	08/06	39 ± 140*	0.2
BEATTY NV			
SPECIE SPRINGS	01/09	49 ± 8	0.2 (1)
	02/03	40 ± 7	0.2
	03/13	35 ± 6	0.2
TOLICHA PEAK	02/10	-5.0 ± 8.8*	<0.01
	07/01	-0.57 ± 8.3*	<0.01
USECOLOGY	01/15	-9.9 ± 8.1*	<0.01
	06/09	2.4 ± 200*	0.01
WELL 11S-48-1DD COFFERS	02/05	-2.8 ± 8.5*	<0.01
	07/01	22 ± 230*	0.1
WELL 12S-47E-7DBD CITY	03/12	9.0 ± 7.6*	0.04

(continued)

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
BEATTY NV			
WELL ROAD D SPICERS	02/06	-4.2 ± 8.6*	<0.01
	07/01	3.6 ± 7.9*	0.02
YOUNGHANS RCH (COW CAMP)	08/06	-46 ± 140*	<0.01 (2)
YOUNGHANS RCH (HOUSE WE)	08/06	62 ± 140*	0.3 (3)
YOUNGHANS RCH (LOWER PO)	08/06	-29 ± 140*	<0.01 (4)
YOUNGHANS RCH (UPPER PO)	08/06	-79 ± 85*	<0.01 (5)
BOULDER CITY NV			
LAKE MEAD INTAKE	03/10	110 ± 7	0.6
	08/11	79 ± 140*	0.4
CLARK STATION NV			
WELL 6 TTR	05/01	-1.7 ± 8.8*	<0.01
	10/07	-46 ± 250*	<0.01
HIKO NV			
CRYSTAL SPRINGS	04/01	12 ± 7	0.06
	08/12	-62 ± 140*	<0.01
	09/09	35 ± 140*	0.2
INDIAN SPRINGS NV			
WELL 1 SEWER COMPANY	01/17	-6.2 ± 7.9*	<0.01
	06/09	-170 ± 200*	<0.01
WELL 2 US AIR FORCE	01/14	3.5 ± 7.9*	0.02
	06/09	210 ± 200*	1
LAS VEGAS NV			
WELL 28 WATER DISTRICT	02/07	-9.3 ± 200*	<0.01
	06/06	2.7 ± 7.9*	0.01
LATHROP WELLS NV			
CITY 15S-50E-18CDC	01/14	-0.83 ± 7.9*	<0.01
	06/03	-2.4 ± 200*	<0.01
NYALA NV			
SHARP'S RANCH	04/01	6.7 ± 7.6*	0.03
	09/10	-42 ± 140*	<0.01

(continued)

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
OASIS VALLEY NV			
GOSS SPRINGS	03/11	4.5 ± 7.6*	0.02
PAHRUMP NV			
WELL 3 CALVADA ?	05/01	-4.3 ± 9.2*	<0.01
	10/21	-120 ± 250*	<0.01
RACHEL NV			
WELLS 7 AND 8 PENOYER	02/03	-13 ± 9*	<0.01
WELL 13 PENOYER	04/03	-0.71 ± 7.5*	<0.01
	09/08	-18 ± 140*	<0.01
WELL PENOYER CULINARY	04/03	4.4 ± 7.7*	0.02
	09/08	-42 ± 140*	<0.01
UNION CARBIDE WELL	01/15	-48 ± 200*	<0.01
	06/02	1.3 ± 8.0*	<0.01
TONOPAH NV			
CITY WELL	05/01	-6.8 ± 9.3*	<0.01
	10/07	-120 ± 250*	<0.01
WARM SPRINGS NV			
TWIN SPRINGS RANCH	04/01	2.5 ± 8.0*	0.01
	09/10	24 ± 140*	0.1
NTS NV			
WELL 5B	02/05	5.8 ± 8.3*	0.03
	07/03	8.5 ± 11*	0.04
WELL C-1	02/04	-150 ± 200*	<0.01
	07/02	6.3 ± 8.2*	0.03
WELL D TEST	03/03	120 ± 200*	0.6
WELL ~~U16D~~ UE16d	02/04	-86 ± 200*	<0.01
	07/02	1.0 ± 7.9*	<0.01
WELL UE1C	03/03	200 ± 200*	1
WELL UE5C	02/05	-130 ± 200*	<0.01
	06/03	83 ± 7	0.4
	07/03	0.13 ± 7.9*	<0.01

(continued)

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
NTS NV			
WELL UE15D	01/08	88 ± 200*	0.4
BACKGROUND SAMPLES - AMCHITKA, AK			
CONSTANTINE SPRING	08/29	65 ± 8	0.3
DUCK COVE CREEK	08/29	40 ± 8	0.2
JONES LAKE	08/29	30 ± 7	0.2
SITE D HYDRO EXPLORE HOLE	08/28	75 ± 6	0.4
WELL ARMY 1	08/28	45 ± 6	0.2
WELL ARMY 2	08/29	25 ± 6	0.1
WELL ARMY 4	08/29	63 ± 6	0.3
PROJECT CANNIKIN - AMCHITKA, AK			
CANNIKIN LAKE (NORTH END)	08/29	36 ± 7	0.2
CANNIKIN LAKE (SOUTH END)	08/29	47 ± 7	0.2
DK-45 LAKE	08/30	49 ± 8	0.2
ICE BOX LAKE	08/29	39 ± 7	0.2
PIT SOUTH OF CANNIKIN G	08/29	28 ± 6	0.1
WELL HTH-3	08/29	50 ± 7	0.2
WHITE ALICE CREEK	08/29	49 ± 8	0.2

(continued)

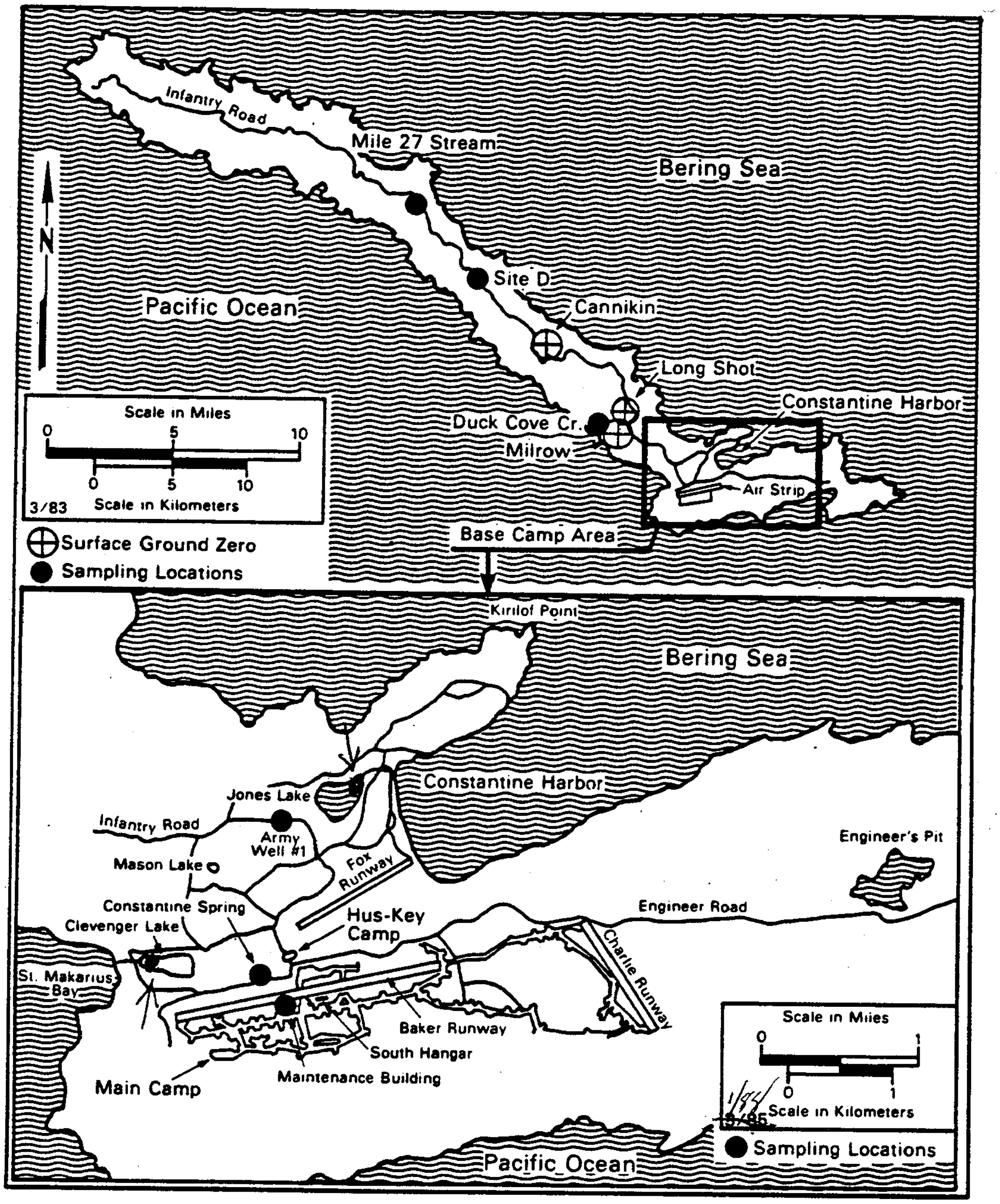


Figure E-1. Amchitka Island and background sampling locations for the LTHMP.

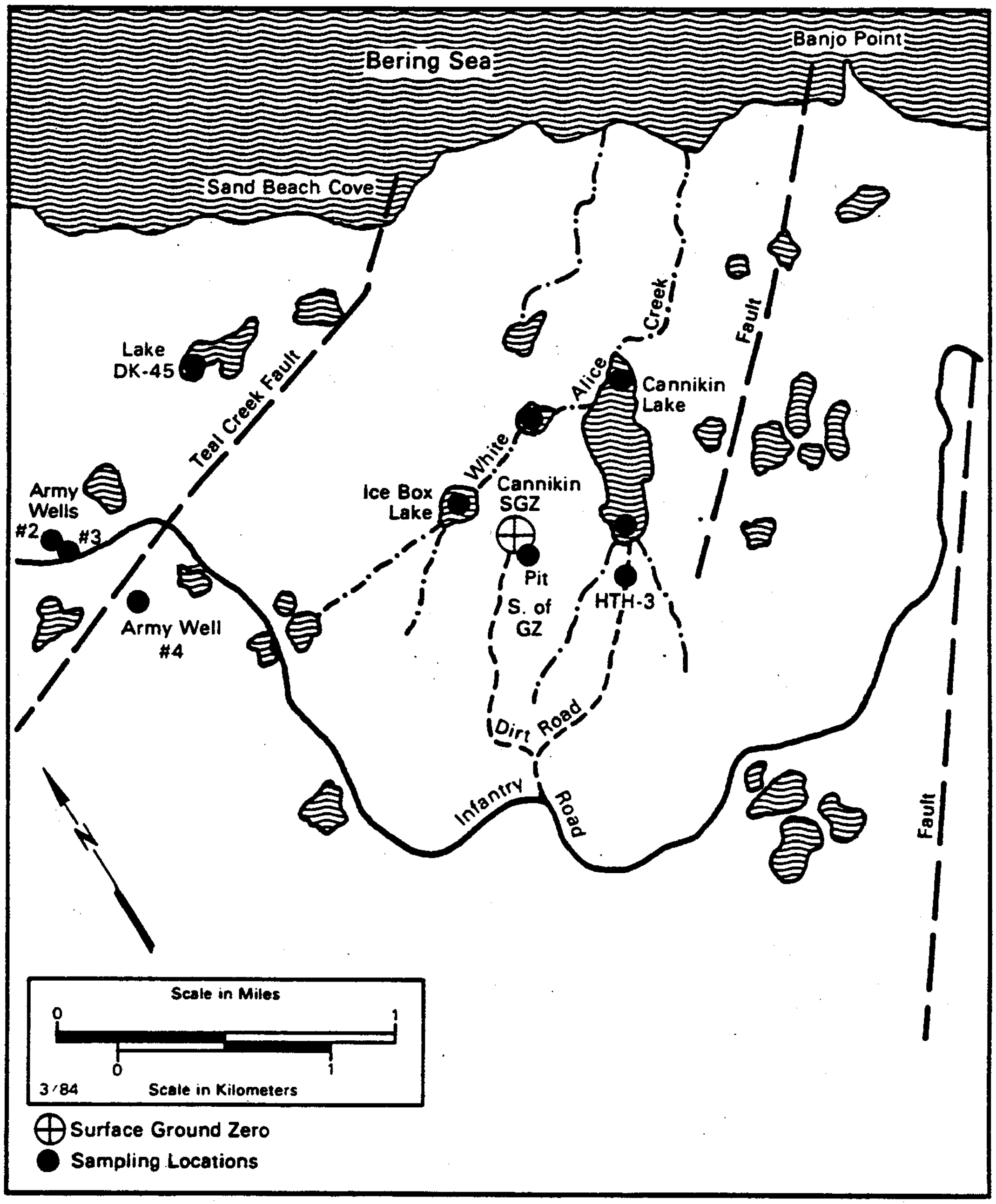
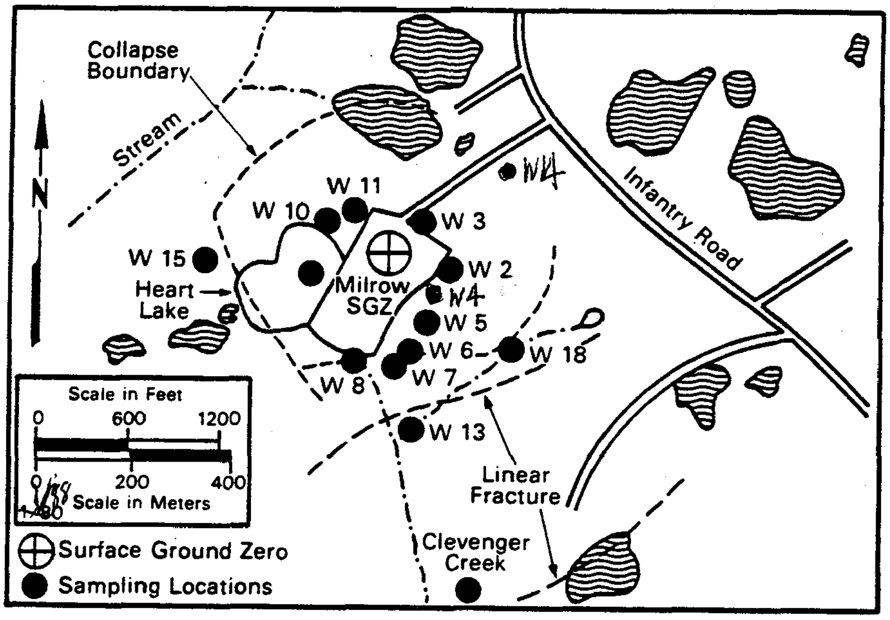


Figure E-2. LTHMP sampling locations for Project Cannikin.

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
<u>PROJECT LONGSHOT - AMCHITKA, AK</u>			
LONG SHOT POND 1	08/30	33 ± 8	0.2
LONG SHOT POND 2	08/30	37 ± 7	0.2
LONG SHOT POND 3	08/30	38 ± 9	0.2
MUD PIT NO.1	06/10	540 ± 190	3
	08/30	310 ± 7	2
MUD PIT NO.2	08/30	410 ± 9	2
MUD PIT NO.3	06/10	870 ± 190	4
	08/30	590 ± 9	3
REED POND	08/30	37 ± 7	0.2
WELL EPA-1	08/30	270 ± 9	1
WELL GZ NO.1	08/30	2300 ± 230	10
WELL GZ NO.2	08/30	150 ± 8	0.8
WELL WL-1	08/30	41 ± 7	0.2
WELL WL-2	08/30	320 ± 9	2
<u>PROJECT MILROW - AMCHITKA, AK</u>			
CLEVENGER CREEK	08/28	44 ± 8	0.2
HEART LAKE	08/28	31 ± 7	0.2
WELL W-2	08/28	28 ± 8	0.1
WELL W-3	08/28	28 ± 8	0.1
WELL W-4	08/28	31 ± 8	0.2
WELL W-7	08/28	35 ± 7	0.2
WELL W-8	08/28	41 ± 7	0.2

(continued)



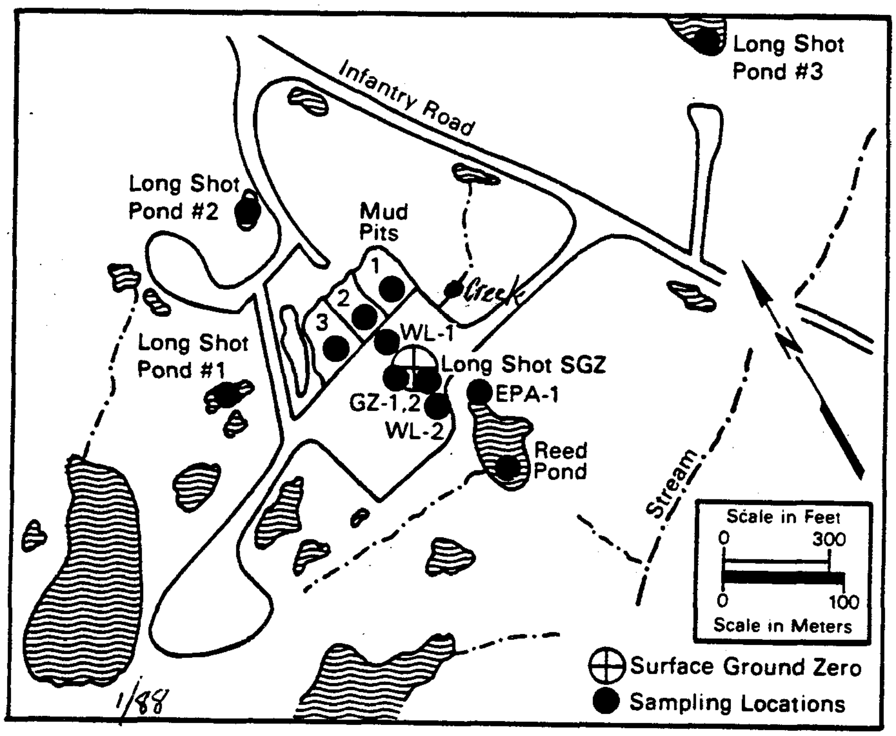


Figure E-3. LTHMP sampling locations for Projects Milrow and Long Shot.

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
PROJECT MILROW - AMCHITKA, AK (CONT)			
WELL W-10	08/28	35 ± 7	0.2
WELL W-11	08/28	87 ± 8	0.4
WELL W-13	08/28	42 ± 7	0.2
WELL W-14	08/28	33 ± 7	0.2
WELL W-15	08/28	28 ± 7	0.1
WELL W-17	08/28	30 ± 8	0.1
WELL W-18	08/28	52 ± 7	0.3
PROJECT RIO BLANCO - COLORADO			
B-1 EQUITY CAMP	06/17	100 ± 8	0.5
BRENNAN WINDMILL	06/16	71 ± 7	0.4
CER NO.1 BLACK SULPHUR	06/17	100 ± 7	0.5
CER NO.4 BLACK SULPHUR	06/17	100 ± 8	0.5
FAWN CREEK 1	06/16	58 ± 7	0.3
FAWN CREEK 3 (sp cond 350,pH .6)	06/16	64 ± 7	0.3
FAWN CREEK 6800FT UPSTR (sp cond 190,ph.4)	06/16	59 ± 7	0.3
FAWN CREEK 500FT UPSTRE (sp cond pH.0)	06/16	69 ± 8	0.3
FAWN CREEK 500FT DOWNST	06/16	63 ± 7	0.3
FAWN CREEK 8400FT DOWNS	06/16	49 ± 8	0.2
WELL JOHNSON ARTESIAN	06/17	57 ± 7	0.3
WELL RB-D-01	06/17	25 ± 7	0.1

(continued)

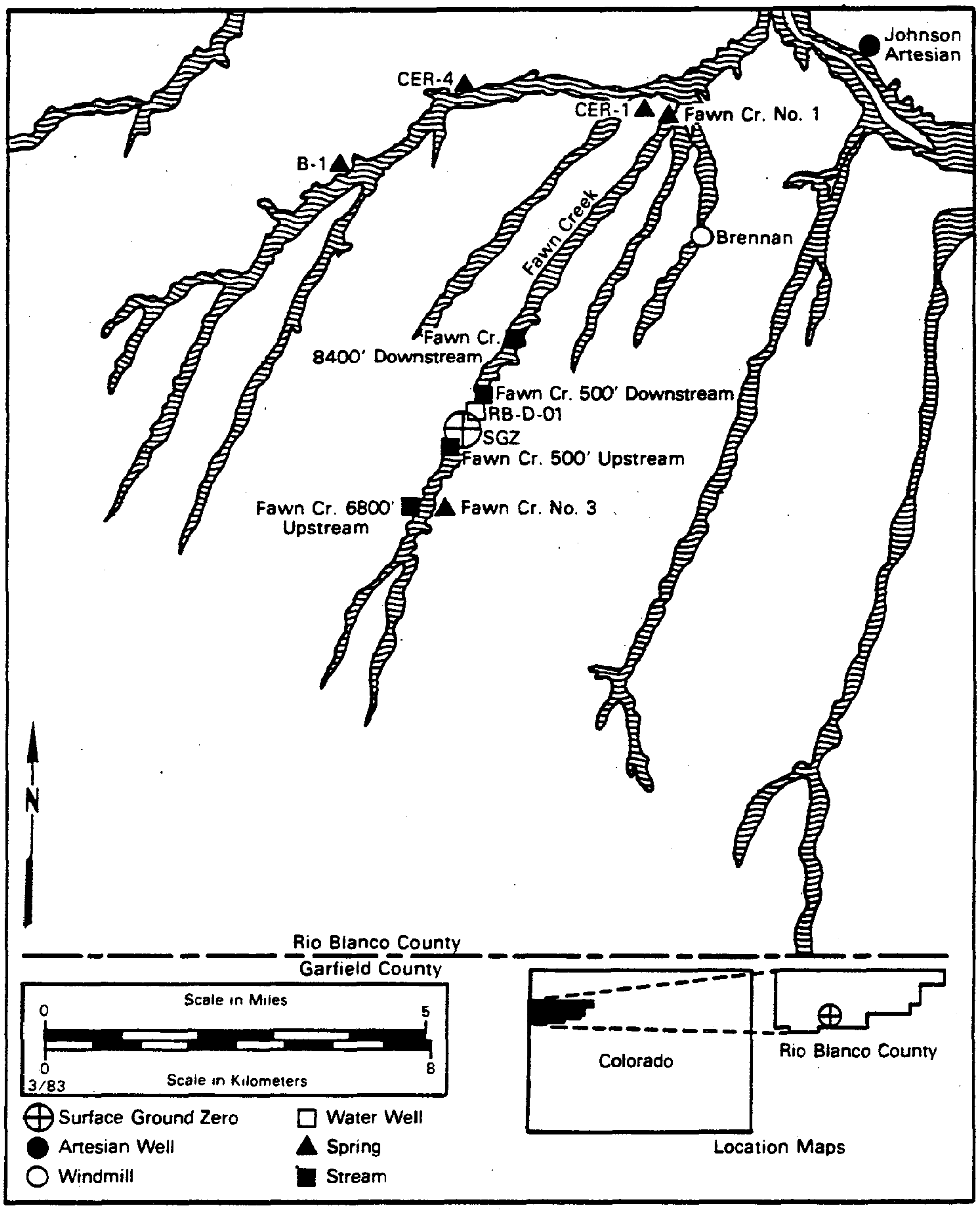


Figure E-4. LTHMP sampling locations for Project Rio Blanco.

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
PROJECT RULISON - COLORADO			
GRAND VALLEY CO			
BATTLEMENT CREEK	06/15	100 ± 8	0.5
CITY SPRINGS	06/15	28 ± 8	0.1
ALBERT GARDNER RANCH	06/15	190 ± 9	1
WELL CER TEST (3H lost)	06/15	NA	
RULISON CO			
LEE HAYWARD RANCH	06/15	260 ± 12	1
POTTER RANCH	06/16	140 ± 8	0.7
ROBERT SEARCY RANCH (SC)	06/15	90 ± 9	0.5
FELIX SEFCOVIC RANCH	06/15	98 ± 8	0.5
	06/16	190 ± 8	1
PROJECT DRIBBLE - MISSISSIPPI			
BAXTERVILLE MS			
HALF MOON CREEK	04/03	36 ± 7	0.2
	04/03	3.6 ± 8.9*	0.02
HALF MOON CREEK OVRFLW	04/03	800 ± 12	4
	04/03	840 ± 12	4
LOWER LITTLE CREEK	04/03	16 ± 8	0.08
	04/03	21 ± 9	0.1
POND WEST OF GZ	04/03	11 ± 9*	0.06
	04/03	14 ± 8	0.07
REECO PIT DRAINAGE-A	04/03	62 ± 9	0.3
REECO PIT DRAINAGE-B	04/03	2800 ± 200	10
REECO PIT DRAINAGE-C	04/03	36 ± 9	0.2
SALT DOME TIMBER CO.	04/04	30 ± 9	0.2

(continued)

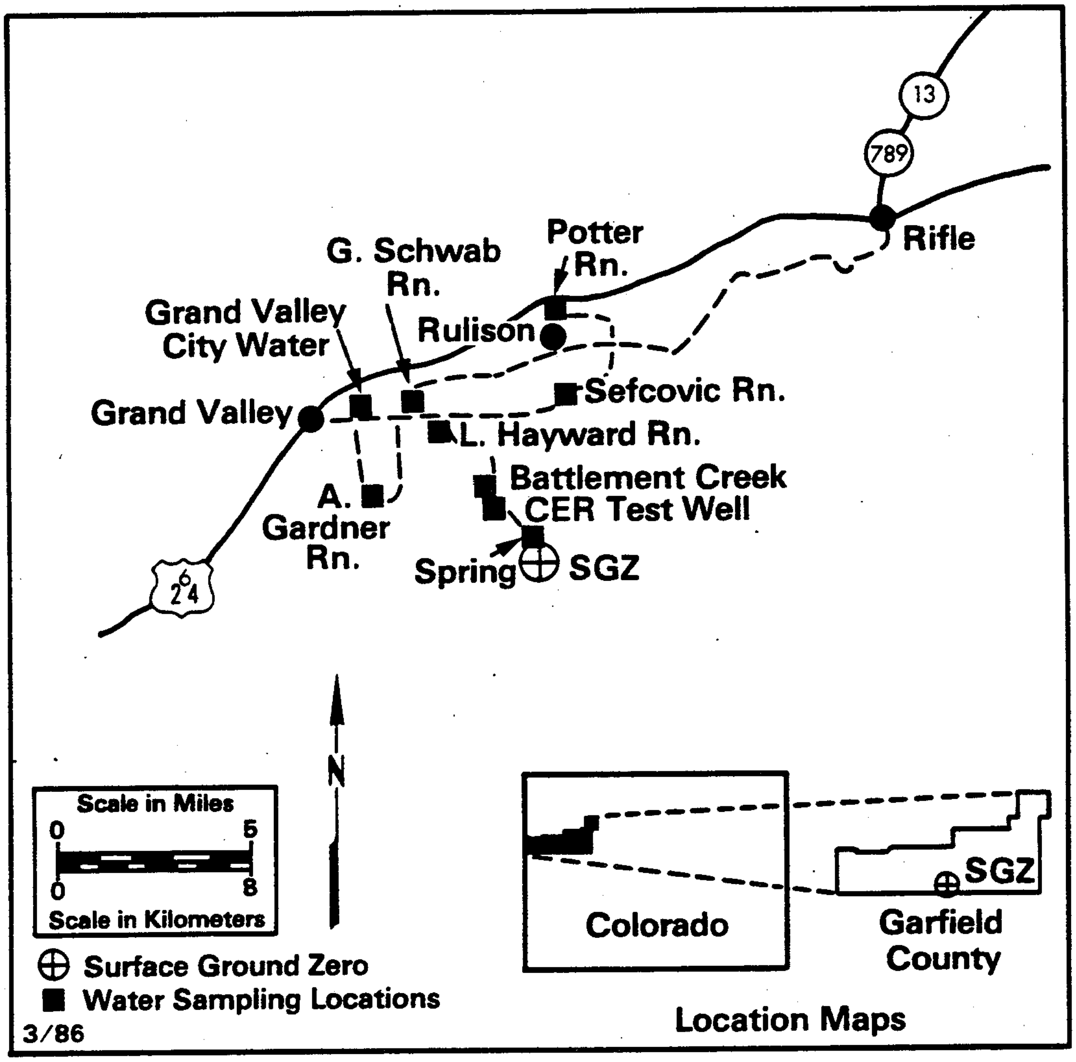


Figure E-5. LTHMP sampling locations for Project Rulison.

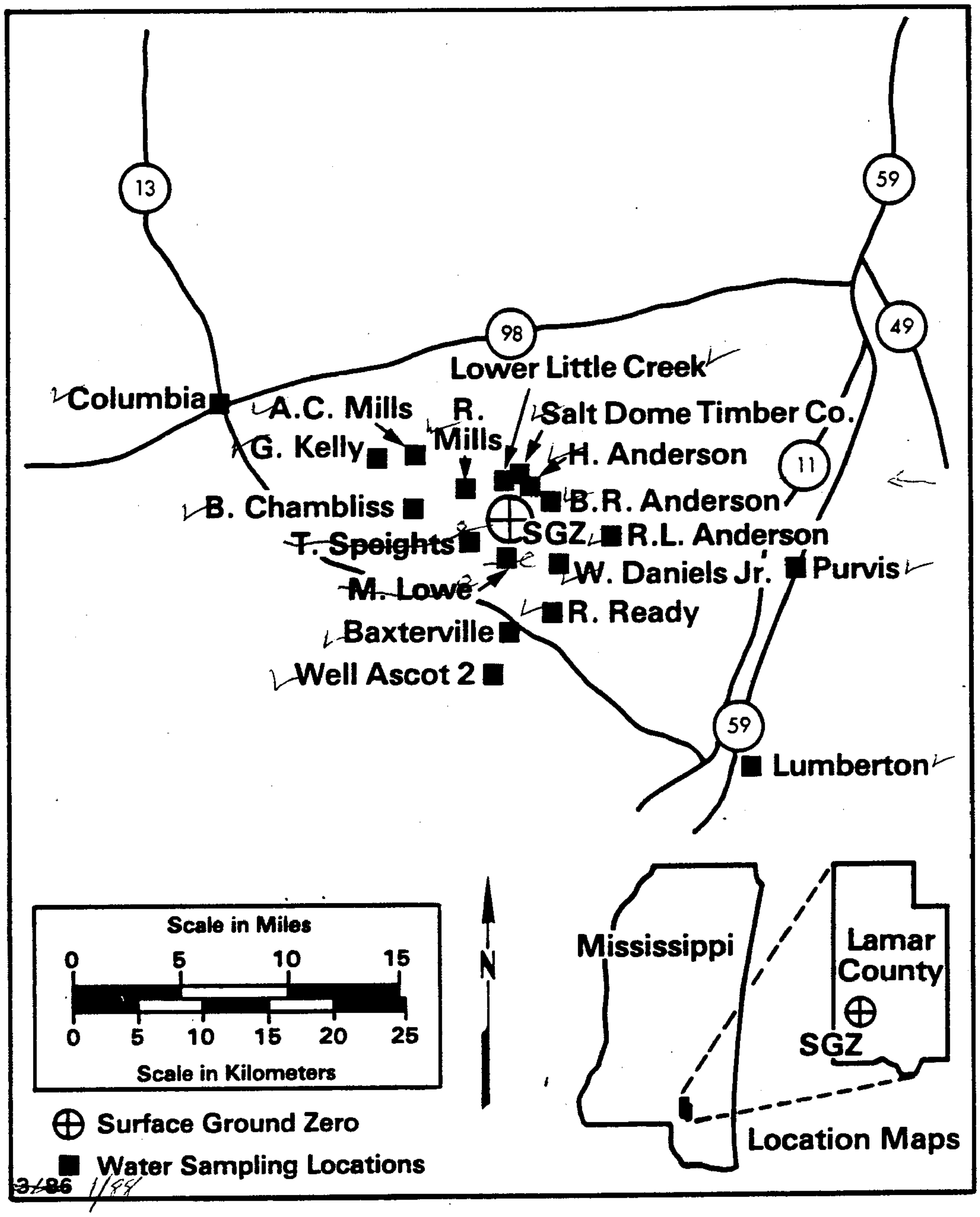


Figure E-6. LTHMP sampling locations for Project Dribble - towns and residences.

PT Lee
R King
T Saucier
Hunt Club

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
BAXTERVILLE MS			
HALF MOON CREEK	04/03	36 ± 7	0.2
	04/03	3.6 ± 8.9*	0.02
HALF MOON CREEK OVRFLW	04/03	800 ± 12	4
	04/03	840 ± 12	4
LOWER LITTLE CREEK	04/03	16 ± 8	0.08
	04/03	21 ± 9	0.1
POND WEST OF GZ	04/03	11 ± 9*	0.06
	04/03	14 ± 8	0.07
REECO PIT DRAINAGE-A	04/03	62 ± 9	0.3
REECO PIT DRAINAGE-B	04/03	2800 ± 200	10
REECO PIT DRAINAGE-C	04/03	36 ± 9	0.2
SALT DOME TIMBER CO.	04/04	30 ± 9	0.2
ANDERSON, B. R.	04/04	42 ± 7	0.2
ANDERSON, H.	04/04	27 ± 7	0.1
ANDERSON, R. L.	04/03	34 ± 8	0.2
	04/03	42 ± 9	0.2
CHAMBLISS, B.	04/03	-3.6 ± 8.4*	<0.01
DANIELS, W. JR.	04/03	36 ± 8	0.2
KELLY, G.	04/03	-6.9 ± 11*	<0.01
LEE, P. T.	04/04	35 ± 9	0.2
MILLS, A. C.	04/03	-0.38 ± 8.1*	<0.01
MILLS, R.	04/03	26 ± 8	0.1
READY, R.	04/03	59 ± 9	0.3
WELL ASCOT 2	04/05	-23 ± 10*	<0.01

(continued)

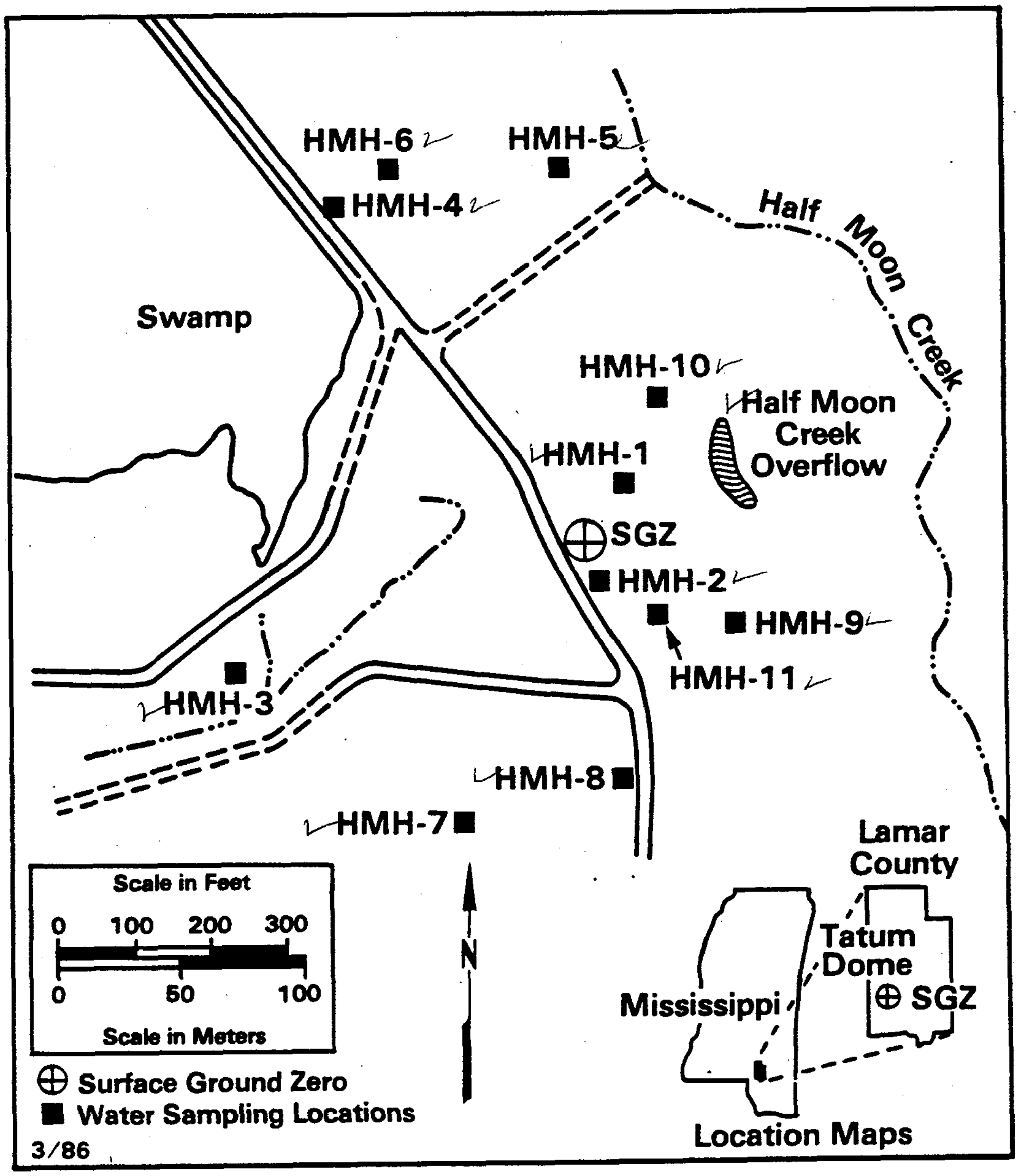


Figure E-7. LTHMP sampling locations for Project Dribble - near GZ.

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
BAXTERVILLE MS			
WELL CITY	04/03	21 ± 8	0.1
WELL E-7	04/04	-7.0 ± 12*	<0.01
WELL HM-1	04/03	-14 ± 9*	<0.01
	04/03	-7.8 ± 9.4*	<0.01
WELL HM-2A	04/03	-12 ± 9*	<0.01
	04/03	-13 ± 9*	<0.01
WELL HM-2B	04/03	-12 ± 10*	<0.01
	04/03	-16 ± 10*	<0.01
WELL HM-3	04/03	-11 ± 10*	<0.01
	04/03	-19 ± 10*	<0.01
WELL HM-L	04/03	1800 ± 180	9
	04/03	1400 ± 180	7
WELL HM-L2	04/03	-21 ± 10*	<0.01
	04/03	66 ± 180*	0.3
WELL HM-S	04/03	14000 ± 270	70
	04/03	14000 ± 270	70
WELL HMH-1	04/03	18000 ± 300	90
WELL HMH-2	04/03	13000 ± 270	70
WELL HMH-3	04/03	81 ± 7	0.4
WELL HMH-4	04/03	28 ± 7	0.1
WELL HMH-5	04/03	1800 ± 200	9
WELL HMH-6	04/03	99 ± 8	0.5
WELL HMH-7	04/03	260 ± 10	1
WELL HMH-8	04/03	34 ± 7	0.2
WELL HMH-9	04/03	22 ± 7	0.1

(continued)

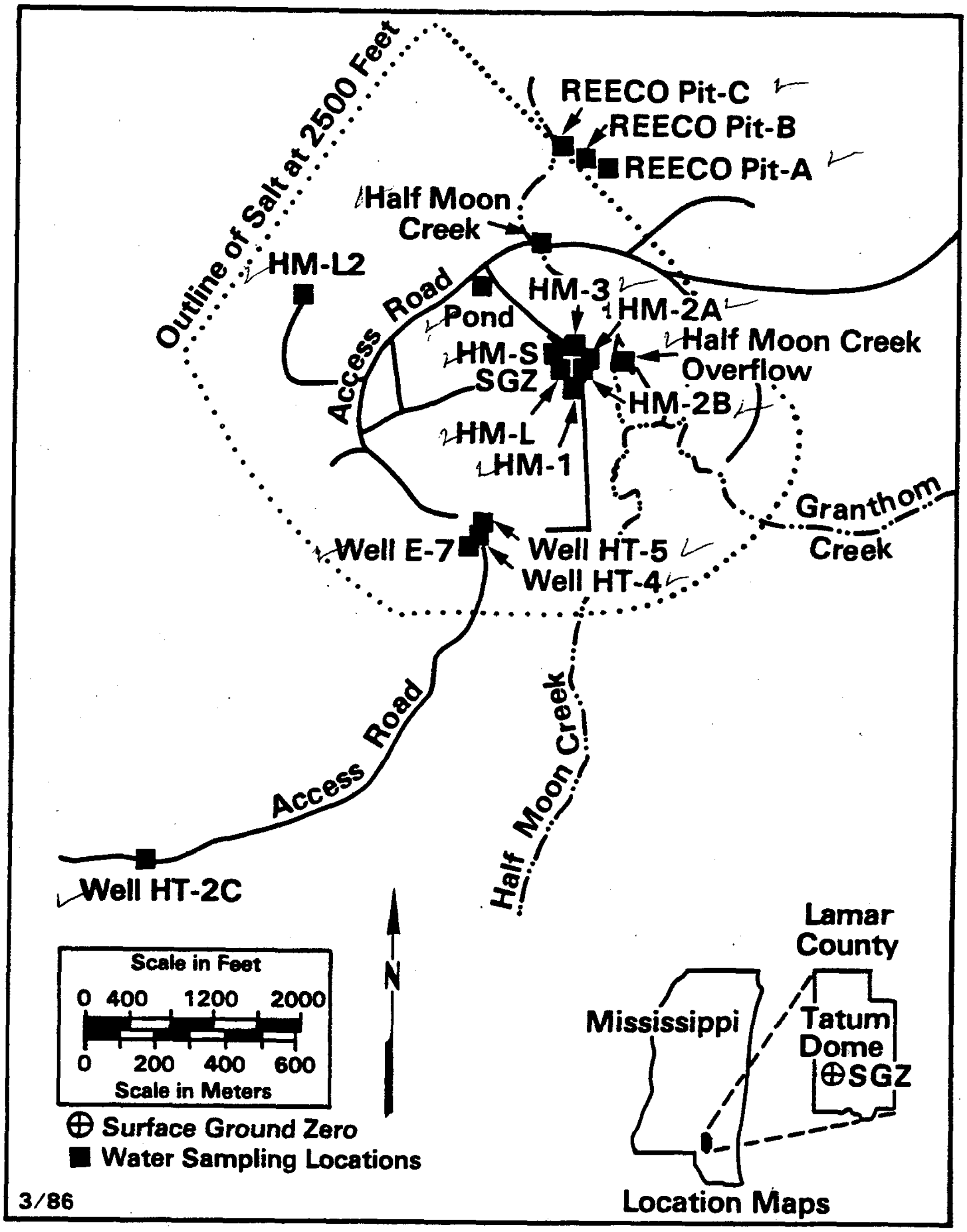


Figure E-8. LTHMP sampling locations for Project Dribble - near Salt Dome.

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
BAXTERVILLE MS			
WELL HMH-10	04/03	25 ± 7	0.1
WELL HMH-11	04/03	1100 ± 190	6
WELL HT-2C	04/04	-4.6 ± 8.8*	<0.01
WELL HT-4	04/04	-17 ± 9*	<0.01
WELL HT-5	04/04	-27 ± 11*	<0.01
WELL PS-3	04/05	20 ± 8	0.1
COLUMBIA MS			
WELL 64B CITY	04/04	-5.0 ± 9.3*	<0.01
LUMBERTON MS			
WELL 2 CITY	04/04	-12 ± 10*	<0.01
PURVIS MS			
CITY SUPPLY	04/03	-17 ± 10*	<0.01
PROJECT FAULTLESS - NEVADA			
BLUE JAY NV			
HOT CREEK RANCH SPRING	07/22	15 ± 8	0.07
MAINTENANCE STATION	07/22	-4.6 ± 9.3*	<0.01
WELL BIAS	07/22	5.4 ± 9.2*	0.03
WELL HTH-1	07/21	2.0 ± 9.2*	0.01
WELL HTH-2	07/21	6.8 ± 9.0*	0.03

(continued)

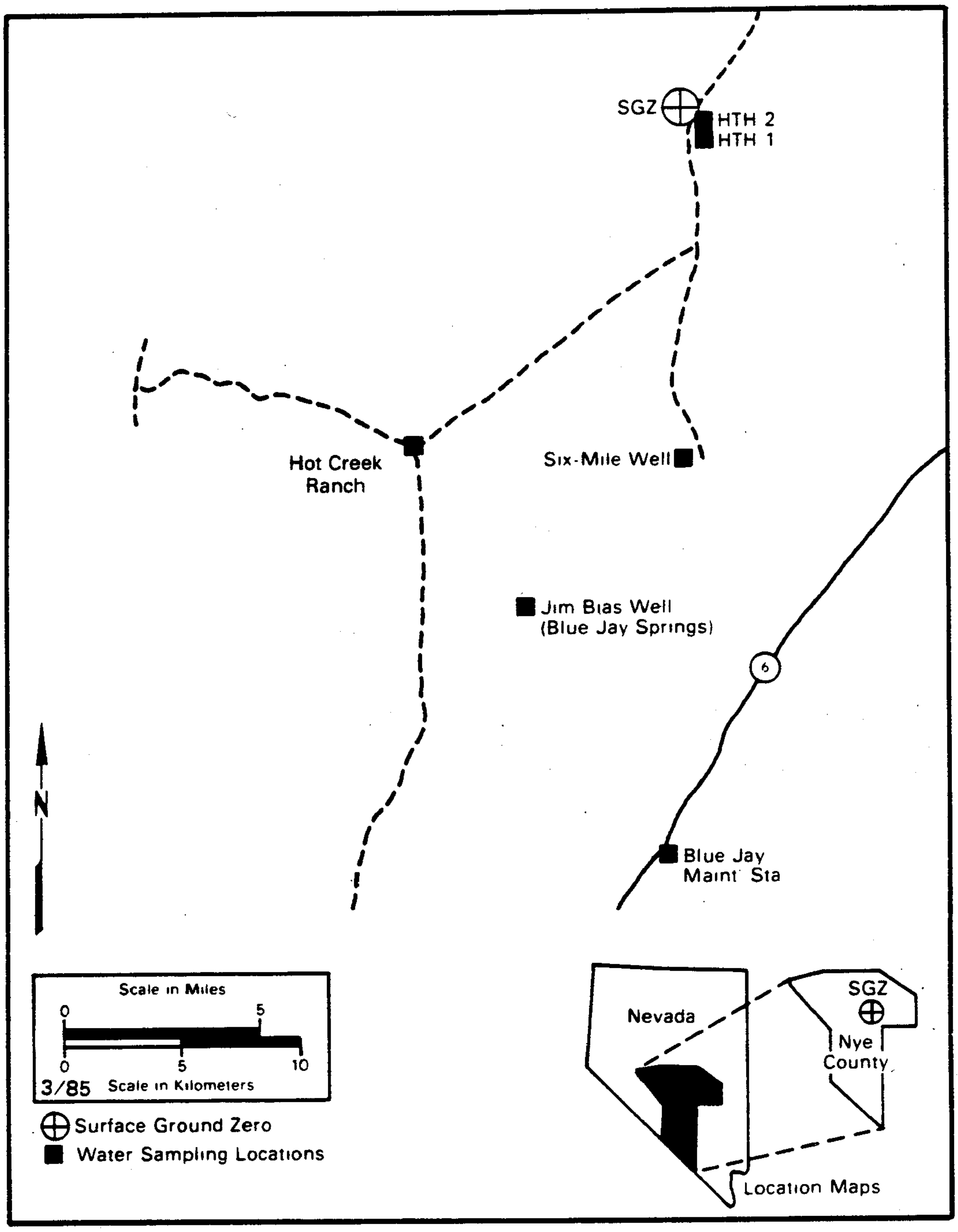


Figure E-9. LTHMP sampling locations for Project Faultless.

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
<u>PROJECT SHOAL - NEVADA</u>			
FRENCHMAN STATION NV			
HUNT'S STATION	02/19	1.7 ± 8.7*	<0.01
WELL FLOWING	02/19	-0.36 ± 8.8*	<0.01
FRENCHMAN STATION	02/19	0.87 ± 8.7*	<0.01
WELL H-3	02/19	-2.7 ± 8.7*	<0.01
WELL HS-1	02/19	8.8 ± 8.8*	0.04
<u>PROJECT GASBUGGY - NEW MEXICO</u>			
GOBERNADOR NM			
ARNOLD RANCH	06/11	54 ± 8	0.3
BIXLER RANCH	06/13	20 ± 8	0.1
BUBBLING SPRINGS	06/11	120 ± 9	0.6
CAVE SPRINGS	06/12	120 ± 9	0.6
LA JARA CREEK	06/11	69 ± 9	0.3
LOWER BURRO CANYON	06/12	120 ± 8	0.6
WELL EPNG 10-36	06/13	320 ± 11	2
WELL JICARILLA 1	06/12	68 ± 7	0.3
WELL 30.3.32.343 (NORTH)	06/12	96 ± 8	0.5

(continued)

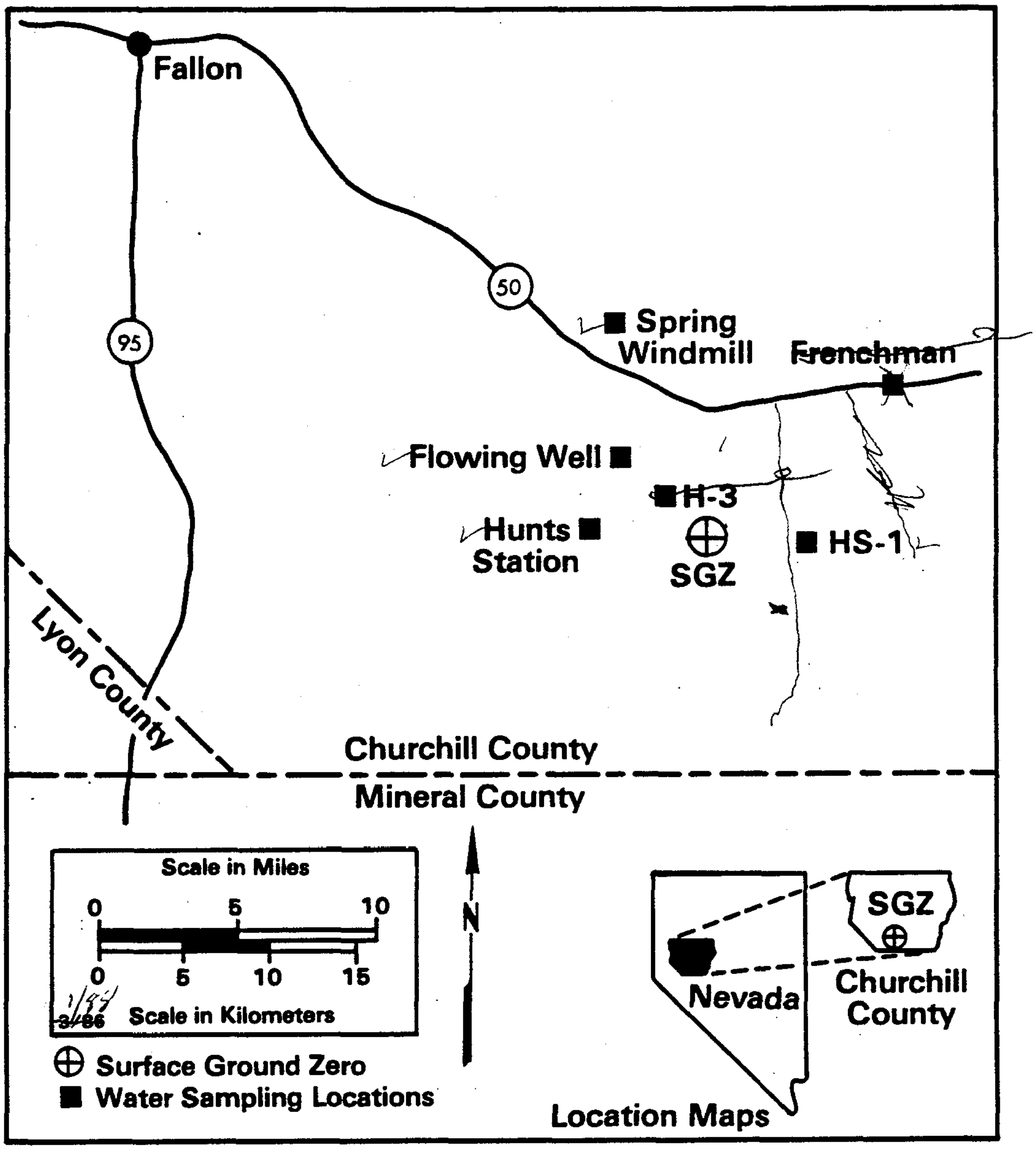


Figure E-10. LTHMP sampling locations for Project Shoal.

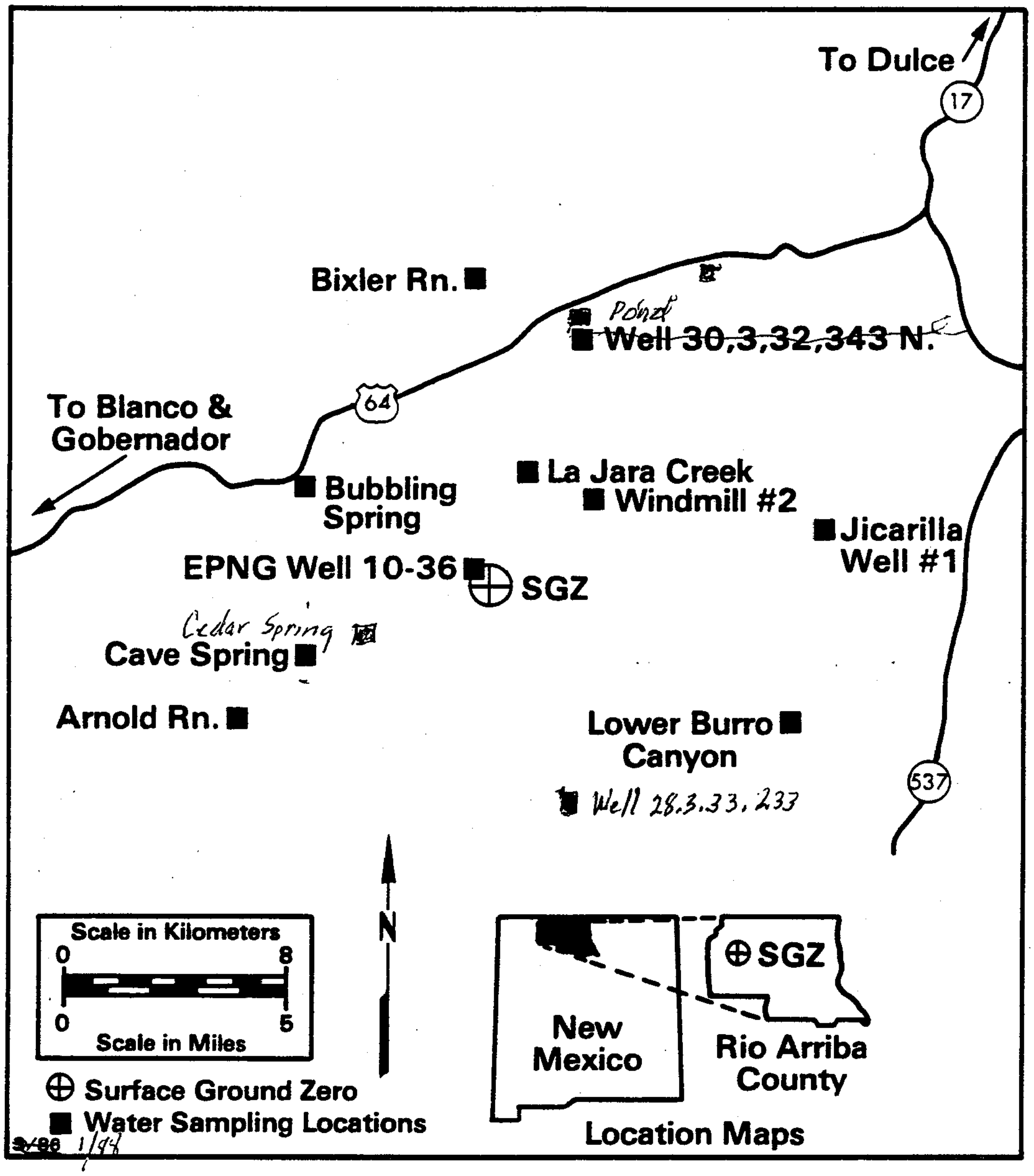


Figure E-11. LTHMP sampling locations for Project Gasbuggy.

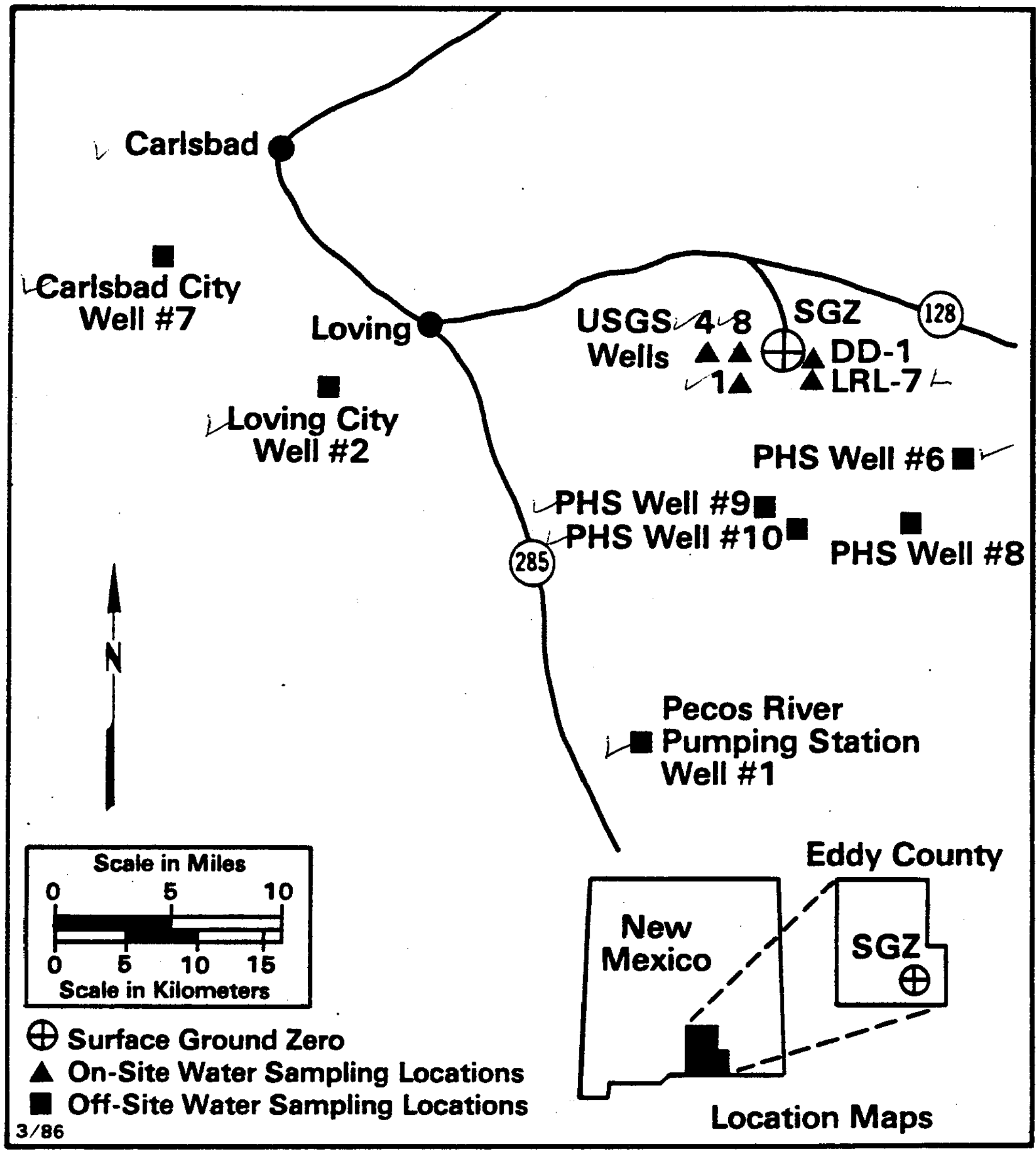


Figure E-12. LTHMP sampling locations for Project Gnome.

TABLE E-7. Continued

SAMPLING LOCATION	COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE	
<u>PROJECT GNOME - NEW MEXICO</u>				
CARLSBAD NM				
WELL 7 CITY	03/20	5.2 ± 7.6*	0.03	
LOVING NM				
WELL 2 CITY	03/20	5.1 ± 7.5*	0.03	
MALAGA NM				
WELL 1 PECOS PUMPING ST	03/19	1.1 ± 8.8*	<0.01	(6)
WELL LRL-7	03/21	16000 ± 310	80	(7)
WELL PHS 6	03/19	66 ± 7	0.3	
WELL PHS 8	03/19	26 ± 7	0.1	
WELL PHS 9	03/19	3.3 ± 7.8*	0.02	
WELL PHS 10	03/19	4.0 ± 7.7*	0.02	
WELL USGS 1	03/19	1.3 ± 7.9*	<0.01	
WELL USGS 4	03/21	220000 ± 670	1000	(8)
MALAGA NM				
WELL USGS 8	03/21	160000 ± 780	800	(9)

* CONCENTRATION IS LESS THAN THE MINIMUM DETECTABLE CONCENTRATION (MDC).

NOTES

	ANALYSIS	RESULT	2SIGMA	UNITS
(1)	226RA	0.095	0.057	PCI/L
	234U	0.53	0.07	PCI/L
	235U	0.014	0.014*	PCI/L
	238U	0.23	0.05	PCI/L
(2)	226RA	0.060	0.040	PCI/L
	234U	6.0	0.4	PCI/L
	235U	0.13	0.04	PCI/L
	238U	2.3	0.2	PCI/L

TABLE E-7. Continued

SAMPLING LOCATION				COLLECTION DATE 1985	CONC. ± 2 SIGMA TRITIUM (PCI/L)	PCT OF CONC. GUIDE
	Analysis	Result	2 Sigma	Units		
(3)	226RA	0.14	0.05	PCI/L		
	234U	17	1	PCI/L		
	235U	0.27	0.05	PCI/L		
	238U	6.0	0.3	PCI/L		
(4)	226RA	0.030	0.025*	PCI/L		
	234U	6.7	0.5	PCI/L		
	235U	0.090	0.051	PCI/L		
	238U	2.6	0.2	PCI/L		
(5)	226RA	0.10	0.05	PCI/L		
	234U	5.4	0.4	PCI/L		
	235U	0.059	0.029	PCI/L		
	238U	2.1	0.2	PCI/L		
(6)	238PU	-0.80	2.1*	PCI/L		
	239PU	-0.40	1.5*	PCI/L		
(7)	90SR	10	7	PCI/L		
	137CS	210	16	PCI/L		
	238PU	-1.3	2.7*	PCI/L		
	239PU	-0.92	1.9*	PCI/L		
(8)	90SR	13000	750	PCI/L		
	238PU	-0.0063	0.033*	PCI/L		
	239PU	-0.0032	0.023*	PCI/L		
(9)	90SR	5640	392	PCI/L		
	137CS	62	9	PCI/L		
	238PU	-0.49	2.2*	PCI/L		
	239PU	-0.028	1.5*	PCI/L		

TABLE E-8. SUMMARY OF ANALYTICAL RESULTS FOR THE MILK SURVEILLANCE NETWORK - 1986

SAMPLING LOCATION	SAMPLE TYPE	NO. OF SAMPLES	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/L) MAX	MIN	AVG
BENTON CA - IRENE BROWN RANCH	10	8	K	2.3	1.4	2.1
		3	3H	69	-49	11
		3	89SR	0.70	-0.15	0.25
		3	90SR	0.66	0.51	0.58
BENTON CA - PAUL ALLRED	13	1	K	1.4	1.4	1.4
		1	3H	11	11	11
		1	89SR	-0.031	-0.031	-0.03
		1	90SR	0.23	0.23	0.23
HINKLEY CA - BILL NELSON DAIRY	12	12	K	1.8	1.3	1.6
		4	3H	180	99	130
		4	89SR	1.1	0.068	0.66
		4	90SR	0.89	0.21	0.55
RIDGECREST CA - CEDARSAGE FARM	10	11	K	2.3	1.6	2.0
		4	3H	240	-240	57
		4	89SR	0.69	-0.50	0.03
		4	90SR	0.88	0.15	0.49
AUSTIN NV - YOUNG'S RANCH	13	10	K	1.8	1.3	1.5
		4	3H	470	31	240
		4	89SR	1.8	-0.98	0.45
		4	90SR	0.83	-0.018	0.37
CURRANT NV - MANZONIE RANCH	13	12	K	2.2	0.32	1.3
		5	3H	530	50	190
		4	89SR	1.2	-0.90	0.36
		4	90SR	0.63	-0.51	0.12
DYER NV - OZEL LEMON	13	12	K	1.7	1.2	1.4
		3	3H	730	-130	230
		3	89SR	0.50	-0.015	0.30
		3	90SR	1.1	0.098	0.68

(continued)

TABLE E-8. Continued

SAMPLING LOCATION	SAMPLE TYPE	NO. OF SAMPLES	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/L) MAX	MIN	AVG
GOLDFIELD NV - FRAYNE RANCH	10	7	K	2.1	1.7	2.0
		2	3H	260	200	230
		2	89SR	-1.7	-1.8	-1.7
		2	90SR	2.4	1.6	2.0
LAS VEGAS NV - HEIN HETTINGA DRY (LDS)	12	11	K	2.0	0.49	1.5
		5	3H	550	140	280
		5	89SR	0.48	-5.6	-1.2
		5	90SR	1.2	0.024	0.54
LATHROP WELLS NV - JOHN DEER RANCH	10	7	K	2.3	1.7	2.0
		2	3H	130	-43	44
		2	89SR	2.5	-5.4	-1.4
		2	90SR	0.86	0.46	0.66
LOGANDALE NV - KNUDSEN DAIRY	12	12	K	1.8	0.44	1.4
		5	3H	210	7.6	130
		5	89SR	0.94	-8.2	-1.6
		5	90SR	1.1	0.24	0.60
LUND NV - MCKENZIE DAIRY	12	12	K	1.8	0.45	1.4
		4	3H	340	-72	130
		4	89SR	-0.21	-1.1	-0.72
		4	90SR	0.76	0.49	0.61
MCGILL NV - LARSEN RANCH	13	11	K	1.9	1.0	1.5
		5	3H	450	240	360
		4	89SR	0.92	-3.9	-0.71
		4	90SR	1.0	-0.27	0.18
MESQUITE NV - SF AND K DAIRY	12	12	K	1.7	0.41	1.5
		5	3H	280	120	200
		5	89SR	0.58	-2.9	-0.96
		5	90SR	1.6	0.67	1.0

(continued)

TABLE E-8. Continued

SAMPLING LOCATION	SAMPLE TYPE	NO. OF SAMPLES	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/L) MAX	MIN	AVG
MOAPA NV - ROCKVIEW DAIRIES, INC	12	12	K	1.7	0.43	1.4
		5	3H	190	-77	52
		5	89SR	2.1	-4.8	-0.71
		5	90SR	1.3	-0.054	0.61
NYALA NV - SHARP'S RANCH	13	12	K	2.0	0.41	1.5
		3	3H	340	-10	150
		4	89SR	0.73	-3.9	-0.70
		4	90SR	1.3	0.62	0.96
CALIENTE NV - JUNE COX RANCH	10	11	K	2.2	0.48	1.4
		5	3H	350	-52	140
		6	89SR	0.67	-1.0	-0.22
		6	90SR	0.91	-0.36	0.35
ROUND MT NV - BERG'S RANCH	13	7	K	1.7	1.2	1.5
		2	3H	180	160	170
		2	89SR	1.5	-0.29	0.59
		2	90SR	1.9	1.4	1.6
SHOSHONE NV - HARBECKE RANCH	13	12	K	1.8	0.42	1.4
		3	3H	660	94	300
		4	89SR	1.6	0.043	0.85
		4	90SR	2.0	0.78	1.2
RACHEL NV - JAMES MOODY	13	1	K	1.4	1.4	1.4
		1	3H	-57	-57	-57
RACHEL NV - PENOYER FARM CRIS CASTLETON	13	11	K	2.0	1.3	1.6
		3	3H	130	53	87
		4	89SR	0.13	-2.4	-0.54
		4	90SR	1.2	0.19	0.56

(continued)

TABLE E-8. Continued

SAMPLING LOCATION	SAMPLE TYPE	NO. OF SAMPLES	RADIO-NUCLIDE	RADIOACTIVITY CONC. (PCI/L) MAX	MIN	AVG
CEDAR CITY UT - BRENT JONES DAIRY	13	3	K	1.8	1.4	1.7
		1	3H	91	91	91
		2	89SR	4.7	0.49	2.6
		2	90SR	0.91	-0.98	-0.03
CEDAR CITY UT - WESTERN GEN DAIRIES	12	9	K	1.7	0.48	1.4
		2	3H	220	36	130
		2	89SR	2.3	-1.8	0.27
		2	90SR	0.96	0.84	0.90
ST GEORGE UT - GENTRY DAIRY	12	10	K	1.8	0.37	1.5
		3	3H	210	-120	51
		4	89SR	0.97	-1.3	0.07
		4	90SR	0.64	-0.19	0.15
ST GEORGE UT - TRUMAN CANNON	13	2	K	1.7	1.5	1.6
		1	3H	340	340	340
		1	89SR	-1.3	-1.3	-1.3
		1	90SR	0.97	0.97	0.97

TABLE E-9. ANALYTICAL RESULTS FOR THE STANDBY MILK SURVEILLANCE NETWORK - 1986

SAMPLING LOCATION	COLLECTION DATE 1986	3H (PCI/L)	CONC. ± 2 SIGMA 89SR (PCI/L)	90SR (PCI/L)
GAMMA SPECTROMETRY AND RADIOCHEMICAL ANALYSES				
TAYLOR AZ SUNRISE DAIRY	08/11	190 ± 280*	-1.0 ± 1.5*	0.89 ± 0.97*
TUCSON AZ SHAMROCK DAIRY (PIMA CO	08/11	180 ± 270*	0.58 ± 0.98*	0.18 ± 0.66*
FAYETTEVILLE AR UNIVERSITY OF ARK	08/18	300 ± 270*	NA	NA
RUSSELLVILLE AR ARKANSAS TECH UNIV	08/18	160 ± 280*	-1.5 ± 1.1*	2.3 ± 1.6*
BAKERSFIELD CA CARNATION DAIRY	08/12	NA	0.24 ± 0.94*	0.59 ± 0.60*
MODESTO CA FOSTER FARMS DAIRY	08/19	240 ± 280*	NA	NA
WEED CA MEDO-BEL CREAMERY	08/11	230 ± 270*	1.3 ± 1.3*	0.55 ± 0.52*
WILLOWS CA FOREMOST FOODS COMPANY	08/11	350 ± 290*	-1.1 ± 1.1*	0.83 ± 0.66*
COLORADO SPGS CO SINTON DAIRY CO	07/22	380 ± 280*	NA	NA
FT COLLINS CO POUDRE VALLEY DAIRY	07/22	350 ± 260*	NA	NA
GRAND JCT CO COLORADO WEST DAIRIES	07/24	NA	0.98 ± 1.2*	0.33 ± 0.58*
PUEBLO CO HYDE PARK DAIRY CO	07/30	NA	4.3 ± 12*	0.11 ± 1.2*
BURLINGTON IA MISS VALLEY MILK PRO	07/29	290 ± 260*	-11 ± 1*	3.7 ± 2.2
DAVENPORT IA SWISS VALLEY FARMS CO	07/28	110 ± 260*	0.63 ± 1.8*	1.8 ± 1.1

TABLE E-9. Continued

SAMPLING LOCATION	COLLECTION DATE 1986	3H (PCI/L)	CONC. ± 2 SIGMA 89SR (PCI/L)	90SR (PCI/L)
GAMMA SPECTROMETRY AND RADIOCHEMICAL ANALYSES				
GARDEN CITY KS				
MYERS MILK PROD	07/24	130 ± 270*	1.5 ± 1.4*	1.5 ± 0.8
	07/28	180 ± 280*	NA	NA
MANHATTAN KS				
KANSAS STATE UNIVERSITY	08/04	170 ± 270*	0.33 ± 2.1*	1.7 ± 1.2*
BATON ROUGE LA				
LA STATE UNIV	08/18	100 ± 270*	0.18 ± 1.2*	NA
LAFAYETTE LA				
UNIV SOUTHWESTERN LA	08/18	84 ± 270*	NA	NA
MONROE LA				
BORDEN'S	08/18	140 ± 270*	NA	NA
RUSTON LA				
TECH UNIV DAIRY	08/18	SAMPLE DESTROYED IN MAIL		
FOSSTON MN				
LAND O' LAKES INC	07/30	110 ± 270*	-1.6 ± 1.3*	3.4 ± 0.8
ROCHESTER MN				
ASSC MILK PRODUCERS	07/28	260 ± 270*	2.5 ± 2.5*	1.5 ± 0.8
AURORA MO				
MID-AMERICA DAIRY INC	07/28	NA	-0.43 ± 1.5*	2.6 ± 1.0
CHILLICOTHE MO				
MID-AMERICA DAIRYMEN	07/22	220 ± 290*	3.3 ± 2.6*	2.0 ± 0.7
BOZEMAN MT				
DARIGOLD FARMS	07/24	250 ± 270*	NA	NA
HAVRE MT				
VITA-RICH DAIRY	07/21	300 ± 280*	2.1 ± 1.5*	1.4 ± 1.5*
NORFOLK NE				
GILLETTE DAIRY	07/28	170 ± 270*	-0.53 ± 1.8*	3.3 ± 1.0
	07/31	NA	-0.70 ± 1.1*	2.5 ± 0.7

(continued)

TABLE E-9. Continued

SAMPLING LOCATION	COLLECTION DATE 1986	3H (PCI/L)	CONC. ± 2 SIGMA 89SR (PCI/L)	90SR (PCI/L)
GAMMA SPECTROMETRY AND RADIOCHEMICAL ANALYSES				
OMAHA NE				
ROBERTS DAIRY-MARSHALL	07/29	180 ± 270*	NA	NA
LAS VEGAS NV				
ANDERSON DAIRY	08/11	410 ± 240	NA	NA
RENO NV				
MODEL DAIRY	08/11	430 ± 250	NA	NA
ALBUQUERQUE NM				
BORDEN'S VALLEY GOLD	08/18	310 ± 290*	0.29 ± 1.4*	1.1 ± 0.9*
LA PLATA NM				
ROTHLISBERGER DAIRY	08/19	530 ± 250	0.46 ± 0.86*	0.74 ± 0.60*
DEVILS LAKE ND				
LAKE VIEW DAIRY	08/18	280 ± 280*	NA	NA
FARGO ND				
CASSCLAY CREAMERY	08/05	210 ± 270*	NA	NA
CLAREMORE OK				
SWAN BROS DAIRY	08/18	130 ± 280*	NA	NA
ENID OK				
AMPI GOLDSPOT DIVISION	08/25	170 ± 270*	0.0049 ± 0.79*	1.9 ± 0.7
MCALESTER OK				
OK STATE PENITENTIARY	08/19	46 ± 290*	-0.83 ± 0.89*	1.7 ± 0.7
STILLWATER OK				
OSU DAIRY	08/18	330 ± 280*	NA	NA
CORVALLIS OR				
SUNNY BROOK DAIRY	08/25	140 ± 300*	-0.47 ± 0.74*	1.3 ± 0.6
MEDFORD OR				
DAIRYGOLD FARMS	08/26	89 ± 270*	NA	NA
TILLAMOOK OR				
TILLAMOOK CO CRMY	08/25	130 ± 260*	0.97 ± 1.6*	1.4 ± 0.6

(continued)

TABLE E-9. Continued

SAMPLING LOCATION	COLLECTION DATE 1986	3H (PCI/L)	CONC. ± 2 SIGMA 89SR (PCI/L)	90SR (PCI/L)
GAMMA SPECTROMETRY AND RADIOCHEMICAL ANALYSES				
BEAVER UT CACHE VALLEY DAIRY	07/18	160 ± 270*	NA	NA
PROVO UT BYU DAIRY PRODUCTS LAB	07/21	360 ± 260*	0.46 ± 1.9*	1.3 ± 0.9*
CEDAR CITY UT WESTERN GEN DAIRIES	07/29	NA	0.43 ± 1.2*	0.83 ± 0.66*
SEATTLE WA CONSOLIDATED DAIRY PROD	08/25(1)	220 ± 270*	-0.033 ± 1.4*	1.1 ± 0.8*
SPOKANE WA CONSOLIDATED DAIRY	08/25	230 ± 280*	-0.22 ± 0.98*	1.2 ± 0.8
LARAMIE WY UNIV OF WYO (DAIRY)	08/01	350 ± 260*	NA	NA
RIVERTON WY ALBERTSON'S PLANT	07/30	240 ± 270*	NA	NA

SAMPLING LOCATION	COLLECTION DATE 1986	SAMPLING LOCATION	COLLECTION DATE 1986
GAMMA SPECTRAL ANALYSES ONLY**			
PIMA AZ SMITH HUNT DAIRY	08/11	MANTECA CA DEJAGER DAIRY NO 2 NORTH	08/11
YUMA AZ GOLDEN WEST DAIRY	08/11	REDDING CA MCCOLL'S DAIRY PROD	08/11
LITTLE ROCK AR BORDENS	08/18	SAN LUIS OBISPO CA CAL STATE POLY	08/12
FRESNO CA STATE UNIV CREAMERY	08/14	SEBASTOPOL CA WM MILLER DAIRY	08/11

(continued)

TABLE E-9. Continued

SAMPLING LOCATION	COLLECTION DATE 1986	SAMPLING LOCATION	COLLECTION DATE 1986

<u>GAMMA SPECTRAL ANALYSES ONLY**</u>

SAMPLING LOCATION	COLLECTION DATE 1986	SAMPLING LOCATION	COLLECTION DATE 1986
SMITH RIVER CA COUNTRY MAID DAIRY	08/12	GREAT FALLS MT MEADOW GOLD DAIRY	07/23
TRACY CA DEUEL VOC INST	08/11	MISSOULA MT BEATRICE DAIRY PRODUCTS	07/29
WILLITS CA RIDGEWOOD RANCH DAIRY	08/13	GERING NE 4-STATES DAIRY-D SCHILL	07/31
DELTA CO ARDEN MEADOW GOLD DAIRY	08/04	GD ISLAND NE MID-AMER DAIRYMN-JIM SA	07/30
LAKE MILLS IA LAKE MILLS COOP CRMY	07/30	SUPERIOR NE MID-AMER DAIRYMN-D FRIT	07/29
LEMARS IA WELLS DAIRY	07/29	FALLON NV CREAMLAND DAIRY	08/11
DALTON MN DALTON CO-OP CREAMERY	08/06	YERINGTON NV VALLEY DAIRY	08/10
FLENSBURG MN FLENSBURG CO-OP CMRY	08/08 (2)	EUGENE OR ECHO SPRINGS DAIRY	08/25
NICOLLET MN WALTER SCHULTZ FARM	08/15	GRANTS PASS OR VALLEY OF ROGUE DAIRY	08/25
JACKSON MO MID-AMERICA DAIRYMEN IN	07/29	KLAMATH FALLS OR NEDO BEL CREAMERY	08/25
JEFFERSON CITY MO CENTRAL DAIRY CO	07/22	MILTON-FREEWATER OR PARENTS DAIRY	08/25
BILLINGS MT MEADOW GOLD DAIRY	07/28	MYRTLE POINT OR SAFEWAY STORES INC	08/25

(continued)

TABLE E-9. Continued

SAMPLING LOCATION	COLLECTION DATE 1986	SAMPLING LOCATION	COLLECTION DATE 1986
GAMMA SPECTRAL ANALYSES ONLY**			
REDMOND OR		MOSES LAKE WA	
EBERHARD'S CREAMERY INC	08/26	SAFEWAY STORES INC	08/25
NORTH OGDEN UT		CHEYENNE WY	
WESTERN GENERAL DAIRY	07/17	DAIRY GOLD FOODS	08/06
SMITHFIELD UT			
CACHE VALLEY DAIRY	07/17, 07/21		

* CONCENTRATION IS LESS THAN THE MINIMUM DETECTABLE CONCENTRATION (MDC).
** POTASSIUM-40 WAS THE ONLY GAMMA EMITTER DETECTED EXCEPT FOR THE TWO SAMPLES LISTED BELOW.

NOTES

	ANALYSIS	RESULT	2SIGMA	UNITS	SAMPLING LOCATION
(1)	137CS	13	7	PCI/L	Seattle, WA
(2)	137CS	31	13	PCI/L	Flensburg, MN

TABLE E-10. SUMMARY OF RADIATION DOSE EQUIVALENTS FROM TLD DATA - 1986

STATION LOCATION	MEASUREMENT PERIOD ISSUE	MEASUREMENT PERIOD COLLECT	DOSE EQUIVALENT RATE (MREM/D) MAX.	MIN.	AVG.	ADJUSTED DOSE EQUIVALENT (MREM/Y)
Alamo, NV	11/07/85	11/06/86	0.25	0.22	0.24	88
American Borate, NV	11/07/85	11/06/86	0.27	0.23	0.26	95
Atlanta Mine, NV	12/09/85	12/01/86	0.24	0.20	0.22	80
Austin, NV	01/08/86	01/15/87	0.40	0.31	0.36	131
Baker, CA	12/13/85	12/01/86	0.23	0.19	0.21	77
Barstow, CA	12/12/85	12/01/86	0.27	0.23	0.25	91
Battle Mountain, NV	12/11/85	12/03/86	0.23	0.19	0.21	77
Beatty, NV	11/07/85	11/04/86	0.29	0.25	0.27	99
Bishop, CA	12/11/85	12/02/86	0.28	0.25	0.26	95
Blue Eagle Ranch, NV	12/10/85	12/02/86	0.19	0.16	0.17	62
Blue Jay, NV	01/15/86	01/15/87	0.32	0.29	0.31	113
Boulder, UT	12/10/85	12/09/86	0.25	0.22	0.23	84
Bryce Canyon, UT	12/10/85	12/09/86	0.23	0.21	0.22	80
Cactus Springs, NV	11/04/85	11/03/86	0.17	0.14	0.16	58
Caliente, NV	11/06/85	11/06/86	0.29	0.26	0.27	99
Carp, NV	11/06/85	11/06/86	0.30	0.27	0.28	102
Cedar City, UT	11/05/85	11/05/86	0.20	0.19	0.19	69
Cherry Creek, NV	12/10/85	12/02/86	0.30	0.25	0.27	99
Clark Station, NV	01/13/86	01/14/87	0.30	0.28	0.29	106
Coaldale, NV	12/11/85	12/04/86	0.29	0.24	0.27	99
Colorado City, AZ	11/05/85	11/04/86	0.19	0.12	0.17	62

(continued)

TABLE E-10. Continued

STATION LOCATION	MEASUREMENT PERIOD ISSUE	MEASUREMENT PERIOD COLLECT	DOSE EQUIVALENT RATE (MREM/D) MAX.	MIN.	AVG.	ADJUSTED DOSE EQUIVALENT (MREM/Y)
Complex 1, NV	12/10/85	12/03/86	0.31	0.27	0.29	106
Corn Creek, NV	11/08/85	11/03/86	0.12	0.10	0.11	40
Cortez Rd./HWY 278, NV	12/11/85	12/03/86	0.31	0.27	0.28	102
Coyote Summit, NV	01/13/86	01/12/87	0.32	0.30	0.31	113
Crescent Valley, NV	12/11/85	12/03/86	0.24	0.20	0.22	80
Crystal, NV	11/08/85	11/06/86	0.19	0.17	0.18	66
Currant, NV	12/11/85	12/02/86	0.29	0.25	0.26	95
Currie, NV	12/10/85	12/02/86	0.31	0.26	0.28	102
Death Valley JCT., CA	11/07/85	11/06/86	0.20	0.17	0.19	69
Delta, UT	01/13/86	01/08/87	0.21	0.18	0.19	69
Diablo Maint. Sta., NV	01/13/86	01/13/87	0.33	0.30	0.32	117
Duchesne, UT	01/15/86	01/06/87	0.20	0.18	0.19	69
Duckwater, NV	12/11/85	12/02/86	0.27	0.23	0.25	91
Elgin, NV	11/06/85	11/06/86	0.35	0.24	0.30	110
Elko, NV	12/10/85	12/02/86	0.25	0.19	0.22	80
Ely, NV	12/11/85	12/02/86	0.23	0.20	0.21	77
Enterprise, UT	11/05/85	11/05/86	0.34	0.30	0.32	117
Eureka, NV	01/07/86	01/15/87	0.31	0.24	0.28	102
Fallon, NV	12/11/85	12/03/86	0.22	0.18	0.20	73
Ferron, UT	11/06/85	11/06/86	0.20	0.13	0.18	66
Flying Diamond CP, NV	12/12/85	12/04/86	0.23	0.19	0.21	77

(continued)

TABLE E-10. Continued

STATION LOCATION	MEASUREMENT PERIOD ISSUE	MEASUREMENT PERIOD COLLECT	DOSE EQUIVALENT RATE (MREM/D) MAX.	MIN.	AVG.	ADJUSTED DOSE EQUIVALENT (MREM/Y)
Furnace Creek, CA	11/06/85	11/06/86	0.17	0.13	0.16	58
Gabbs, NV	12/11/85	12/04/86	0.21	0.17	0.19	69
Garrison, UT	12/09/85	12/01/86	0.21	0.18	0.19	69
Geyser Ranch, NV	12/09/85	12/01/86	0.28	0.24	0.26	95
Goldfield, NV	01/06/86	01/12/87	0.26	0.20	0.24	88
Grantsville, UT	01/14/86	01/08/87	0.21	0.18	0.19	69
Green River, UT	11/05/85	11/06/86	0.21	0.13	0.18	66
Groom Lake-NTS, NV	01/07/86	01/12/87	0.20	0.17	0.18	66
Gunnison, UT	11/06/85	11/06/86	0.20	0.12	0.17	62
Hancock Summit, NV	01/13/86	01/12/87	0.39	0.35	0.37	135
Hiko, NV	11/07/85	11/06/86	0.22	0.18	0.20	73
Hot Ck. Ranch, NV	01/15/86	01/15/87	0.24	0.22	0.23	84
Ibapah, UT	12/09/85	12/01/86	0.32	0.25	0.28	102
Independence, CA	12/11/85	12/02/86	0.24	0.22	0.23	84
Indian Springs, NV	11/04/85	11/03/86	0.14	0.12	0.13	47
Jacob's Lake, AZ	11/04/85	11/04/86	0.29	0.17	0.25	91
Kanab, UT	11/04/85	11/04/86	0.18	0.12	0.16	58
Kirkeby Ranch, NV	12/09/85	12/01/86	0.22	0.19	0.20	73
Koyens Ranch, NV	01/15/86	01/13/87	0.24	0.22	0.23	84
Las Vegas (Airport), NV	12/31/85	12/31/86	0.15	0.13	0.14	51
Las Vegas (Placak), NV	12/31/85	12/31/86	0.15	0.12	0.14	51

(continued)

TABLE E-10. Continued

STATION LOCATION	MEASUREMENT PERIOD ISSUE	MEASUREMENT PERIOD COLLECT	DOSE EQUIVALENT RATE (MREM/D) MAX.	MIN.	AVG.	ADJUSTED DOSE EQUIVALENT (MREM/Y)
Las Vegas (UNLV), NV	12/31/85	12/31/86	0.12	0.10	0.11	40
Las Vegas (USDI), NV	12/31/85	12/31/86	0.17	0.15	0.16	58
Lathrop Wells, NV	11/04/85	11/03/86	0.24	0.21	0.23	84
Lavada's Market, NV	11/08/85	11/07/86	0.24	0.19	0.21	77
Lida, NV	01/07/86	01/14/87	0.29	0.22	0.26	95
Loa, UT	12/10/85	12/09/86	0.35	0.32	0.33	120
Logan, UT	01/06/86	01/06/87	0.21	0.16	0.19	69
Lone Pine, CA	12/11/85	12/02/86	0.23	0.18	0.21	77
Lovelock, NV	12/11/85	12/03/86	0.22	0.18	0.20	73
Lund, NV	12/10/85	12/02/86	0.24	0.19	0.22	80
Lund, UT	12/11/85	12/01/86	0.32	0.26	0.28	102
Mammoth Lakes, CA (1)	12/11/85	12/02/86	0.31	0.23	0.28	102
Manhattan, NV	01/08/86	01/15/87	0.40	0.32	0.36	131
Mesquite, NV	11/04/85	11/04/86	0.18	0.15	0.16	58
Milford, UT	12/09/85	12/01/86	0.27	0.22	0.24	88
Mina, NV	12/11/85	12/04/86	0.28	0.22	0.25	91
Moapa, NV	11/04/85	11/04/86	0.20	0.17	0.18	66
Monticello, UT	11/05/85	11/05/86	0.26	0.18	0.23	84
Mtn. Meadows Ranch, NV (2)	01/15/86	01/14/87	0.20	0.18	0.19	69
Nash Ranch, NV	12/12/85	12/04/86	0.24	0.21	0.22	80
Nephi, UT	01/13/86	01/05/87	0.20	0.17	0.18	66

(continued)

TABLE E-10. Continued

STATION LOCATION	MEASUREMENT PERIOD ISSUE	COLLECT	DOSE EQUIVALENT RATE (MREM/D) MAX.	MIN.	AVG.	ADJUSTED DOSE EQUIVALENT (MREM/Y)
Nyala, NV	01/15/86	01/14/87	0.23	0.21	0.22	80
Olancha, NV	12/12/85	12/01/86	0.24	0.21	0.23	84
Overton, NV	11/04/85	11/04/86	0.17	0.13	0.15	55
Page, AZ	11/05/85	11/05/86	0.18	0.10	0.16	58
Pahrump, NV	11/07/85	11/06/86	0.14	0.11	0.13	47
Parowan, UT	12/10/85	12/02/86	0.23	0.19	0.21	77
Penoyer Farms, NV	01/13/86	01/15/87	0.31	0.27	0.29	106
Pine Creek Ranch, NV	12/10/85	12/03/86	0.33	0.29	0.31	113
Pioche, NV	12/09/85	12/04/86	0.24	0.20	0.22	80
Price, UT	01/16/86	01/06/87	0.21	0.18	0.19	69
Provo, UT	01/14/86	01/06/87	0.21	0.17	0.19	69
Queen City Smt., NV	01/13/86	01/13/87	0.35	0.31	0.34	124
Rachel, NV	01/15/86	01/12/87	0.30	0.27	0.28	102
Reed Ranch, NV	01/13/86	01/13/87	0.30	0.27	0.29	106
Ridgecrest, CA	12/12/85	12/01/86	0.23	0.18	0.20	73
Rose Ranch, NV	12/09/85	12/01/86	0.32	0.26	0.29	106
Round Mt., NV	01/08/86	01/15/87	0.35	0.28	0.32	117
Ruby Valley, NV	12/10/85	12/02/86	0.32	0.25	0.28	102
S. Desert Cor. Ctr., NV	11/08/85	11/03/86	0.14	0.10	0.13	47
Salt Lake City, UT	11/08/85	11/06/86	0.29	0.25	0.26	95
Schurz, NV	12/11/85	12/04/86	0.28	0.25	0.27	99

(continued)

TABLE E-10. Continued

STATION LOCATION	MEASUREMENT PERIOD ISSUE	COLLECT	DOSE EQUIVALENT RATE (MREM/D) MAX.	MIN.	AVG.	ADJUSTED DOSE EQUIVALENT (MREM/Y)
Scotty's JCT., NV	01/06/86	01/12/87	0.31	0.23	0.29	106
Sheri's Ranch, NV	11/07/85	11/07/86	0.28	0.23	0.25	91
Shoshone, CA	11/07/85	11/06/86	0.20	0.15	0.18	66
Springdale, NV	11/06/85	11/05/86	0.30	0.26	0.28	102
St. George, UT	11/05/85	11/05/86	0.17	0.14	0.15	55
Stone Cabin Ranch, NV	01/14/86	01/14/87	0.31	0.26	0.29	106
Sunnyside, NV	12/12/85	12/04/86	0.17	0.14	0.15	55
Tempiute, NV	01/15/86	01/13/87	0.30	0.27	0.28	102
Tikaboo Valley, NV	01/13/86	01/12/87	0.29	0.25	0.27	99
Tonopah Test Rng., NV	01/07/86	01/14/87	0.30	0.24	0.28	102
Tonopha, NV	01/07/86	01/15/87	0.35	0.30	0.32	117
Trout Creek, UT	12/09/85	12/01/86	0.24	0.21	0.22	80
Twin Springs Ranch, NV	01/14/86	01/14/87	0.31	0.28	0.29	106
Uhalde's Ranch, NV (3)	12/10/85	12/03/86	0.32	0.25	0.28	102
US Ecology, NV	11/07/85	11/07/86	0.30	0.26	0.29	106
Valley Crest, CA	11/07/85	11/06/86	0.24	0.13	0.17	62
Vernal, UT	01/15/86	01/06/87	0.23	0.19	0.21	77
Vernon, UT	01/14/86	01/08/87	0.23	0.20	0.21	77
Warm Springs, NV	01/13/86	01/14/87	0.36	0.32	0.34	124
Wells, NV	12/10/85	12/02/86	0.25	0.22	0.23	84
Wendover, UT	12/09/85	12/01/86	0.21	0.16	0.19	69

(continued)

TABLE E-10. Continued

STATION LOCATION	MEASUREMENT PERIOD ISSUE	COLLECT	DOSE EQUIVALENT RATE (MREM/D) MAX.	MIN.	AVG.	ADJUSTED DOSE EQUIVALENT (MREM/Y)
Willow Springs Lodge, UT	01/14/86	01/08/87	0.20	0.17	0.18	66
Winnemucca, NV	12/11/85	12/03/86	0.24	0.20	0.22	80
Young's Ranch, NV	01/08/86	01/15/87	0.33	0.22	0.27	99

Footnotes

(1) Previously called Mammoth Mtn., CA
(2) Previously called Casey's Ranch, NV
(3) Previously called Adaven, NV

TABLE E-11. SUMMARY OF RADIATION DOSES FOR OFFSITE RESIDENTS - 1986

RESIDENT NO.	Background Station Location	Measurement Issue	Period Collect	Dose Equivalent Rate (MREM/D) Max.	Min.	Avg.	Net Exposure (MREM)
2	Caliente, NV	01/08/86	01/13/87	0.31	0.27	0.30	2.6
3	Blue Jay, NV	08/07/86	01/15/87	0.27	0.20	0.23	0.0
6	Indian Springs, NV	01/17/86	01/07/87	0.17	0.15	0.16	0.0
7	Goldfield, NV	01/06/86	01/12/87	0.24	0.20	0.22	0.0
8	Twin Springs Ranch, NV	01/14/86	01/12/87	0.28	0.25	0.26	0.0
9	Blue Eagle Ranch, NV	01/07/86	01/06/87	0.19	0.16	0.17	0.0
10	Complex 1, NV	01/08/86	01/07/87	0.29	0.27	0.28	0.0
11	Complex 1, NV	01/08/86	01/07/87	0.30	0.27	0.29	0.0
13	Koyens Ranch, NV	01/15/86	01/12/87	0.20	0.10	0.16	0.0
14	Tikaboo Valley, NV	01/13/86	01/12/87	0.24	0.18	0.21	0.0
15	Tikaboo Valley, NV	01/13/86	01/12/87	0.23	0.20	0.22	0.0
18	Nyala, NV	01/15/86	01/12/87	0.23	0.17	0.19	0.0
19	Goldfield, NV	01/06/86	01/12/87	0.24	0.19	0.21	0.0
21	Beatty, NV	01/16/86	01/06/87	0.26	0.23	0.25	0.0
22	Alamo, NV	01/08/86	01/14/87	0.20	0.17	0.19	0.0
24	Corn Creek, NV	12/31/85	09/02/86	0.14	0.11	0.13	0.0
25	Corn Creek, NV	12/31/85	12/31/86	0.16	0.14	0.15	6.6
29	Stone Cabin Ranch, NV	01/14/86	01/12/87	0.34	0.23	0.27	0.0
33	Lathrop Wells, NV	01/15/86	01/09/87	0.24	0.22	0.23	0.0
34	Furnace Creek, CA	01/14/86	01/08/87	0.20	0.17	0.18	3.6

(continued)

TABLE E-11. (Continued)

Resident No.	Background Station Location	Measurement Issue	Period Collect	Dose Equivalent Rate (MREM/D) Max.	Min.	Avg.	Net Exposure (MREM)
36	Pahrump, NV	01/15/86	01/07/87	0.17	0.13	0.14	0.0
37	Indian Springs, NV	01/17/86	01/07/87	0.18	0.14	0.16	0.0
38	Beatty, NV	01/16/86	01/06/87	0.33	0.30	0.32	3.5
40	Goldfield, NV	01/06/86	01/12/87	0.25	0.20	0.22	0.0
42	Tonopah, NV	01/07/86	01/13/87	0.27	0.24	0.26	0.0
44	Cedar City, UT	01/07/86	01/13/87	0.24	0.21	0.23	11.9
45	St. George, UT	01/06/86	01/13/87	0.18	0.14	0.16	8.9
47	Ely, NV	01/07/86	01/06/87	0.23	0.19	0.22	0.0
49	Las Vegas (UNLV), NV	12/31/85	12/31/86	0.21	0.19	0.19	28.1
51	Tonapah, NV	01/08/86	01/12/87	0.33	0.30	0.32	0.0
52	Salt Lake City, UT	01/03/86	01/06/87	0.25	0.24	0.24	0.0
54	Rachel, NV	01/15/86	01/13/87	0.26	0.18	0.23	0.0
55	Rachel, NV	01/15/86	01/13/87	0.26	0.22	0.25	0.0
56	Corn Creek, NV	12/31/85	12/31/86	0.21	0.14	0.17	17.4
57	Overton, NV	01/06/86	01/12/87	0.22	0.15	0.19	12.7
60	Shoshone, CA	01/14/86	01/07/87	0.20	0.18	0.19	0.0
223	Corn Creek, NV	12/31/85	12/31/86	0.16	0.11	0.13	3.9
232	Hiko, NV	01/08/86	01/14/87	0.24	0.21	0.23	11.1
233	Ely, NV	01/06/86	01/06/87	0.21	0.19	0.20	0.0

(continued)

TABLE E-11. (Continued)

Resident No.	Background Station Location	Measurement Issue	Period Collect	Dose Equivalent Rate (MREM/D) Max.	Min.	Avg.	Net Exposure (MREM)
239	Hot Creek Ranch, NV	01/15/86	07/02/87	0.27	0.25	0.26	0.0
247	Caliente, NV	01/08/86	10/07/86	0.20	0.18	0.19	0.0
248	Penoyer Farms, NV	01/13/86	01/13/87	0.27	0.21	0.23	0.0
249	Austin, NV	01/08/86	01/15/87	0.27	0.21	0.24	0.0
258	Pioche, NV	01/06/86	07/28/86	0.24	0.21	0.23	0.0
263	Death Valley Jct., CA	01/14/86	08/06/86	0.21	0.15	0.18	0.0
264	Rachel, NV	01/15/86	01/13/87	0.28	0.24	0.26	0.0
275	Corn Creek, NV	01/31/86	04/01/86	0.15	0.15	0.15	0.0
280	Pine Creek Ranch, NV	06/03/86	01/07/87	0.29	0.21	0.26	5.4
281	Currant, NV	06/10/86	12/02/86	0.21	0.11	0.18	0.0
283	Pioche, NV	08/27/86	11/24/86	0.20	0.20	0.20	0.0
292	Death Valley Jct., CA	10/21/86	01/09/87	0.20	0.20	0.20	0.0
293	Pioche, NV	12/01/86	01/05/87	0.21	0.21	0.21	0.0
295	Currant, NV	12/02/86	01/06/87	0.20	0.20	0.20	0.0

TABLE E-12. NOBLE GAS SAMPLES CONTAINING DETECTABLE CONCENTRATIONS OF XENON-133

SAMPLING LOCATION	COLLECTION DATE 1986	CONC. ± 2 SIGMA (PCI/M3)	PCT OF CONC. GUIDE
SHOSHONE CA	05/05-05/12	24 ± 6	<0.01
	05/16-05/19	29 ± 5	<0.01
ALAMO NV	04/23-04/30	30 ± 5	<0.01
	05/07-05/14	40 ± 5	<0.01
	05/14-05/21	18 ± 6	<0.01
AUSTIN NV	05/06-05/13	54 ± 11	0.01
	05/13-05/20	25 ± 9	<0.01
BEATTY NV	05/05-05/12	39 ± 11	<0.01
	05/12-05/19	52 ± 20	0.01
DIABLO NV-1MI TWD REED RA	04/22-04/23	64 ± 10	0.01
ELY NV	05/06-05/13	36 ± 7	<0.01
	05/13-05/20	30 ± 8	<0.01
GOLDFIELD NV	05/05-05/12	45 ± 7	<0.01
	05/12-05/19	31 ± 10	<0.01
GROOM LAKE NV	04/25-04/26	330 ± 10	0.07
	04/29-04/30	730 ± 15	0.01
	05/09-05/16	52 ± 9	0.01
HIKO NV	04/25-04/26	220 ± 7	0.04
	04/28-04/30	92 ± 20	0.02
INDIAN SPRINGS NV	05/05-05/12	43 ± 6	<0.01
	05/12-05/19	37 ± 8	<0.01
LAS VEGAS NV	05/06-05/13	67 ± 11	0.01
	05/13-05/20	25 ± 8	<0.01
LATHROP WELLS NV	03/24-03/31	84 ± 7	0.02
	05/05-05/12	37 ± 15	<0.01
	05/12-05/19	37 ± 9	<0.01
OVERTON NV	05/06-05/13	31 ± 9	<0.01
	05/15-05/20	21 ± 7	<0.01
PAHRUMP NV	05/15-05/19	24 ± 4	<0.01
	05/19-05/27	12 ± 6	<0.01

Continued

TABLE E-12. Continued

SAMPLING LOCATION	COLLECTION DATE 1986	CONC. ± 2 SIGMA (PCI/M3)	PCT OF CONC. GUIDE
PIOCHE NV	05/22-05/27	9.4 ± 5.4	<0.01
RACHEL NV			
ROBINSON TRAILER PARK	04/23-04/30	29 ± 5	<0.01
	04/30-05/07	20 ± 6	<0.01
	05/07-05/14	45 ± 6	<0.01
	05/14-05/21	17 ± 7	<0.01
	05/21-05/29	9.6 ± 5.8	<0.01
PENOYER FARM CRIS CASTL	04/22-04/23	18 ± 5	<0.01
	04/28-04/30	160 ± 7	0.03
	04/30-05/05	29 ± 7	<0.01
MEDLIN RANCH	04/25-04/26	430 ± 15	0.09
	04/28-04/30	94 ± 6	0.02
TONOPAH NV	05/05-05/12	57 ± 15	0.01
	05/12-05/19	35 ± 9	<0.01
FALLINI'S (TWIN SPGS) RAN	04/30-05/05	92 ± 9	0.02
CEDAR CITY UT	05/13-05/20	33 ± 12	<0.01

*CONCENTRATION IS LESS THAN THE MINIMUM DETECTABLE CONCENTRATION (MDC).

ADDENDUM 1

NONRADIOLOGICAL SUPPLEMENT TO THE NTS ENVIRONMENTAL MONITORING REPORT

Prepared by:

Industrial Hygiene
Reynolds Electrical and Engineering Co., Inc.

Report Period:

Calendar Year 1986

INTRODUCTION:

Environmental compliance activities which are the subject of this report are regulated under Chapter 445 of the State of Nevada Administrative Codes. Chapters 445.131, 445.361, and 445.401 respectively address water pollution control, public water systems, and air pollution. There were a total of 23 facilities which had State of Nevada operating permits or approval in 1986. For common information including site description, geology, land use, etc., reference the EPA Annual Report.

SUMMARY:

Water Pollution

No effluent monitoring is required.

Air Pollution

There was no State inspection in CY86 of the 23 facilities which had operating permits or registration certificates. A State inspection conducted January 14 and 15, 1987, found no violations for permitted facilities operating in CY86.

No effluent monitoring is required and none was performed. The allowable emissions are established by State-determined operating constraints which were not exceeded.

Ground-water Monitoring

Composite quarterly samples were taken from two wells to monitor changes in nitrate concentration.

MONITORING DATA COLLECTION, ANALYSIS, AND EVALUATION:

Air Pollution Control

a. Area 1 Shaker Plant - Operating restrictions to Permits 922 and 923 were not violated during this period. The facilities were not operated in excess of the allowable hours and an annual production report was transmitted to the State by April 15, 1987.

b. Area 12 Concrete Batch Plant - The plant did not exceed the permit restriction of 8 hours per day, nor more than 296 hours per year. An annual report was transmitted to the State by April 15, 1987.

c. Area 3 Aggregate Plant - The restrictions to Operating Permit 919 were not exceeded. The plant did not operate in excess of 8 hours per day, nor more than 280 hours per year. An annual production report was submitted to the State by April 15, 1987.

d. Area 1 Aggregate Plant - The restrictions to Operating Permit 1287 were not exceeded. The plant did not operate in excess of 9 hours per day, nor more than 1125 hours per year. An annual production report was be submitted by April 15, 1987.

e. Area 5 Surface Area Disturbance - The restrictions to Permit 921 were not exceeded. A final fugitive dust control plan will be submitted at least six months prior to abandonment of the site.

f. Area 2 Stemming Systems - The restrictions to Operating Permits 957 and 958 were not exceeded.

g. NTS 4,000,000 BTU/hour or Greater Boiler Permits - The restrictions to Permits 1035, 1036 and 925 were not exceeded. The boilers were not operated in excess of 8,400 hours per year. All boilers used Number 2 fuel oil. An annual analysis of fuel for sulfur and BTU content was submitted on September 26, 1986.

h. Area 3 Portable Stemming System - The restrictions to Operating Permit 1089 were satisfied in the annual report sent to the State by April 15, 1987.

i. Area 1 Concrete Batch Plant - The plant did not exceed Operating Permit 1082 restriction of 500 operating hours per year.

j. Iow Portable Crusher - The crusher did not exceed Operating Permit 1217 restriction of not operating in excess of 8 hours per day nor more than 650 hours at any one location.

Ground-Water Monitoring

Monthly ground water samples were collected from Wells Ue5C and Ue5B and composited into calendar year quarterly samples to monitor changes in nitrate concentration. The CY86 fourth quarter result from Well Ue5B was 67.0

milligrams of nitrates per liter (mg/l) and the sample from Well Ue5C was 75.9 mg/l.

ADDENDUM 2
Part A

ENVIRONMENTAL PERMITS, ORDERS, AND NOTICES

Part A of this Addendum pertains to EG&G activities at the locations shown.

EG&G Operations	Permit/Notification Type	Issue Date	Issuing Agency
Santa Barbara Operation	Notification of Hazardous Waste Activity EPA ID #CAD980813224	Feb. 1985	State of California
(Robin Hill Facility)	Industrial Waste Control Permit #II-202	1973	Goleta Sanitary Dist. California
(The "226" Building)	Industrial Waste Control Permit (application)	Jan. 1987	Goleta Sanitary Dist. California
Kirtland Oper. (Craddock Fac.)	Notification of Hazardous Waste Activity EPA ID #NMD049986896	Dec. 1985	State of New Mexico
Los Alamos	No Notifications or Permits required	----	----
Washington Aerial Measurements	No Notifications or Permits required	----	----
San Ramon Oper. (San Ramon Facility)	Notification of Hazardous Waste Activity EPA ID #CAD056196900	May 1983	State of California
(Pleasanton Facility)	Wastewater Discharge Permit #3672-101	Nov. 1985	Dublin/San Ramon Sanitary Dist. California
(San Ramon Facility)	Wastewater Discharge Permit (no number)	Jan. 1985	Central Contra Costa Sanitary Dist. California
Woburn Oper.	Notification of Hazardous Waste Activity EPA ID #MAD980578983	Jan. 1982	State of Massachusetts
	Wastewater Permit #43005732-0	Oct. 1984	State of Massachusetts

ADDENDUM 2
Part A (Continued)

EG&G Operations	Permit/Notification Type	Issue Date	Issuing Agency
Las Vegas Oper.	Notification of Hazardous Waste Activity EPA ID #NVD097868731	Aug. 1980	State of Nevada
	PCB Notification NVT-PCB-137	Feb. 1986	State of Nevada
	Extremely Hazardous Waste Disposal Permit #3-9886	Jan. 1987	State of California
(North Las Vegas)	Wastewater Contribution Permit #85-1	Aug. 1985	City of North Las Vegas
(Sunset & Escondido)	Industrial Wastewater Permit CCSD-012	March 1986	Clark County
	Air Pollution Control Operation*		Clark County
	Permits		
	A06501	Nov. 1981	Clark County
	A06502	Nov. 1981	Clark County
	A06504	Aug. 1976	Clark County
	A06505	Oct. 1976	Clark County
	A06503	Nov. 1981	Clark County
	A06506	May 1984	Clark County
	A06507	May 1984	Clark County
	A06509	May 1984	Clark County
	A06510	May 1984	Clark County
	A06511	May 1984	Clark County
	A06512	Feb. 1985	Clark County
	A06503	May 1984	Clark County
	A06504	May 1984	Clark County

*Renewed annually

ADDENDUM 2
Part B (Continued)

STATUS OF THE ENVIRONMENTALLY RELATED FACILITIES AT THE NTS, ADMINISTERED THROUGH THE REYNOLDS ELECTRICAL CO., INC. (REECO)

CLEAN AIR ACT

The State of Nevada Air Quality Regulations require a registration certificate before starting construction, modification, or alterations of an air contaminant emission source. An operating permit is required before initial operation of the emission source. A registration certificate or operating permit is required before the surface disturbance of 20 acres or more accumulative total of land.

PERMIT NO.	LOCATION/FACILITY	ITEM(S)	ISSUE DATE	EXPIRATION DATE	PERMITTEE
OP918	Area 6	Concrete Batch Plant	11/21/84	11/29/89	F&S
OP919	Area 3 Protec Aggregate Hopper	Bacon-Western Dust Filters	12/03/84	12/03/89	DOE
OP921	Area 5 Aggregate Plant	Surface Disturbance	12/03/84	12/03/89	DOE
OP922	Area 1 Shaker Plant	Simplicity Screen Pioneer Screen Cedarapids Screen Conveyors Baghouse Bins	12/03/84	12/03/89	DOE
OP923	Area 1 Shaker PLant	CMI Rotary Dryer Baghouse Bins	12/03/84	12/03/89	DOE
OP925	Area 23, Bldg. 753	Ajax Boiler #83-35651	12/03/84	12/03/89	DOE
OP928	Area 12 Concrete Batch Plant	Ideal Mfg. Co.	12/03/84	12/03/89	DOE
OP957	Area 2 LLNL Portable Stemming System	Barber-Greene Conveyor Atlas Conveyors (s)	12/03/84	12/03/89	DOE

ADDENDUM 2
Part B (Continued)

CLEAN AIR ACT (Continued)

PERMIT NO.	LOCATION/FACILITY	ITEM(S)	ISSUE DATE	EXPIRATION DATE	PERMITTEE
OP958	Area 2 LLNL Portable Stemming System	Barber-Greene Conveyor Atlas Converyor Nordberg Converyor	12/03/84	12/03/89	DOE
OP1035	Portable Boiler	Superior #2 Bioler Serial #1342-1576	10/20/85	10/20/90	REECo
OP1036	Area 6 Decon Facility	York-Shipley Boiler Serial #82-14857	10/20/85	10/20/90	REECo
OP1082	Area 1 Concrete Batch Plant	Rex Lo-Go Plant	1/30/86	1/30/91	REECo
OP1084	Area 1 Shaker Plant	Surface Disturbance	1/30/86	1/30/91	REECo
OP1085	Area 6 Diesel Tank	105,000 gallons	2/25/86	2/25/91	REECo
OP1086	Mercury Gasoline Tank	420,000 gallons	2/25/86	2/25/91	REECo
OP1087	Mercury Diesel Tank	420,000 gallons	2/25/86	2/25/91	REECo
OP1089	Area 3 Portable Stemming System	4 Double Hoppers 1 Conveyor Belt	2/25/86	2/26/91	REECo
OP1090	Area 6 Gasoline Tank	42,000 gallons	2/25/86	2/25/91	REECo
OP1217	Area 1 Portable Aggregate Plant	Iowa Crusher	12/03/84	12/03/89	REECo
OP1287	Area 1 Aggregate Plant	Portec Crusher Screens, Screws and Conveyors	2/12/87	2/12/92	REECo

ADDENDUM 2
Part B (Continued)

CLEAN AIR ACT (Continued)

PERMIT NO.	LOCATION/FACILITY	ITEM(S)	ISSUE DATE	EXPIRATION DATE	PERMITTEE
RC974	Area 6 DAF	Surface Disturbance	4/19/85		DOE
RC1367	Nevad Test Site	Surface Disturbance	3/17/87		REECo
87-5	Open Burning	Fire Dept. and Env. Sci. Training	8/27/86	8/31/87	REECo
87-37	Tank Burn Test	Open Burning	3/31/87	7/31/87	REECo

ADDENDUM 2
PART B (continued)

WATER POLLUTION

State of Nevada Water Pollution Control Regulations require a permit for construction, installation, or significant modification of sewage collection and treatment facilities and review of plans and specifications for sewage treatment works.

The State of Nevada inspected the sewage treatment systems (lagoons) in Areas 6, 12 and 23 in November, 1985. Applications for permits will be made after completion of final design.

The Area 30 Exploratory Shaft Sanitary Waste System Plan was reviewed by the State, and approved 3/2/84.

CLEAN WATER

State of Nevada water supply regulations require review and approval of plans and specifications for construction of public (potable) water systems and for any substantial addition to or alteration of existing systems and periodic sampling for bacteriological, chemical, and radiological analyses.

Permits Received:

System	Permit No.	Expiration Date	Permittee
NTS - Area 23	NY-360-12C	9/30/87	REECo
NTS - Area 1	NY-5024-12NC	9/30/87	REECo
NTS - area 2 & 12	NY-4099-12C	9/30/87	REECo
NTS - Area 6	NY-5000-12NC	9/30/87	REECo
NTS - Area 3	NY-4097-12NC	9/30/87	REECo
NTS - Area 25	NY-4098-12NC	9/30/87	REECo

Periodic sampling for bacteriological, chemical, and radiological analyses is being done.

SOLID WASTE

State of Nevada Regulations governing solid waste require review and approval of solid waste management plans.

There is a salvage yard in Area 23; sanitary landfills in Areas 6, 10, and 23; and construction landfills in Areas 3, 19, and 25. DOE/NV instructed REECo on 4/8/85 to obtain the necessary State permits or approvals for these facilities.

ADDENDUM 2
PART B (Continued)

RCRA WASTE

REECo has an EPA Identification Number, NV3890090001, for hazardous waste activities. A Part B Permit application for the Radioactive Waste Management Site Landfill in Area 5 was submitted to EPA Region IX by DOE/NV November, 1985. A report must be sent to the State by March 1, of each year providing information on hazardous wastes shipped offsite the previous calendar year.

PCBS

REECo has been issued PCB Generator I.D. No. NVG-PCB-006 by the State. An annual report must be sent to the State by July 1, covering the previous calendar year.

ADDENDUM 2
PART C

STATUS OF THE ENVVIRONMENTALLY RELATED FACILITIES AT THE TTR, ADMINISTERED THROUGH REECO

CLEAN AIR ACT

1. REECo was issued Operating Permit #1083 for the Ross Concrete Batch Plant on 1/30/86. This permit expires 1/30/91.

2. REECo was issued Operating Permit #1081 for the C. S. Johnson Batch Plant on 1/30/86. This permit expires 1/30/91.

3. A permit for Open Burning at the Fire Department Training Facility in the TTR was issued 9/17/86. This permit (#87-8) expires 9/17/87.

4. REECo was issued operating Permits #1311 - #1315 for the one diesel and four JP-4 storage tanks respectively on 3/26/87. The permits expire 3/26/92.

5. REECo was issued Operating Permit #1316 on 3/26/87 for an incinerator. This permit requires calendar year reporting of throughput and operating hours by April 15, each year. The permit expires on 3/26/92.

6. REECo was issued Registration Certificate #1379 on 3/27/87 to construct an additional diesel storage tank.

WATER POLLUTION

1. The sewage lagoon system is complete and in operation, replacing the 100,000 and 50,000 gpd Sewage Treatment Package Plants. Information is currently being gathered for DOE to obtain a permit for this lagoon system.

2. Plans for the Sewage Treatment Package Plant to be installed at Site 4 were submitted to the State for review and approval on 10/31/85. Approval is expected after State receipt of additional requested information. A permit will not be issued (less than 10,000 gpd inflow).

CLEAN WATER

1. Public Water Supply Operating Permits:

ADDENDUM 2
PART C (Continued)

Permits Received:

System	Permit No.	Expiration Date	Permittee
TTR-Sandia-Area 6	NY-3014-12NC	9/30/87	REECo
TTR-Site 3A	NY-5001-12NC	9/30/87	REECo
TTR-Site O&M	NY-5002-12NC	9/30/87	REECo
TRR-Site 1A	NY-4068-12C	9/30/87	REECo

SOLID WASTE

Operation and maintenance plan for the sanitary landfill was submitted to the State on December 19, 1981.

RCRA WASTE

TTR has an EPA Identification Number, NV 3570090016, for hazardous waste activities.

ADDENDUM 3

ENVIRONMENTAL IMPACT STATEMENTS AND ENVIRONMENTAL ASSESSMENTS

The following Environmental Assessments were completed in CY 1986.

1. United States Geological Survey (USGS) Soil Studies near Beatty, Nevada
2. USGS drill holes near Lathrop Wells, Nevada
3. The Liquid Gas Fuel Spill Test Facility at Frenchmen Flat, Nevada Test Site

No Environmental Impact Statements were written in CY 1986.

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO.	2.	3. RECIPIENT'S ACCESSION NO.
DOE/DP/00539-058		

4. TITLE AND SUBTITLE
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Radiation Monitoring Around U.S. Nuclear Test Area, Calendar Year 1986

5. REPORT DATE

6. PERFORMING ORGANIZATION CODE

7. AUTHOR(S) R.G. Patzer, C.A. Fontana, R.F. Grossman, S.C. Black, R.E. Dye, A.A. Mullen, D.J. Thome', and D.D. Smith

8. PERFORMING ORGANIZATION REPORT NO.

9. PERFORMING ORGANIZATION NAME AND ADDRESS
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16. ABSTRACT

This report covers the routine radiation monitoring activities conducted by the Environmental Monitoring Systems Laboratory-Las Vegas in areas which may be affected by nuclear testing programs of the Department of Energy. This monitoring is conducted to document compliance with standards, to identify trends in environmental radiation, and to provide such information to the public. It summarizes activities for calendar year 1986. An addendum covers non-radiological activities and facilities on the Nevada Test Site. Low levels of xenon-133 attributable to NTS activities were detectable off site twice. In addition, debris from the Chernobyl reactor accident was detectable throughout the Western U.S. for several weeks. All measured radiation levels were very low and calculated maximum radiation doses, based on conservative assumptions are: From NTS activities: 1.4 urem for an individual and 5.7×10^{-3} person-rem to the population within 80 km of the NTS. From Chernobyl fallout: (only I-131 was significant) an effective dose equivalent of 1 to 60 urem was calculated for infant thyroids at sampling stations West of the Mississippi. The maximum dose from world-wide fallout (from Kr-85, Sr-90 and Pu-239) was estimated to be 120 urem, or about one-thousandth of natural background radiation exposures.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

18. DISTRIBUTION STATEMENT	19. SECURITY CLASS *(This Report)*	21. NO. OF PAGES
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