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RADIOACTIVITY IN WATER CENTRAL NEVADA TEST AREA

by

W. E. Nork
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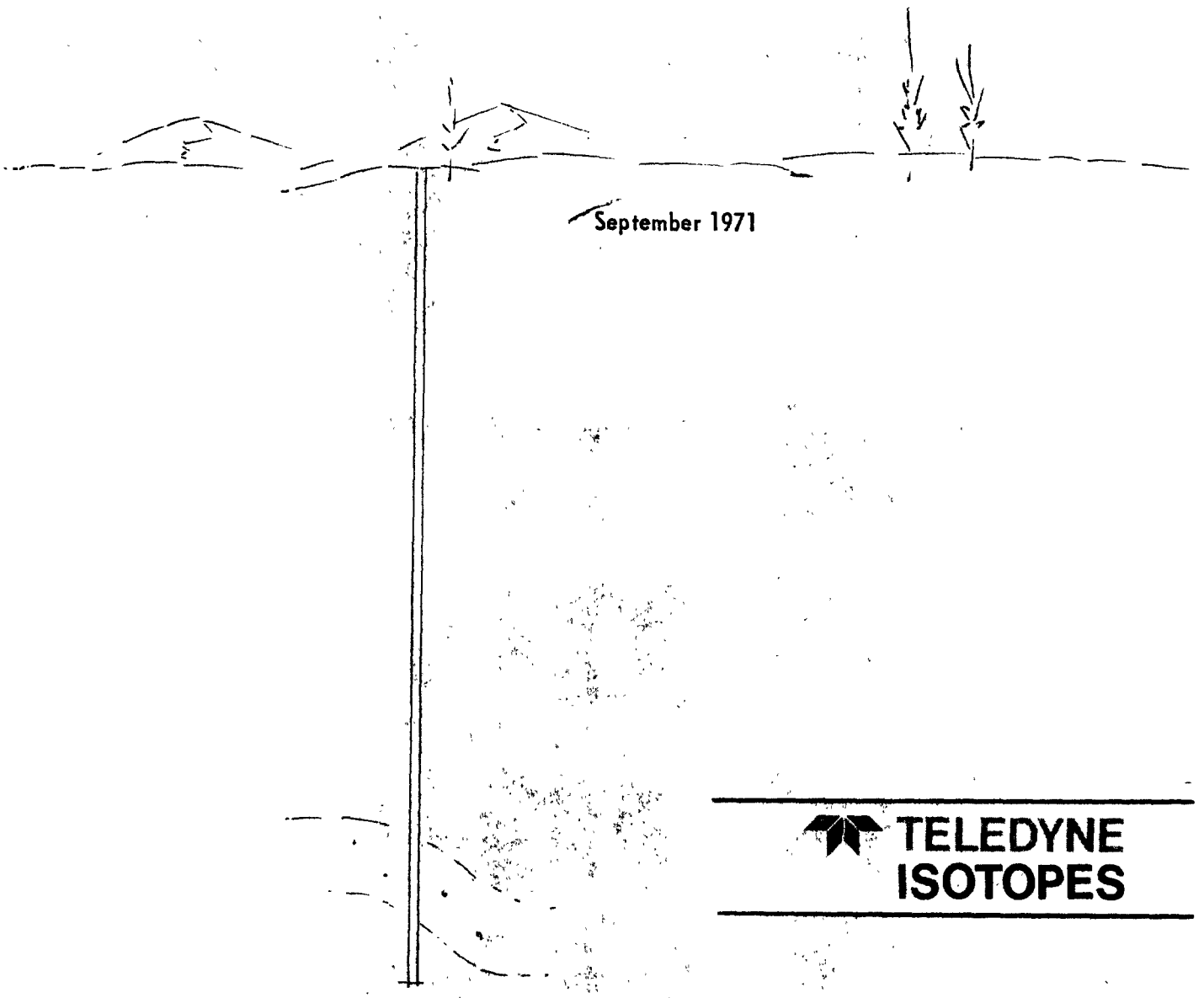

September 1971

TELEDYNE ISOTOPES

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Contract AT(29-2)-1229

Prepared for

U. S. Atomic Energy Commission
Nevada Operations Office
Las Vegas, Nevada

Approved: E. H. Essington

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ABSTRACT

Experience associated with Project Shoal and Project Long Shot has demonstrated the necessity for documenting pre-detonation background radioactivity levels in environmental waters. Possible natural fluctuations and cyclic variations in background radioactivity levels in water may be distinguished from explosion produced radioactivity by long-term sequential sampling and analysis. A plan for multiple sampling and analysis for the Central Nevada Test Area (CNTA) was prepared and implemented by Teledyne Isotopes (TI) on behalf of the U. S. Atomic Energy Commission (AEC).

Low-level tritium and gross radioactivity analyses for background determinations were made on water samples collected from the CNTA. A series of samples were collected from sampling points of interest at various times and analyzed. Lower limits of tritium and gross radioactivity concentrations in water were reasonably well established. Determination of background radioactivities due to naturally occurring radionuclides in water was established for all proposed sites in Central Nevada. After selection of Hot Creek Valley as the CNTA, sampling efforts were concentrated there and the frequency of sampling at other locations diminished.

Hydraulic test data from wells were analyzed to determine the potential migration characteristics of contaminants in the ground-water system. Radionuclide migration through geologic media is governed by the combined effects of water velocity and retardation of the radionuclide by sorption and dispersion. The degree of radionuclide sorption and retardation are approximated in the laboratory by measurement of distribution of a radionuclide between the mineral and solution phases.

A number of samples from UCe-18 indicated natural radioactivity levels above the reference Concentration Guide values. Specific radiochemical analyses indicated that the radioactivity was due to the presence of natural uranium.

Samples taken in Faultless re-entry drill hole UC-1-P-2SR were analyzed for comparison with pre-event background levels of tritium and gross radioactivity.

1.0 INTRODUCTION

Beginning in the second quarter of FY 1967, an intensive search was made for a suitable supplemental weapons test site in the central portion of Nevada. Part of this effort included an evaluation of the hydrologic and geologic characteristics of the various sites investigated and determination of the chemical characteristics and natural radioactivity levels of the ground and surface waters at each location. To implement this effort, a Hydrologic Task Force was formed consisting of Teledyne Isotopes (TI), the U. S. Geological Survey (USGS), and the Desert Research Institute of the University of Nevada (DRI).

The role of TI in the Hydrologic Task Force was to determine environmental levels of radioactivity in waters at each proposed site, test the physical and chemical characteristics of rocks through which contaminants might be transported as a consequence of weapons testing, and estimate the total radioactive contamination that would result for each specific undergound nuclear detonation conducted in the area.

This report summarizes the rock and water sampling efforts and laboratory analyses performed by TI for the U. S. Atomic Energy Commission (AEC) under Contract AT(29-2) 1229 before, during, and following the execution of the Faultless event in the Central Nevada Test Area (CNTA) covering the period March 1967 to December 1970. Conclusions based on the levels of radioactivity found and specific recommendations on monitoring network design are presented.

2.0 RADIOACTIVITY IN ENVIRONMENTAL WATERS

The unexpected appearance of explosion produced radioactivity at the Long Shot site, Amchitka Island, Alaska and the difficulty in identifying fluctuations in background ground-water radioactivity near the Shoal site clearly indicated the value and necessity of documenting pre-detonation radioactivity in environmental waters. In order to determine the appearance of radioactivity produced by a local underground nuclear explosion, the masking effect of periodic fluctuations and cyclic variations in environmental radioactivity levels must be determined. This can be accomplished by a long-term sequential sampling and analysis program. Such a program for sequential sampling and analysis at CNTA was prepared and implemented by TI beginning in March 1967. The plan included 1) design and set-up of a monitoring network, 2) periodic sampling of ground water from wells and springs in central Nevada, and 3) determination of gross radioactivity, and in some cases, specific radionuclide levels in these waters.

2.1 Monitoring Network

On February 11, 1967, members of the Hydrologic Task Force met in Tonopah, Nevada, and discussed the status of the well and spring inventory conducted to that date. Each known water use point was evaluated for:

1. accessibility for year-round sampling,
2. continuous availability of water for sampling,
3. significance relative to source of water,
4. thermal characteristics (hot springs were given a high priority),
5. significance relative to public assurance, and
6. ample coverage of the initially proposed 12,000 square miles and proposed testing sites within this area.

As a result of this evaluation approximately sixty sampling points were selected as the initial monitoring network shown in Figure 1. Hydrologic test holes and exploratory holes were included. The first sampling expeditions were conducted by TI in March and April 1967. Several of the selected sampling points could be sampled only once or not at all because of inclement weather conditions or changes in status of the sampling points.

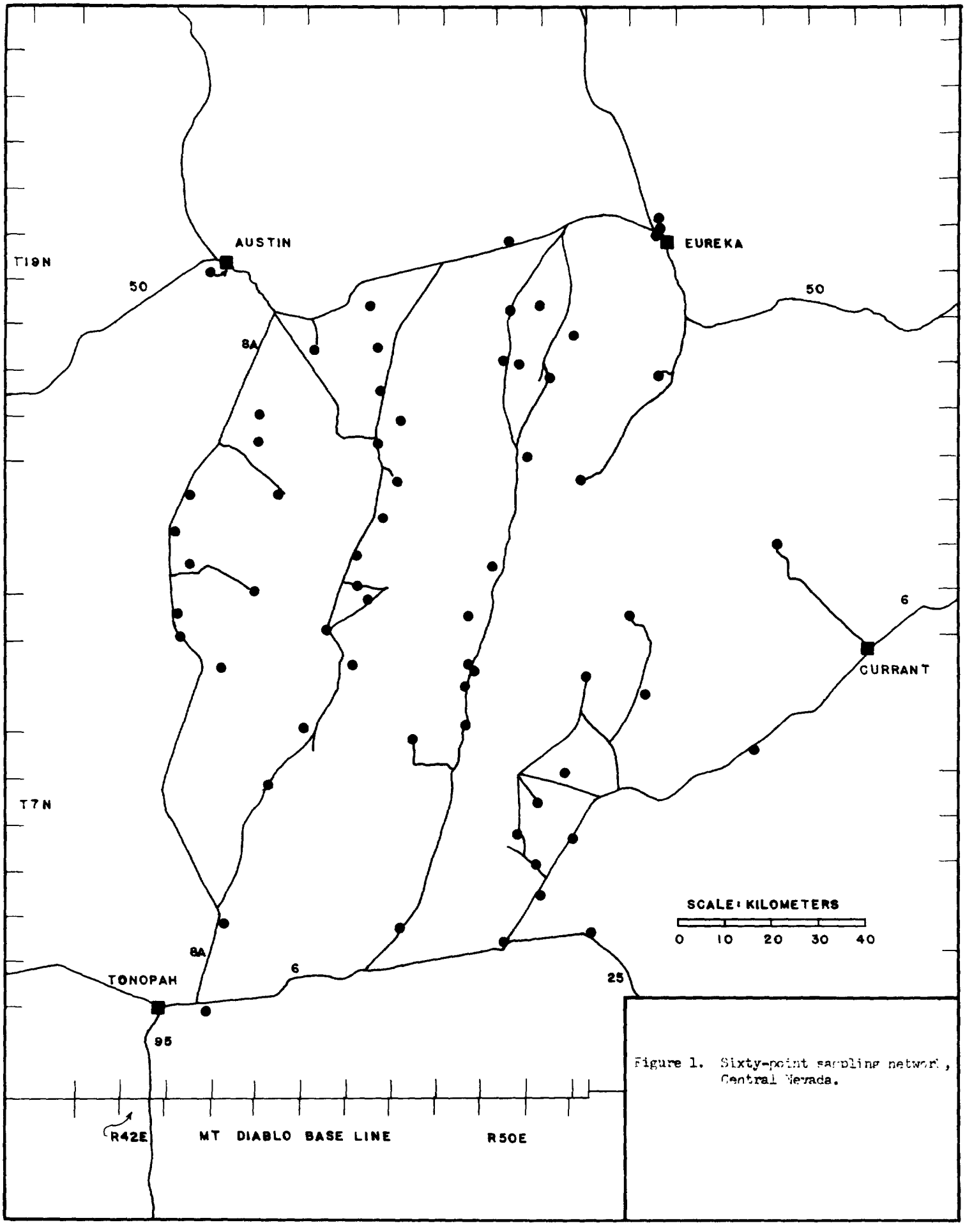

Figure 1. Sixty-point sampling network, Central Nevada.

For instance, during the hydrologic testing of certain holes samples were collected only once before the hole became inaccessible. Consequently, all the original sixty points were not sampled according to design. Substitute points were later added to complete the regional network.

Modifications to the sampling network reduced the number of sample points to about 30 by early Summer 1967. Meanwhile, it became apparent that Hot Creek Valley was the area of prime interest in central Nevada. Continued surveillance of valleys such as Big Smokey Valley, located 80 or more miles away, became unnecessary and the sampling network was modified as shown in Figure 2.

Selection of Hot Creek Valley as the CNTA prompted final reduction of the sampling network to eight points. These eight points were sampled regularly from April 1967 through December 1970. The eight sampling sites, as well as exploratory and emplacement drill holes in the CNTA are shown in Figure 3.

2.2 Sample Collection and Preparation

A cooperative effort by TI and the USGS produced a field procedures and practices handbook to serve as a guide in the collection of water samples and to minimize potential sources of error in the sample collection and assay program. A specific procedure was described for the collection of each type sample. Thus, samples collected for general chemistry analysis did not receive the same treatment as those collected for gross radioactivity assay or for low-level tritium determination. Since many of the network sampling points coincided with points in the USGS water chemistry sampling network, samples were exchanged with the USGS for duplicate analyses and quality control.

Both well and spring water samples were collected as close as possible to the point where water first emerges from the ground. Well samples were collected generally where the water was delivered into a storage tank or reservoir. Spring samples were collected at the orifice when possible. Wells were pumped at least thirty minutes before sampling or until water temperature stabilized. Several of the wells had no provision for sampling

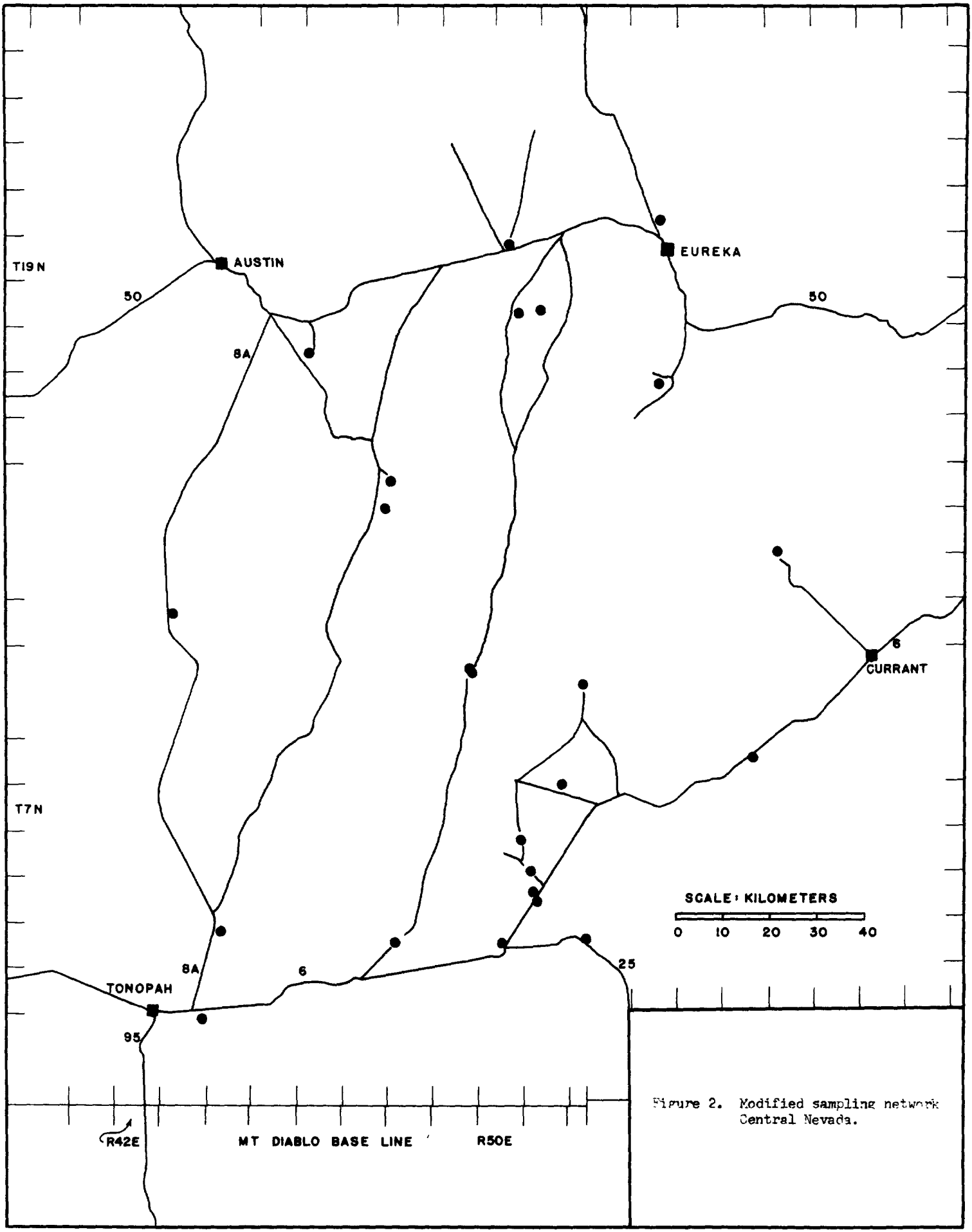

Figure 2. Modified sampling network Central Nevada.

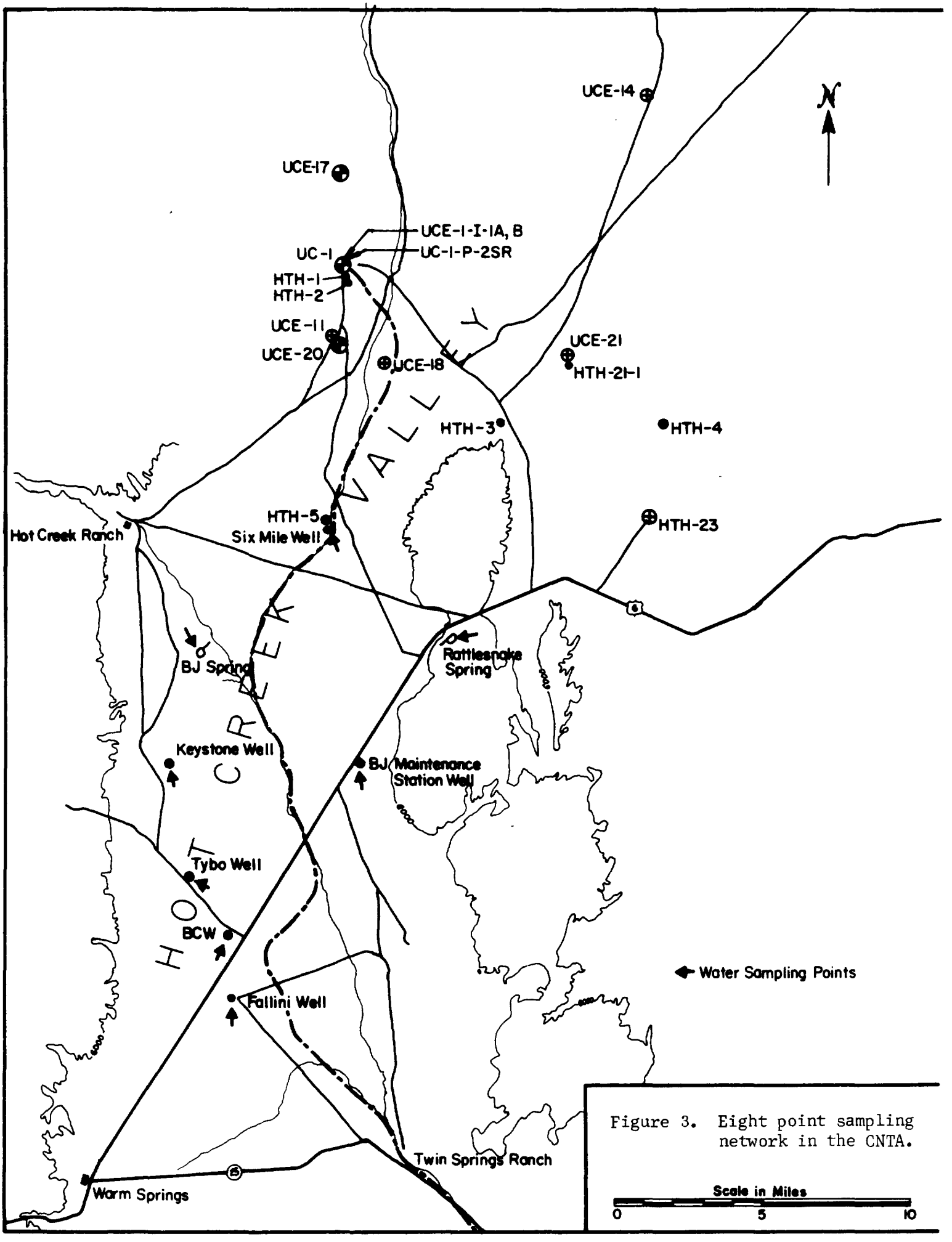

Figure 3. Eight point sampling network in the CNTA.

water directly from the well--for example, Blue Jay Maintenance Station. All of the samples from this well came from the storage tank.

Samples from points in the monitoring network were collected every 5 to 7 weeks beginning in March 1967. A list of the various sampling points cross-referenced with abbreviations and tabulated according to network section is presented in Appendix A. Temperature and pH measured while sampling and sample point locations are listed in Appendix B.

Samples collected for gross radioactivity determinations were filtered as soon as possible after sampling, usually within hours. Most waters collected from wells and springs were expected to contain varying amounts of suspended solids. These suspended solids were expected to react chemically, reducing soluble radionuclide concentrations in water. Filtration minimized the sorption of radionuclides on solids in suspension and eliminated long term ionic exchanges which might have occurred between the liquid and solid phase. Filtration was effected by passing the sample through a membrane-type filter with a pore size of 0.45 micron. The separated suspended solids on the filter were saved, and gross radioactivity measurements were performed separately on them. A portion of the filtered water was assayed for potassium content by atomic absorption spectrophotometry. The filtered water samples were aliquoted to give a residue upon evaporation of less than 200 milligrams (mg). These aliquots were evaporated nearly to dryness in Pyrex beakers, then transferred to two-inch diameter stainless steel planchets on which the evaporation was completed in an oven at 110 degrees centigrade (°C) for 12-24 hours. The cooled planchets, which were previously tared, were reweighed to determine the weight of the residues. The weight of the residue must be known so that a proper self-absorption correction factor can be applied to convert the counting rate of the sample to the disintegration rate.

Filters containing the separated suspended solids were mounted in planchets and counted with the same geometry as the mounted dissolved solids. The maximum weight of the suspended solids was generally less than one milligram, thus no correction for self-absorption was made.

Proportional counting of the suitably mounted samples permitted

the simultaneous determination of alpha and beta/gamma activities. Samples found to contain significant activity other than K^{40} were then analyzed radiochemically for individual radioactive species.

Tritium concentration in the samples was determined as HTO by liquid scintillation counting or as HT by gas proportional counting. If the sample contained a large quantity of suspended solids or dissolved material which might have interferred with liquid scintillation counting techniques, a small portion of the sample was distilled prior to assay.

2.3 Gross Radioactivity

Gross radioactivity levels in water were measured to determine beta/gamma (corrected for K^{40} content) and alpha emissions. In most water samples uncontaminated by explosion products, most of the natural radioactivity was due to K^{40}. The potassium content of a sample was assayed and the K^{40} was calculated and subtracted from the total radioactivity of the sample. This method of analysis permits the determination of emissions from only those radionuclides that remain in the residue after desiccation and loss of volatile components. Any radon which may be dissolved in the water as a result of the decay of Ra^{226} is lost in sample preparation. The build-up of the Rn^{222} daughter product commences at the end of sample preparation, and the two radioisotopes approach secular equilibrium after about a month of build-up.

2.3.1 Radioassay Methods

Sharp Low Beta proportional anticoincidence counters were used in all gross radioactivity measurements utilizing a gas mixture of 10 percent methane - 90 percent argon, flowing through thin window detectors of 2-inch diameter. Backgrounds were determined by taking the mean of several successive long term countings of blank planchets. Stable beta/gamma background of about 0.8 counts per minute (cpm), and alpha backgrounds from 0.03 cpm to 0.08 cpm were usual. The samples were counted for a minimum of 60 minutes, although the average counting time was probably closer to 100 minutes. Standards used for beta/gamma and alpha counting were Cs^{137} and U^{233}, respectively.

2.3.2 Calculation Procedures

All results are reported in picocuries per liter (pCi/l). The statistical error is reported at the 95 percent confidence limit, ± 2 standard deviations (2 σ). Potassium concentration was determined concurrently with radioactivity determinations on all dissolved solids. This allowed radioactivity due to natural K^{40} to be subtracted from the total measured beta/gamma radioactivity. A radioactivity contribution of 0.76 picocuries per milligram (pCi/mg) of natural potassium was used for this determination. The efficiency of the instrument for the weight of sample on the planchet was determined by reference to a previously constructed efficiency curve based on self-absorption for both Cs^{137} and U^{233}. The K^{40} counting efficiency was also determined in this manner.

Calculation of the gross beta/gamma and alpha radioactivity (X) including correction for K^{40} contribution was made using the following equations:

$$X(\text{pCi/l}, \beta/\gamma) = 0.45 \frac{G}{V} \left(\frac{Z}{t} - B - 1.68 \frac{KV}{F}\right) \quad (1)$$

$$X(\text{pCi/l}, \alpha) = 0.45 \frac{G}{V} \left(\frac{Z}{t} - B\right) \quad (2)$$

where: G = conversion factor for Cs^{137} standard $\left(\frac{dpm}{cpm}\right)$,

V = volume of sample (l),

Z = total accumulated counts,

t = counting time (m),

B = background count rate (cpm),

K = potassium concentration in original sample (ppm), and

F = conversion factor for K^{40} standard (dpm/cpm).

The detection limit is arbitrarily set at three standard deviations of the background counting rate, assuming that the background is counted for the same length of time as the sample.

2.3.3 Counter Calibration

The choice of a standard to which the total of the radioactivities in each sample is related is largely arbitrary. Cesium-137 (actually Cs^{137} and Ba^{137m} in secular equilibrium) is used as the beta standard since it is

used by many laboratories as a standard for gross radioactivities. This permits comparison of data since the energies of the beta emissions approximate an average for the range of beta emissions generally encountered. The choice of an alpha standard is also arbitrary but detection efficiency of the counters for alpha is not significantly dependent on alpha emission energy. Uranium-233 is used as the alpha counting standard because: 1) the alpha energies of this nuclide are comparable with those of the significant natural uranium isotopes as well as with those of plutonium, 2) the half-life of U^{233} is sufficiently long (1.6×10^5 years) that no decay correction need be made, and 3) the daughter products of U^{233} are long-lived and no correction for build-up is necessary.

2.3.4 Analytical Results

Results of the gross beta/gamma and alpha measurements are summarized in Appendix C for both suspended and dissolved solids. Gross beta/gamma radioactivity levels in dissolved solids prior to the Faultless event in Hot Creek Valley ranged from 0.0 to 5.1 with a mean of 2.8 $\pm$ 1.4 pCi/l (25 samples, 1σ). After the Faultless event gross beta/gamma levels ranged from 0.0 to 26.3 with a mean value of 3.3 $\pm$ 3.1 (95 samples). Gross alpha activity in dissolved solids prior to Faultless ranged from less than 1.0 to 13.2 with a mean value of 5.0 $\pm$ 3.1 pCi/l (22 samples). After the Faultless event the gross alpha ranged from less than 1.0 to 22 with a mean value of 5.7 $\pm$ 4.3 pCi/l (93 samples). The highest levels of gross radioactivity were observed in deep samples from UCe-18 which will be discussed in Section 3.0. In isolated cases the gross beta/gamma or gross alpha activity was higher after the Faultless event. No trends are evident in the data either before or after the sporadic high values, thus no significance can be attributed to these high values at this time.

2.4 Tritium

Tritium occurs naturally in environmental waters. Because of the atmospheric testing of thermonuclear devices, tritium levels have increased substantially above natural levels. Pre- and post-Faultless water samples were analyzed for tritium in order to distinguish between tritium

of atmospheric origin entering the local hydrologic system and tritium produced by the underground nuclear explosion.

2.4.1 Radioassay Methods

Two methods were used to measure tritium levels in water, liquid scintillation and low-level gas proportional counting. Tritium in water was determined by liquid scintillation counting if the tritium content was above several hundred tritium units (TU*). In this method a portion of the unfiltered sample (usually 2.00 ml) was added to a dioxane-based liquid scintillation solution in a transparent vial and radioassayed on a liquid scintillation spectrometer with appropriately set discriminators. Correction for the detection-efficiency of the instrument was based on tritium standards counted with the samples. Samples and blanks were counted for at least 60 minutes. Usually several blanks were counted with a group of samples, and the mean and standard deviations of the background count rate were calculated on the basis of the counting rate of the replicate blanks. The detection limit for the procedure was considered to be three standard deviations (3σ) of the background counting rate. By calculating the standard deviation on the basis of replicate counting of several blanks rather than on the total accumulated counts of a single blank, a more accurate value for the statistical distribution of observations was achieved. Variations in a counting rate due to inherent instrument instabilities were thereby included with the other statistical errors in the calculation. This is important since stable counting rates are difficult to achieve on liquid scintillation counters. Using these procedures, the detection limit for the tritium assay was about 600 TU, which was above the level found in post-1966 precipitation.

In mid-1969, the procedure for liquid scintillation detection of tritium as described above was modified. The modification decreased the lower limit of detection from approximately 600 TU to 150 TU.

In the new procedure, 5 ml of distilled sample water were mixed with 20 ml of scintillation solution in a plastic, scintillation-counting vial. The solution in the vial was thoroughly mixed, and allowed to stand in the dark for at least one week before counting. Following this treatment,

---

* One TU is equivalent to 3.2 pCi/l.

the vial was placed in a Beckman CPM-100 liquid scintillation spectrometer system. Counting was started after the sample vial was in the dark in the instrument cabinet for a minimum of three hours. Exposure of the vial to light was avoided before and during counting. The same procedure was followed for tritium standards of known radioactivity and blanks of ground water known to have no significant tritium content.

The scintillation solution was prepared by dissolving 7.0 grams of 2,5-diphenyloxazole (PPO), 0.5 grams of 1,4-bis-[2-(5-phenyloxazolyl)]-benzene (POPOP), and 120 grams of naphthalene in 1,4-dioxane. This solution was diluted to one liter with 1,4-dioxane. Scintillation grade reagents were used.

Many of the samples had tritium concentrations in the order of a few to several hundred TU. These samples were radioassayed by the gas proportional counting technique. In this method the sample water was converted to hydrogen gas and counted in that state. Five milliliters of water were quantitatively reduced to hydrogen by hot magnesium (590°C). After purification by passing over activated charcoal and cooled by a dry ice-methanol slush, the hydrogen was expanded into a gas-proportional detector to a pressure of 300 cm Hg in a 1.14 liter volume. The counter was shielded by an anti-coincidence ring, 8 inches of steel, a layer of paraffin wax, and a sheet of cadmium metal. The counting characteristics were optimized by use of 100 cm Hg of nonradioactive methane to act as an internal quenching agent. This combination of hydrogen and methane gave adequate performance over a long period of time. The mean background counting rate in the "tritium window" at a pressure of 300 cm Hg of hydrogen was 1.50 ± .07 cpm (1 σ) for a long count (12 hours minimum), and reproducible within the ± .07 error. The counter had an efficiency in the "tritium window" of 80 percent. Table 1 shows the reproducibility of background and associated tritium standards for a series of five separate observations. With a background fluctuation (± .07 cpm) and efficiency (80 percent), the system was capable of detecting a minimum of 12 TU (three standard deviations of the background counting rate) without prior enrichment of the sample.

TABLE 1

REPRODUCIBILITY OF BACKGROUND AND STANDARD COUNT RATE IN LOW LEVEL TRITIUM ANALYSES

	Background	Tritium Standard Count Rate
1.	1.47 cpm	39.7 cpm
2.	1.58 cpm	39.8 cpm
3.	1.44 cpm	38.5 cpm
4.	1.45 cpm	39.7 cpm
5.	1.56 cpm	38.4 cpm

2.4.2 Analytical Results

Results of the tritium radioassays are summarized in Appendix D. Tritium levels determined by liquid scintillation are noted by an asterisk (*) after the reported value. Prior to the Faultless event tritium levels in Hot Creek Valley water sources ranged from 14.0 to 148 with a mean value of 76.2 ± 52.7 TU (12 samples, 1σ). After the Faultless event tritium levels ranged from 0.0 to 210 with a mean value of 35.2 ± 35.0 TU (60 samples).

2.5 Specific Radionuclides

Certain well and spring samples (especially thermal springs) from central Nevada contained gross radioactivity levels considerably above the average for the area. There are two possible sources for these elevated radioactivity levels; naturally occurring radioisotopes and nuclear explosions. If the radioactivity is of natural origin the identity and levels must be established so that future comparisons in determining the presence or absence of explosion produced radioactivity can be made. If of nuclear explosion origin the level of individual radioisotopes must be established so that judgement of water use safety can be made. In this respect Concentration Guide* values (CG) are used for reference comparison of radioactivity levels. The CG value referenced is specifically for radioactivity added to water and which neither the identity nor the concentration of any component radionuclide is known. A different CG value (2×10^{-7} µCi/ml or 200 pCi/l) may be used for reference if the following radionuclides are known to be absent: Sr^{90}, I^{125}, I^{126}, I^{129}, I^{131}, Pb^{210}, Ra^{226}, Ra^{228}, Cm^{248}, and Cf^{252}. Several spring water samples consistently exceeded the CG value (10 pCi/l) for gross radioactivity. These samples were analyzed for Sr^{90}, Pb^{210}, and radium to establish the environmental levels of these radionuclides. The same samples were analyzed for Cs^{137}, the presence of which indicates fission product contamination. Radium-228, a decay product of Th^{232}, was not determined. The iodines, curium, and californium are assumed to be absent from environmental waters.

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* CG's are referenced concentrations as given in November 8, 1968, revision of USAEC Manual, Chap. 0524, Standards for Radiation Protection, Annex A, Table II, Column 2, reduced by a factor of three to be consistent with standards applicable to Individuals and Population Groups in Uncontrolled Areas. These guides are applied as per instructions in TN NV 0500-23, dated May 12, 1969. For gross activity measurements, one CG=1×10^{-8} µCi/ml (10 pCi/l).

2.5.1 Radioassay Methods

Samples collected in the field were filtered within hours after collection, the filtrate was acidified, and cesium, strontium, lead and barium carriers were added. Usually a four-liter sample was collected for radioisotopic analysis. Specific analytical procedures are given in Appendix E.

2.5.2 Analytical Results

Table 2 summarizes the results of the specific radionuclide analyses. No significant levels of Cs^{137} or Sr^{90} were found in these samples indicating that any radioactivity present in the water is probably not of nuclear testing origin. Radium-226 in secular equilibrium with three alpha emitting daughters produces nearly a four-fold increase in alpha activity attributable to Ra^{226}. The alpha activities attributable to Ra^{226} and daughters in SPG-WARM samples account for only 25 to 40 percent of the measured gross alpha activity. The remainder may be caused by natural uranium. Alpha-contribution from Ra^{226} and daughters in the other three samples listed is greater than the gross alpha activity. This observation is presently unexplainable.

3.0 RADIOACTIVITY IN DRILL HOLE UCe-18

Nine pre-Faultless water samples collected from various packer zones in AEC well UCe-18, June 1967, were analyzed for gross radioactivities. All samples exceed the CG value (10 pCi/l) for unidentified and unknown concentrationsof radionuclides.

Scandium-46 was suspected as the contributing radionuclide, since Sc^{46} had been introduced into the hole in a tracer injection survey conducted just two weeks before the water samples were collected. However, Sc^{46} could not have accounted for the high level of alpha radiation. Furthermore, there was no evidence of Sc^{46} on the gamma spectra of the samples.

3.1 Analytical Results

Radiochemical analyses were conducted on 9 water samples from UCe-18 by TI and USGS concurrently. Table 3 summarizes gross alpha and

TABLE 2

Concentration of Specific Radionuclides in Selected Water Samples from the Hydrologic Surveillance Network, Central Nevada.

Sample Designation	Lab No.	Ra^{226}	Pb^{210}	Cs^{137}	Sr^{90}
		pCi/l	pCi/l	pCi/l	pCi/l
SPG-WARM	30	Not Determined	Not Determined	Not Determined	<0.2
SPG-WARM	122	8.54 ± 0.52	1.84 ± 0.43	<0.5	<0.1
SPG-WARM	232	4.09 ± 0.23	2.10 ± 0.32	<0.5	<0.1
SPG-BOWL	228	3.61 ± 0.10	0.68 ± 0.18	<0.5	<0.1
SPG-POTS	227	14.3 ± 0.2	1.56 ± 0.27	<0.5	<0.1
SPG-SPNC	229	4.66 ± 0.10	2.26 ± 0.46	<0.5	<0.1

TABLE 3

Comparison of Gross Radioactivity Measurements Obtained at USGS and TI Laboratories on Water from Well UCe-18

Zone	Feet Below Land Surface Datum	USGS No.	Gross Alpha		Gross Beta/Gamma *	
			μg/l U USGS	μg/l TI	pCi/l USGS	pCi/l TI
3	5920-6080	68-620	610	615 ± 140	130	170 ± 40
4	5634-5794	68-621	3900	3220 ± 320	1800	2430 ±120
5	5020-5180	68-622	3400	3540 ± 240	1700	2570 ± 60
6	5804-5914	68-623	2800	2680 ± 290	1300	1220 ± 80
7	5530-5640	68-624	2900	3100 ± 290	1200	1610 ± 90
8	5300-5410	68-625	2200	1810 ± 230	980	1380 ± 90
9	4555-4747	68-626	590	910 ± 150	300	330 ± 45
11	406-598	68-627	610	790 ± 130	310	430 ± 50
12	4795-4995	68-628	1000	1060 ± 160	510	430 ± 50

* USGS standard was Sr^{90} - Y^{90}, TI standard was Cs^{137} - Ba^{137m}

gross beta/gamma results obtained by the two laboratories. The TI gross alpha data are within ± 20 percent of the published accuracy of the USGS data for all but two samples: USGS #68 - 626 and 68 - 627. The one large discrepancy in #68 - 626 seems excessive. However, occasional differences up to 30 percent can be expected, due to the many possible variables in running gross alpha measurements. The two sets of measurements of gross beta/gamma should probably not be compared directly, since a different standard was used for each. In the case of the USGS data, Sr^{90} -Y^{90} was the standard; in the case of TI, Cs^{137} -Ba^{137m} was used. Since using Cs^{137} as a standard gives a larger efficiency correction than Sr^{90} the TI data should be the higher. This is the case for all samples except two (USGS #68 - 623 and USGS #68 - 628). By comparing relative alpha activities and assuming approximately proportionate alpha and beta activities it appears likely that the TI data in the two samples cited may be low. This shows that at least a useful correlation between the two sets of data is possible, although no direct comparison should be made.

Results of radiochemical analyses of three water samples from UCe-18 are summarized in Tables 4 and 5. A comparison of the uranium analyses by USGS and TI is shown in Table 4. Fluorometric uranium analyses were performed by Radiation Detection Company, Mountain View, California. The uncertainty values are two standard deviations calculated on the basis of the range of duplicate analyses. All of the TI results are within ± 20 percent of the USGS results. The fact that the USGS data are high compared to TI data by a factor of 1.1 - 1.2 suggests the possibility of a bias on one of the sets of data.

Specific radionuclide analyses are shown in Table 5. All values presented, except for Ra^{226} in Zone 5 and U in all zones should not be interpreted as positive indication of the presence of the respective radionuclide. The results indicate that none of the radionuclides assayed except U accounted for a significant fraction of the gross radioactivity (either alpha or beta/gamma). The U concentration was found to be high, accounting for approximately 100 percent of the gross alpha activity.

All samples from UCe-18 except Zone 3 had a gross radioactivity of over 200 pCi/l and a total solids concentration of over 2000 mg/l.

The investigations to date are not sufficient to explain the high concentration of U in this water, even though there is evidence of anomalously high natural radioactivity in the water-bearing rock in this part of Hot Creek Valley. Ordinarily U is not soluble in near neutral or alkaline waters unless sufficient bicarbonate (or carbonate) is present to form a soluble U complex. All of the nine water samples collected from UCe-18 had a total dissolved solids of over 2000 mg/l. The major contributor to the total dissolved solids was identified as bicarbonate. While this water would be considered non-potable, the solids concentration is not unusual.

3.2 Radioactivity in UCe-18 Cores

Core samples from the approximate depth in UCe-18 at which water samples had the highest radioactivity (Table 3) were radioassayed for gross gamma. Core samples from other depths as well as samples from other wells for qualitative comparison were also radioassayed. There was no attempt to calibrate the detector for efficiency because all cores would have had to be of uniform size and shape. However, the count rates may generally be compared with one another.

Table 6 summarizes the results of core sample radioassay. Except for core 9, samples from UCe-18 appear to contain higher levels of radioactivity than samples from either UE-1 or UCe-17. Also, except for core 5, the level of radioactivity appears to be lower in the shallower samples.

4.0 RADIOACTIVITY IN FAULTLESS REENTRY DRILL HOLE UC-1-P-2SR

Beginning in April 1968, water samples were collected on a periodic basis from reentry drill hole UC-1-P-2SR. The effort was conducted in conjunction with a USGS effort to determine water levels in the reentry drill hole.

TABLE 4

Comparison of Uranium Analyses
Obtained at USGS and TI Laboratories
on Water From Well UCe-18

Zone	U µg/l USGS	U µg/l TI
4	3900	3580 ± 340
5	4000	3680 ± 60
6	3200	2690 ± 70

TABLE 5

Concentration of Specific Radionuclides in
Selected Water Samples from Drill Hole UCe-18.

Sample		Lab No.	Ra^{226}	Pb^{210}	Cs^{137}	Sr^{90}	U (natural)
			pCi/l	pCi/l	pCi/l	pCi/l	pCi/l
Well	Zone						
UCe-18	4	198	0.3 ± 0.4	0.5 ± 0.6	0.5 ± 0.2	0.15 ± 0.5	2370 ± 230
UCe-18	5	199	10.7 ± 1.7	< 2.3	0.6 ± 0.2	0.2 ± 0.4	2440 ± 50
UCe-18	6	200	0.5 ± 0.1	1.0 ± 0.3	0.4 ± 0.2	0.4 ± 0.3	1780 ± 50

TABLE 6

Radioactivity in Cores from
Drill Holes Ue-1, UCe-17, and UCe-18

Well	Core	Core Depth (Feet)	Weight (lbs.)	Net cpm in Core
Ue-1	176	-	-	1861
UCe-17	12	2951	-	1624
UCe-18	5	1090	*	3348
UCe-18	9	3010	6.4	1402
UCe-18	18	5000	2.1	2587
UCe-18	22	5305	8.0	3100
UCe-18	25	5706	5.0	2806
UCe-18	25	5707	3.7	3368
UCe-18	25	5707+	3.2	3200
UCe-18	30	6025	3.0	2680

*Bagful of crushed rock - count rate probably should not be compared with other samples in cylindrical core shape.

Access to UC-1-P-2SR was initially limited to the upper part of the drill hole due to a casing constriction at about 2230 feet deep. Only one sample was collected on each of the first five sampling efforts. During this time, the water level in UC-1-P-2SR was declining and between September 1969 and November 1970, was below the constriction so that no samples could be obtained.

In November 1970, the constriction was opened and samples were collected at 15-meter (50-foot) intervals throughout the water column. Results of analyses are given in Appendices C and D.

No attempt has been made to evaluate the distribution or magnitude of radioactivity levels found in the reentry drill hole. The total estimated section at the Faultless site could not be sampled because UC-1-P-2SR did not extend as a cased hole through the Faultless rubble chimney. To further complicate matters, the water used for drilling of UC-1-P-2SR was obtained from UCe-18 which was high in natural radioactivity. In addition, all radioactive waste products derived in drillback at Faultless were returned to UC-1-P-2SR.

5.0 DISTRIBUTION COEFFICIENTS

Radionuclide migration through geologic media is governed by the combined effects of water velocity and retardation of the radionuclide by sorptive and dispersive phenomena. Sorptive effects on radionuclide retardation can be approximated in the laboratory by measurement of the distribution of radionuclide between the mineral phase and the solution phase. This measurement produces a value (distribution coefficient, K_d) which can be used directly in retardation or total transport equations. Distribution coefficient is defined as follows:

$$K_d = \frac{V}{M} \frac{A_s}{A_w} \qquad (3)$$

where A_s = amount of radionuclide sorbed or taken out of solution by the solid phase,

A_w = amount of radionuclide left in solution,

V = volume of liquid (ml), and

M = mass of material (g).

5.1 Materials and Methods

Distribution coefficients were measured on samples of core and cuttings taken from drill holes in Hot Creek Valley, CNTA exploratory operations. Crushed and size-graded material was suspended in waters taken from the same general area and depth in Hot Creek Valley as the cores and cuttings. The mixture was contaminated in the laboratory with either Ca^{45} or a combination of Sr^{85} and Cs^{137}. The physical and chemical property differences between Sr^{85} and Sr^{90} are assumed to be negligible for the water-mineral systems considered. Figure 3 locates the position of the various drill holes from which cores and cuttings were taken. Table 7 lists the collection of the sample cores, cuttings, and waters.

Core material was crushed after vigorous brushing to remove traces of drilling mud and other foreign material. The crushed material was size graded into three fractions:

500 to 4000 micron,
62 to 500 micron, and
<62 micron

Before size grading the cuttings, one portion was wet sieved through a 62-micron screen to remove the finer particles and drilling mud.

A five-gram portion of the size-graded material was suspended in 20 ml of radionuclide solution and was mixed periodically. After a period of 96 hours the particulate material was separated from the solution by centrifugation and aliquots of the supernatant solution were radioassayed.

Calcium-45 radioactivity was determined by gas proportional counting of a thin film residue derived from evaporation of the supernatant liquid. Strontium-85 and cesium-137 radioactivities were determined together by gamma ray pulse height analysis of the combined spectra. The predominant gamma ray energy resulting from the disintegration of Sr^{85} is 0.514 MeV and is easily distinguishable from that of Cs^{137}, 0.662 MeV. A computer program was used to analyze the spectral data to give radioactivities for each individual isotope and to calculate individual K_d values.

5.2 Results and Interpretation

Table 8 lists the K_d values for Ca^{45}, Sr^{85}, and Cs^{137} for the various water/mineral systems studied.

Radionuclide sorption in ground-water aquifers is a function of several factors, including: 1) amount of surface area exposed to the water containing the radionuclide, 2) physical-chemical conditions of the water/mineral system as it affects degree of chemical interactions, and 3) velocity of ground-water flow compared to the rate of chemical interactions. The mineral surface in the aquifer material which effectively interacts with the radionuclide carrying water is the wall surface of the water conducting fractures and interconnected pores. In order to represent the effective surface in measurement of laboratory K_d's, material closely representing the ground-water aquifer in the undistrubed condition should be used. Large pieces of aquifer material are difficult to handle in laboratory studies, yet small particles may not represent the aquifer. A means for estimating the smallest particle diameter which would be representative was determined by measuring the specific surface area of the aquifer material separated into various particle diameter ranges. Specific surface area measurements on granite, carbonate, tuff, and melt-glass indicated that specific surface area changed very little with particle diameters above about 250μ. Mineral-water chemical interactions also indicated that chemical changes above about 250μ partical diameter were small. Distribution coefficient values reported for particle diameters greater than 250μ were virtually constant. Therefore, the laboratory K_d values reported for the 500 to 4000μ size range are considered to be reasonable estimates of *in situ* K_d values.

The chemical nature of the water also strongly affects the degree of radionuclide sorption. Presence of large quantities of ions which compete for sorptive sites with the radionuclides will tend to decrease the degree of radionuclide sorption and thus lower the effective K_d value. To reduce the possibility of this type of effect in laboratory K_d measurements, waters natural to the aquifer material being tested were used. The effect of temperature was not investigated but all K_d measurements were made at a constant temperature of 25 degrees centigrade.

TABLE 7

Central Nevada Test Site Core,
Cutting, and Water Sample Locations

	Cores and Cuttings		Water	
Sample Designation	Sample Type	Collection Interval	Sample Designation	Collection Interval
UCE 17 A	Cuttings	2000' - 4200'	UCE 17 Zone 14	1770' - 1840'
UCE 17 B	Core 23	4787' - 4789'	UCE 17 Zone 5	4620' - 4820'
UCE 18 A	Core 13	4216' - 4218'	UCE 18 Zone 9	4555' - 4747'
UCE 18 B	Core 14	4498' - 4500'	UCE 18 Zone 12	4795' - 4995'
UCE 11 A	Cuttings	0' - 2500'	UCE 11 Composite	--
UCE 11 B	Core 2	4014' - 4015'	UCE 11 Composite	--
HTH-1-A	Cuttings	2200' - 2400'	HTH-1 Zone 10	700' - 850'
HTH-1-B	Cuttings	3000' - 3700'	HTH-1 Zone 3	2640' - 2710'
UCE1-I-1-A	Core	2400'	HTH-1 Zone 10	700' - 850'
UCE1-I-1-B	Core	3006'	HTH-1 Zone 3	2640' - 2710'

TABLE 8
Distribution Coefficients of Some Central Nevada
Test Site Water-Mineral-Radionuclide Systems

Sample Designation	Sample Type	Water Designation	Distribution Coefficients (K_d)								
			Calcium-45*			Strontium-85*			Cesium-137*		
			500-4000 micron	62-500 micron	< 62 micron	500-4000 micron	62-500 micron	< 62 micron	500-4000 micron	62-500 micron	< 62 micron
UCE-17A	Cuttings	UCE-17 Zone 14	43.7	60.81	86.2	62.1	73.9	93.5	449.2	984.0	2694.0
	Cuttings-Washed	UCE-17 Zone 14	131.3	106.4	131.4	104.3	95.5	124.8	554.6	807.4	1447.0
B	Core 23	UCE-17 Zone 5	213.3	216.6	284.3	143.8	139.6	265.3	107.5	167.9	428.8
UCE-18A	Core 13	UCE-18 Zone 9	529.1	425.3	495.7	563.3	497.2	599.6	1254.0	1003.0	1645.0
B	Core 14	UCE-18 Zone 12	29.8	47.8	53.6	54.1	64.0	84.2	69.3	121.9	1347.0
UCE-11A	Cuttings	UCE-11 Composite	71.5	77.1	90.9	99.3	130.6	120.9	786.9	1519.0	759.2
	Cuttings Washed	UCE-11 Composite	75.6	94.9	136.4	138.1	148.1	235.0	1349.0	1324.0	4404.0
B	Core 2	UCE-11 Composite	185.1	169.5	245.5	228.9	205.5	294.9	888.6	1139.0	2782.0
HTH-1A	Cutting	HTH-1 Zone 10	32.0	31.1	42.0	48.3	38.0	24.8	180.4	138.1	84.2
	Cuttings Washed	HTH-1 Zone 10	354.6	278.8	211.7	516.6	428.1	309.9	454.7	542.1	710.2
B	Cutting	HTH-1 Zone 3	182.2	110.0	67.8	225.0	104.3	79.0	284.4	139.7	93.4
	Cuttings Washed	HTH-1 Zone 3	487.7	514.1	301.2	621.1	656.2	405.7	458.9	391.7	628.0
UCE1-I-1A	Core	HTH-1 Zone 10	1380.0	2065.0	2842.0	570.7	694.4	866.0	2048.0	2542.0	2642.0
B	Core	HTH-1 Zone 3	893.0	794.4	1163.0	2454.0	1806.0	1933.0	2642.0	3165.0	5051.0

* Level of radioisotope in solution: Ca^{45} 0.001 μCi/ml
Sr^{85} 0.005 μCi/ml
Cs^{137} 0.05 μCi/ml

The isotopes of strontium and cesium, both radioactive and stable ions, are readily sorbed by bentonite and would result in unusually high K_d values which are not representative of the ground-water aquifer material being tested. A portion of the cuttings, washed to remove the bentonite, was crushed to produce fines derived directly from the larger remaining particles. Contrary to the expected results, K_d's for the washed cuttings were usually higher than for the unwashed cuttings. This effect may be the result of 1) drilling mud not being present in sufficient quantities to significantly effect radionuclide sorption in the unwashed samples, and/or 2) soluble cations which compete with the radionuclides for sorptive sites may have been removed with the fines.

6.0 RADIONUCLIDES IN WATER RESULTING FROM UNDERGROUND NUCLEAR EXPLOSIONS

Ground-water flowing through an underground nuclear explosion rubble chimney becomes contaminated with radioactivity produced by the explosion. The degree of ground-water contamination is dependent on the amount of radioactivity produced, the source configuration, and such parameters as ground-water velocity and degree of chemical exchange in the aquifers.

6.1 Source of Radionuclides in Water

Radioactive contamination in water is derived from two principal sources: 1) that which occurs naturally in the water and rock through which the water flows; and 2) that which is introduced artificially, such as through underground nuclear explosions.

In Section 3.0 it was noted that natural uranium contributes substantially to the naturally-occurring radioactivity in water in some local areas and tends to be higher in the deep-seated rocks than in the near-surface and valley-fill alluvium.

Radioactive contamination of water resulting from underground nuclear detonations results from the dissolution of radionuclides produced by the fission and fusion of device fuels and neutron activation of geologic and other materials in the near-explosion environment. The amount and kind of radioactive contaminants which will enter the hydrologic system depends

upon the device design, the nature of materials surrounding the device, the solubility and distribution of the radionuclides produced, the availability of ground-water to the explosion zone, and several other physical and chemical factors such as water pH, temperature, and pressure as well as elapsed time after explosion.

6.2 Concentration of Radionuclides in Water

The concentration of radionuclides in ground-water, resulting from a single nuclear explosion would be nearly the same for any underground nuclear explosion where the same design and controlling factors such as rock environment, scaled depth of burial, and degree of ground-water saturation were equivalent. Although larger yield detonations produce more radioactivity, mixing of radioactivity with a larger quantity of water results in nearly the same concentration of radioactive contamination in water. In other words, if control factors were constant, the concentration of explosion derived radionuclides in water would be independent of yield.

6.3 Transport of Radionuclides in Water

Probably all radionuclides in water are retarded to some degree relative to ground-water velocities. It was noted earlier in this report that naturally occurring and/or explosion-produced radionuclides are retarded by chemical exchange reactions in rock/water systems. Some nuclides such as Cs^{137} have consistently exhibited relatively high exchange factors in laboratory tests. Others such as tritium are usually assumed to be non-retarded by exchange.

Independent of the chemical exchange reactions there are several other factors which can significantly retard the movement of radionuclides in water. Probably the most important of these factors is dispersion.

Initial radionuclide concentration and physical/chemical form, chemical exchange, dispersion, ground-water velocity and flow direction are the most important factors to be evaluated in determining the location in time and the areal extent of radioactive contamination resulting from underground nuclear explosions. Each underground event is unique in scope when considering the distribution of specific radionuclides. A general case for radionuclide transport in Hot Creek Valley would be difficult to model.

7.0 CONCLUSIONS AND RECOMMENDATIONS

As the CNTA became better defined and eventually was limited to Hot Creek Valley, so also were the water and rock sampling and analysis studies. Preparatory to and following the Faultless event at the CNTA, rock and water samples were collected and analyzed. From analysis of these samples and consideration of other hydrologic and geologic data, the following conclusions were reached:

1. Radiochemical assay of waters indicated that the background level of tritium in CNTA ground-water was generally less than 200 TU. Samples taken at any given point varied between about 10 and 200 TU, reflecting seasonal changes in tritium content in precipitation.

2. Gross radioactivity measurements indicated that ground-water generally had less than 10 pCi/l gross beta/gamma and gross alpha. Notable exceptions were thermal springs, such as Warm Springs (SPG-WARM), where beta/gamma activity over 100 pCi/l and alpha activity over 200 pCi/l were consistent.

3. Well UCe-18 water contained up to 2500 pCi/l of both gross beta/gamma and gross alpha activity; this was attributed to significant levels of soluble uranium.

4. Water derived from the Faultless drillback hole UC-1-P-2SR contained levels of radioactivity up to about 1000 times background for water in that region.

5. The entire water column in UC-1-P-2SR was completely sampled only after several years delay; consequently, definitive interpretation of the amount and distribution of radioactivity at this location is not possible at this time.

6. Radionuclide sorption studies on rocks from exploration drill holes, using ground-water pumped from them, gave adequate information regarding retardation of nuclides in the ground-water system.

7. Post-Faultless sampling and analyses indicated that no event-related radioactivity has reached the sampling locations in Hot Creek Valley.

On the basis of the findings, it is recommended that:

1. A series of sampling locations at the CNTA be identified and then monitored on a once-a-year basis until definitive description of ground-water flow direction and rate away from the nuclear testing areas in Hot Creek Valley is provided.

2. Analyses of samples for gross beta/gamma, gross alpha, and low level tritium (20 TU detection limit) be continued.

3. Water from HTH-1 and HTH-2 be sampled and analyzed periodically, in addition to UC-1-P-2SR, after the Faultless rubble chimney begins to fill.

APPENDIX A

Abbreviations used in sample designations are explained in Table A. Each point is identified relative to its grouping; 8-point, 30-point, 60-point, or AEC well network. A group of 7 sampling points are listed for reference which do not belong to any of the identified networks.

TABLE A. EXPLANATION OF ABBREVIATIONS USED FOR SAMPLE POINT DESIGNATION

WEL-BCMP	8-PT	BASE CAMP WELL
WEL-FLNI	8-PT	FALLINI WELL
WEL-KEYS	8-PT	KEYSTONE WELL
WEL-TYBO	8-PT	TYBO WELL
WEL-BJMS	8-PT	BLUE JAY MAINTENANCE STATION WELL
SPG-BLUJ	8-PT	BLUE JAY SPRING
SPG-RSNK	8-PT	RATTLESNAKE SPRING
WEL-SIXM	8-PT	SIXMILE WELL
WEL-FRED	30-PT	FREDS WELL
WEL-DBLO	30-PT	DIABLO MAINTENANCE STATION WELL
WEL-APRT	30-PT	TONOPAH AIRPORT WELL
WEL-CHAS	30-PT	CHARLIES WELL
WEL-ED/S	30-PT	EDS WELL
WEL-TN11	30-PT	TONOPAH WELL-11
WEL-TS60	30-PT	TWIN SPRING 60-FOOT WELL
WEL-MC/C	30-PT	MCCIUN WELL, TWIN SPRINGS RANCH NEW WELL
WEL-JOES	30-PT	JOES WELL
WEL-4	30-PT	
WEL-WELL	30-PT	THE BIG WELL
SPG-WARM	30-PT	WARM SPRINGS
SPG-GOAT	30-PT	NANNY GOAT SPRING
SPG-CAIN	30-PT	CAINE SPRINGS
SPG-TWIN	30-PT	TWIN SPRINGS SPRING
SPG-ABEL	30-PT	ABEL SPRING
SPG-DUGN	30-PT	SPRING ABOVE DUGAN PLACE
SPG-UHCR	30-PT	UPPER HOT CREEK RANCH SPRING
SPG-LCKS	30-PT	LOCKES BIG SPRING
SPG-MORS	30-PT	MOORES STATION SPRING
SPG-DUCK	30-PT	DUCKWATER

TABLE A. (CONTD.)

WEL-TN09	60-PT	TONOPAH WELL-9
WEL-TS14	60-PT	TWIN SPRING 140-FOOT WELL
WEL-TRUD	60-PT	TRUDGEN WELL
WEL-RMT1	60-PT	ROUND MOUNTAIN WELL-1
WEL-RMT2	60-PT	ROUND MOUNTAIN WELL-2
WEL-MVW1	60-PT	MONITOR VALLEY WINDMILL-1
WEL-LFLR	60-PT	LITTLE FISH LAKE RANCH WELL
WEL-CRVR	60-PT	CARVERS FLOWING WELL
WEL-ROIR	60-PT	R.O. INC. RANCH WELL
WEL-MQTO	60-PT	MOSQUITO CREEK RANCH WELL
WEL-TURK	60-PT	TURK WELL
WEL-MVW3	60-PT	MONITOR VALLEY WINDMILL-3
WEL-J--S	60-PT	J BAR S RANCH WELL
WEL-BSV1	60-PT	BIG SMOKEY VALLEY FLOWING WELL-1
WEL-MVW5	60-PT	MONITOR VALLEY WINDMILL-5, POTT'S RCH
WEL-FISH	60-PT	FISH CREEK RANCH WELL
WEL-MVW6	60-PT	MONITOR VALLEY WINDMILL-6
WEL-KCHN	60-PT	KITCHEN MEADOWS FLOWING WELL-1
WEL-BART	60-PT	BARTINE RANCH FLOWING WELL
WEL-SIMP	60-PT	SIMPSON WELL
SPG-STON	60-PT	STONE CABIN WELL
SPG-BLMT	60-PT	BELMONT SPRING
SPG-LFLV	60-PT	LITTLE FISH LAKE VALLEY SPRING
SPG-DARO	60-PT	DARROUGH HOT SPRINGS
SPG-CLCK	60-PT	CLEAR CREEK SPRING
SPG-POTS	60-PT	HOT SPRING AT POTTS RANCH
SPG-BOWL	60-PT	DIANAS PUNCH BOWL
SPG-INDN	60-PT	INDIAN CREEK SPRING
SPG-FISH	60-PT	FISH CREEK RANCH SPRING
SPG-SPNC	60-PT	SPENCER HOT SPRING
SPG-SLVN	60-PT	SULLIVAN SPRING
SPG-KLOB	60-PT	KLOBE HOT SPRINGS
TWS-MANH	60-PT	MANHATTEN-TOWN WATER SUPPLY
DOM-PINE	60-PT	PINE CREEK RANCH-DOMESTIC
DOM-ANDR	60-PT	ANDERSON RANCH-DOMESTIC
DOM-MNTR	60-PT	MONITOR RANCH-DOMESTIC
TUN-PONY	60-PT	PONY CANYON TUNNEL
FAD-SHAFT	60-PT	

TABLE A. (CONTD.)

TWS-EURK	60-PT	EUREKA-TOWN WATER SUPPLY
WEL-2		
WEL-3		
SPG-SIXM		SIX MILE CANYON SPRING
SPG-HOTC		HOT CREEK RANCH SPRING
SPG-SQWA		SQUAW WELLS SPRING
SPG-MQTO		MOSQUITO CREEK RANCH SPRING
SPG-OLCS		OLD LOG CABIN SPRING
UC-1-P-2SR	AECW	FAULTLESS REENTRY
UCE-3 Z-1	AECW	EXPLORATORY WELL
UCE-3 Z-2	AECW	EXPLORATORY WELL
UCE-3 Z-3	AECW	EXPLORATORY WELL
UCE-3 Z-4	AECW	EXPLORATORY WELL
UCE-3 Z-5	AECW	EXPLORATORY WELL
UCE-10	AECW	EXPLORATORY WELL
UCE-11	AECW	EXPLORATORY WELL
UCE-16 Z-1	AECW	EXPLORATORY WELL
UCE-16 Z-4	AECW	EXPLORATORY WELL
UCE-17 Z-1	AECW	EXPLORATORY WELL
UCE-17 Z-3	AECW	EXPLORATORY WELL
UCE-17 Z-5	AECW	EXPLORATORY WELL
UCE-17 Z-10	AECW	EXPLORATORY WELL
UCE-17 Z-14	AECW	EXPLORATORY WELL
UCE-18	AECW	EXPLORATORY WELL
UCE-18 Z-3	AECW	EXPLORATORY WELL
UCE-18 Z-4	AECW	EXPLORATORY WELL
UCE-18 Z-5	AECW	EXPLORATORY WELL
UCE-18 Z-6	AECW	EXPLORATORY WELL
UCE-18 Z-7	AECW	EXPLORATORY WELL
UCE-18 Z-8	AECW	EXPLORATORY WELL
UCE-18 Z-9	AECW	EXPLORATORY WELL
UCE-18 Z-11	AECW	EXPLORATORY WELL

TABLE A. (CONTD.)

UCE-18 Z-12	AECW	EXPLORATORY WELL
UCE-20 Z-7	AECW	EXPLORATORY WELL
HTH-1 Z-2	AECW	HYDRO TEST WELL
HTH-1 Z-3	AECW	HYDRO TEST WELL
HTH-1 Z-4	AECW	HYDRO TEST WELL
HTH-1 Z-9	AECW	HYDRO TEST WELL
HTH-1 Z-10	AECW	HYDRO TEST WELL
HTH-2	AECW	HYDRO TEST WELL
HTH-3	AECW	HYDRO TEST WELL
HTH-4 Z-1	AECW	HYDRO TEST WELL
HTH-4 Z-4	AECW	HYDRO TEST WELL
HTH-5	AECW	HYDRO TEST WELL
HTH-21	AECW	HYDRO TEST WELL
HTH-21-1	AECW	HYDRO TEST WELL
HTH-23	AECW	HYDRO TEST WELL

APPENDIX B

Listed in Table B are all sampling locations in the CNTA from which water was collected and analyzed during the period March 1967 through December 1970. Table B-1 consists of the eight sampling points in Hot Creek Valley which were monitored most frequently. Table B-2 lists the sampling points referred to as the 30-point network. The 30-point network consists of the eight points listed in Table B-1 and the points listed in Table B-2. Table B-3 lists the initial 60-point surveillance network and includes points given in Tables B-1 and B-2.

Wells drilled for exploration, hydrologic testing, and reentry are given in Table B-4.

Sample point locations for the 8-point, 30-point, and 60-point network are given by township/range designation. Exploratory, test, and reentry wells are referenced according to the Nevada State Grid System.

Abbreviations used in sample designation are explained in Appendix A. Collector/remarks abbreviations are: TI for Teledyne Isotopes, DRI for Desert Research Institute, USGS for U. S. Geological Survey, FIL for filtered sample, POND for sample taken from well water collection basin or pond, and in the case of UC-1-P-2SR, numbers followed by M indicate depth in meters below land surface at which sample was obtained. Wells designated by Z-number refer to zones from which samples were obtained.

TABLE B. COLLECTION INFORMATION FOR CNTA WATER SAMPLES

B-1. EIGHT-POINT NETWORK

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
WEL-BCMP	05N/51-07BC	8/18/67	17.0	-	230	TI /FIL
		9/29/67	18.0	-	332	TI
		11/29/67	17.0	-	363	TI
		3/27/68	17.0	-	437	TI
		4/29/68	24.0	6.0	467	TI
		6/27/68	23.0	5.5	511	TI
		8/ 1/68	24.0	7.6	532	TI
		10/17/68	14.0	7.8	597	TI
		1/15/69	16.0	6.4	610	TI
		3/18/69	18.0	7.6	641	TI
		4/29/69	19.0	6.8	680	TI
		6/24/69	18.0	7.5	688	TI
		8/12/69	19.0	6.0	694	TI
		10/21/69	17.0	7.7	784	TI
		12/ 4/69	11.5	8.6	1180	TI
		2/17/70	7.8	6.0	1561	TI
		4/28/70	8.9	7.1	1693	TI
		6/16/70	18.0	6.2	1702	TI
		9/15/70	26.0	-	1931	TI
		12/ 3/70	10.0	-	2156	TI
WEL-FLNI	05N/51-19BA	4/11/67	-	-	32	TI
		5/11/67	-	-	73	USGS/FIL
		6/21/67	-	-	126	TI /FIL
		8/16/67	13.5	-	222	TI /FIL
		10/ 1/67	12.5	-	331	TI
		11/28/67	12.0	-	364	TI
		4/29/68	14.0	6.0	468	TI
		6/27/68	14.0	5.5	512	TI
		1/15/69	12.0	6.0	609	TI
		3/18/69	13.0	7.3	640	TI
		4/29/69	14.5	6.4	679	TI
		6/24/69	13.0	7.3	687	TI
		10/21/69	13.0	7.5	783	TI
		2/17/70	10.0	6.3	1562	TI
		4/28/70	8.9	6.2	1694	TI
		6/16/70	10.0	5.3	1703	TI
WEL-KEYS	06N/50-11BC	11/29/67	16.0	-	365	TI
		3/27/68	17.5	-	440	TI
		5/ 1/68	17.0	5.8	470	TI
		6/27/68	18.0	5.3	514	TI
		8/ 1/68	17.3	7.6	533	TI
		10/17/68	17.0	7.3	598	TI
		4/29/69	16.0	6.0	682	TI
		12/ 4/69	15.0	7.9	1181	TI

TABLE B-1. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
WEL-TYBO	06N/50-35A	4/ 9/67	-	-	56	TI
		5/11/67	-	-	74	DRI /FIL
		6/26/67	-	-	127	TI /FIL
		6/27/68	18.0	5.3	513	TI
		3/18/69	17.0	-	642	TI
		6/24/69	18.0	7.2	689	TI
		10/21/69	16.5	7.9	785	TI
		2/17/70	13.3	5.3	1563	TI
		4/28/70	13.3	5.2	1695	TI
		6/16/70	15.5	5.5	1704	TI
		9/15/70	17.5	-	1932	TI
WEL-BJMS	06N/51-22BC	4/11/67	-	-	52	TI
		5/11/67	-	-	75	DRI /FIL
		6/21/67	-	-	128	TI /FIL
		8/16/67	20.0	-	223	TI /FIL
		10/ 1/67	17.5	-	333	TI
		11/28/67	15.0	-	366	TI
		3/26/68	15.0	-	441	TI
		4/30/68	16.0	5.0	471	TI
		6/26/68	18.0	5.5	515	TI
		7/31/68	21.0	7.5	534	TI
		10/17/68	16.0	7.8	599	TI
		1/15/69	13.0	6.8	612	TI
		3/18/69	15.0	8.0	643	TI
		4/29/69	16.0	6.8	683	TI
		6/24/69	18.5	7.6	690	TI
		8/12/69	18.0	6.3	695	TI
		10/21/69	16.5	7.6	786	TI
		12/ 4/69	16.0	8.1	1182	TI
		2/17/70	15.6	6.0	1564	TI
		4/28/70	12.8	7.1	1696	TI
		6/16/70	18.0	6.2	1705	TI
		9/15/70	17.5	-	1933	TI
		12/ 3/70	15.5	-	2157	TI
SPG-BLUJ	07N/50-24DB	8/ 2/67	-	-	251	USGS/FIL
		11/29/67	11.0	-	368	TI
		3/27/68	12.0	-	443	TI
		4/ 8/68	5.0	-	480	DRI
		5/ 1/68	15.0	6.0	473	TI
		6/27/68	19.5	5.3	517	TI
		8/ 1/68	14.0	7.2	536	TI
		10/17/68	14.0	7.0	600	TI
		1/15/69	10.0	6.6	613	TI
		3/18/69	12.0	7.4	644	TI

TABLE B-1. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
SPG-BLUJ	07N/50-24DB	6/24/69	13.0	7.2	691	TI
		8/12/69	14.0	7.3	698	TI
		12/ 4/69	12.0	6.8	1183	TI
		6/16/70	14.0	6.0	1706	TI
		9/15/70	18.5	-	1934	TI
		12/ 3/70	9.5	-	2158	TI
SPG-RSNK	07N/52-19D	5/11/67	-	-	107	USGS/FIL
		7/30/68	28.0	7.5	537	TI
		10/17/68	17.5	7.3	601	TI
		1/15/69	5.0	5.0	614	TI
		3/18/69	3.0	7.5	645	TI
		4/29/69	14.5	5.5	686	TI
		4/29/69	13.5	6.0	684	TI
		6/24/69	19.5	6.8	692	TI
		8/12/69	26.0	6.2	696	TI
		10/21/69	15.5	7.6	787	TI
		2/17/70	7.6	6.0	1565	TI
		4/28/70	8.9	6.8	1697	TI
		6/16/70	17.0	5.5	1707	TI
		9/15/70	23.0	-	1935	TI
		12/ 3/70	-	-	2161	TI
WEL-SIXM	08N/51-34CD	4/ 9/67	-	-	39	TI
		5/11/67	-	-	81	USGS/FIL
		6/26/67	-	-	131	TI /FIL
		10/ 2/67	15.5	-	336	TI
		11/29/67	13.5	-	371	TI
		3/27/68	-	-	446	TI
		5/ 1/68	16.0	5.3	476	TI
		5/ 1/68	15.0	5.3	475	TI
		6/27/68	15.0	5.3	520	TI
		1/15/69	15.0	5.3	615	TI
		3/18/69	17.0	7.9	646	TI
		4/29/69	16.0	6.0	685	TI
		6/24/69	16.0	7.2	693	TI
		8/12/69	16.0	5.8	697	TI
		2/17/70	12.2	5.7	1566	TI
		6/16/70	14.0	5.2	1708	TI
		9/15/70	15.5	-	1936	TI

TABLE B. (CONTD.)

B-2. THIRTY-POINT NETWORK

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
WEL-FRED	01N/53-07AD	11/29/67	14.0	-	353	TI
		4/30/68	17.0	9.3	456	TI
WEL-DBLO	01N/53-32CAA	8/ 3/67	-	-	264	USGS/FIL
		11/29/67	-	-	354	TI
		3/28/68	10.5	-	430	TI
		4/30/68	20.5	5.4	457	TI
		6/26/68	25.5	5.2	500	TI
		7/30/68	22.0	7.7	524	TI
WEL-APRT	02N/43-01BC	3/30/67	28.0	-	21	TI
		5/ 8/67	-	-	68	USGS/FIL
		6/24/67	-	-	120	TI /FIL
		9/27/67	28.0	-	326	TI
		11/30/67	25.0	-	376	TI
		3/28/68	29.0	-	431	TI
		4/29/68	29.0	5.5	458	TI
		6/27/68	28.5	6.0	501	TI
WEL-CHAS	03N/51-19BA	8/ 2/67	-	-	265	USGS/FIL
		11/29/67	16.5	-	355	TI
		3/28/68	17.0	-	432	TI
		4/30/68	16.0	5.2	459	TI
		6/26/68	17.0	4.8	502	TI
		7/31/68	16.8	7.3	525	TI
WEL-ED/S	03N/53-35B	11/29/67	22.0	-	356	TI
		4/30/68	23.0	5.7	460	TI
		6/26/68	22.0	5.5	503	TI
		7/30/68	22.0	6.8	526	TI
WEL-TN11	04N/44-08ABB	5/ 8/67	-	-	69	USGS/FIL
		6/19/67	-	-	121	TI /FIL
		9/27/67	12.5	-	327	TI
		11/30/67	12.0	-	357	TI
		3/28/68	13.0	-	433	TI
		4/29/68	-	5.0	461	TI
		6/25/68	12.5	5.2	504	TI
WEL-TS60	04N/51-13DA	4/11/67	-	-	38	TI
		6/21/67	-	-	124	TI /FIL
		8/ 2/67	-	-	233	USGS/FIL
		8/16/67	15.6	-	221	TI /FIL
		9/29/67	19.0	-	329	TI
		11/29/67	9.0	-	360	TI
WEL-MC/C	04N/51-13DA	5/ 2/68	17.0	5.7	465	TI

TABLE B-2. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
WEL-MC/C	04N/51-13DA	6/27/68	17.5	5.5	509	TI
		7/30/68	18.0	6.9	531	TI
WEL-JOES	04N/51-29	11/29/67	19.0	-	362	TI
		4/30/68	18.5	5.0	466	TI
		6/27/68	19.5	5.5	510	TI
WEL-4	05N/54-35	3/26/68	-	-	439	TI
		4/30/68	20.5	5.5	469	TI
WEL-WELL	08N/56-02DA	8/ 7/67	-	-	257	DRI /FIL
		11/28/67	20.0	-	373	TI
		3/28/68	21.0	-	448	TI
		4/30/68	20.5	5.8	478	TI
		6/26/68	20.0	5.5	522	TI
		7/29/68	22.0	7.8	541	TI
SPG-WARM	04N/50-20CB	4/11/67	-	-	30	TI
		5/11/67	-	-	71	USGS/FIL
		6/21/67	-	-	122	TI /FIL
		8/ 3/67	-	-	232	USGS/FIL
		9/29/67	59.0	-	328	TI
		11/29/67	60.0	-	358	TI
		3/28/68	60.0	-	434	TI
		4/29/68	60.0	6.8	462	TI
		6/27/68	60.5	7.0	505	TI
		8/ 1/68	60.0	6.3	527	TI
SPG-GOAT	04N/50-20CCC	8/ 3/67	-	-	249	USGS
		6/27/68	-	7.0	506	TI
		8/ 1/68	42.0	7.0	528	TI
SPG-CAIN	04N/51-12BA	8/ 2/67	-	-	231	USGS/FIL
		11/29/67	16.5	-	359	TI
		3/27/68	15.0	-	435	TI
		5/ 2/68	17.0	6.0	463	TI
		6/27/68	18.5	7.0	507	TI
		7/30/68	16.0	6.8	529	TI
SPG-TWIN	04N/51-13DA	4/11/67	-	-	42	TI
		5/11/67	-	-	72	DRI /FIL
		8/ 2/67	-	-	241	USGS
		8/16/67	16.5	-	220	TI /FIL
		11/29/67	16.0	-	361	TI
		3/27/68	16.0	-	436	TI
		5/ 2/68	16.5	5.5	464	TI

TABLE B-2. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
SPG-TWIN	04N/51-13DA	6/27/68	-	7.0	508	TI
		7/30/68	18.8	6.8	530	TI
SPG-ABEL	06N/54-24CA	11/28/67	44.5	-	367	TI
		3/26/68	45.0	-	442	TI
		4/30/68	45.0	6.5	472	TI
		6/26/68	45.0	5.7	516	TI
		7/30/68	46.0	6.5	535	TI
SPG-DUGN	08N/49-25	4/ 9/67	-	-	58	TI
		5/11/67	-	-	79	DRI /FIL
		6/20/67	-	-	129	TI /FIL
		7/31/67	-	-	246	USGS
		9/29/67	36.0	-	334	TI
		11/30/67	36.0	-	369	TI
		3/27/68	37.0	-	444	TI
		6/27/68	38.0	5.7	518	TI
		8/ 1/68	39.0	6.9	538	TI
		9/15/70	37.0	-	1938	TI
SPG-UHCR	08N/50-29DA	4/ 9/67	-	-	37	TI
		5/11/67	-	-	80	DRI /FIL
		6/20/67	-	-	130	TI /FIL
		7/31/67	-	-	242	USGS
		9/26/67	65.0	-	335	TI
		11/30/67	76.0	-	370	TI
		3/27/68	-	-	445	TI
		5/ 1/68	66.0	7.0	474	TI
		6/27/68	72.0	7.0	519	TI
		8/ 1/68	68.0	7.3	539	TI
		9/15/70	76.1	-	1937	TI
SPG-LCKS	08N/55-15AC	4/ 8/67	-	-	53	TI
		6/27/67	-	-	132	TI /FIL
		8/ 7/67	-	-	245	USGS
		9/27/67	-	-	337	DRI
		11/28/67	37.0	-	372	TI
		3/26/68	38.0	-	447	TI
		4/30/68	38.0	6.3	477	TI
		6/26/68	39.0	6.1	521	TI
		7/30/68	38.0	6.8	540	TI
SPG-MORS	10N/51-36BA	4/11/67	-	-	51	TI
		5/11/67	-	-	85	DRI /FIL
		6/20/67	-	-	135	TI /FIL
		10/ 1/67	14.0	-	339	TI

TABLE B-2. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
SPG-MORS	10N/51-36BA	11/29/67	13.0	-	374	TI
SPG-DUCK	13N/56-32BD	4/ 8/67	-	-	34	TI
		6/21/67	-	-	138	TI /FIL
		8/ 7/67	-	-	244	DRI
		9/27/67	-	-	341	DRI
		11/28/67	33.0	-	375	TI
		3/26/68	33.0	-	449	TI
		4/30/68	32.0	5.7	479	TI
		6/26/68	33.5	5.5	523	TI

TABLE B. (CONTD.)

B-3. SIXTY-POINT NETWORK

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
WEL-TN09	04N/44-08B	3/28/67	12.0	-	26	TI
WEL-TS14	04N/51-13DA	4/11/67	-	-	36	TI
		6/21/67	-	-	125	TI /FIL
		8/ 2/67	-	-	238	USGS/FIL
		9/29/67	18.0	-	330	TI /POND
WEL-TRUD	07N/45-05AA	5/ 7/67	-	-	77	DRI /FIL
		5/ 7/67	-	-	76	DRI /FIL
WEL-RMT1	10N/44-21B	3/29/67	7.0	-	41	TI
WEL-MVW1	10N/46-12A	4/ 4/67	-	-	62	TI
WEL-LFLR	10N/49-10DA	4/ 6/67	-	-	46	TI
		5/11/67	-	-	83	USGS/FIL
		6/22/67	-	-	133	TI /FIL
WEL-CRVR	11N/43-29	3/28/67	-	-	60	TI
		5/ 7/67	-	-	87	USGS/FIL
WEL-ROIR	12N/43-09B	3/29/67	82.0	-	48	TI
		5/17/67	-	-	91	USGS/FIL
WEL-MQTO	12N/47-30D	4/ 4/67	-	-	55	TI
WEL-TJRK	13N/43-19AB	3/29/67	15.0	-	27	TI
		5/ 7/67	-	-	92	USGS/FIL
WEL-MVW3	13N/47-30CD	4/ 3/67	-	-	40	TI
		5/ 9/67	-	-	93	USGS/FIL
WEL-J--S	14N/43-28AC	3/30/67	19.0	-	44	TI
		5/ 8/67	-	-	94	USGS/FIL
WEL-BSV1	15N/44-01A	3/30/67	14.0	-	29	TI
		5/ 8/67	-	-	97	USGS/FIL
WEL-MVW5	16N/47-04DD	4/ 1/67	-	-	22	TI
WEL-FISH	16N/54-17CC	5/10/67	-	-	100	USGS/FIL
WEL-MVW6	18N/47-22ADB	4/ 1/67	-	-	23	TI
		5/ 9/67	-	-	102	USGS/FIL
WEL-KCHN	18N/51-30BC	4/ 7/67	-	-	59	TI

TABLE B-3. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
WEL-KCHN	18N/51-30BC	6/23/67	-	-	144	TI /FIL
		8/ 5/67	-	-	236	USGS/FIL
		9/28/67	28.0	-	347	TI
WEL-BART	19N/50-16BC	4/11/67	-	-	43	TI
		5/ 9/67	-	-	104	USGS/FIL
		6/23/67	-	-	145	TI /FIL
		9/28/67	17.5	-	348	TI
WEL-SIMP	20N/53-23CA	5/ 9/67	-	-	106	USGS/FIL
SPG-STON	04N/48-08BC	5/10/67	-	-	70	USGS/FIL
		7/27/67	-	-	243	USGS
		9/26/67	15.0	-	350	TI
SPG-BLMT	09N/45-26AD	4/ 5/67	-	-	54	TI
		5/ 7/67	-	-	82	DRI /FIL
SPG-LFLV	10N/49-14DD	5/10/67	-	-	84	DRI /FIL
		6/22/67	-	-	134	TI /FIL
		8/ 3/67	-	-	235	USGS/FIL
		9/28/67	40.0	-	338	DRI
SPG-DARO	11N/43-07D	3/28/67	86.0	-	33	TI
		5/ 7/67	-	-	86	USGS/FIL
		6/23/67	-	-	136	TI /FIL
		8/15/67	94.0	-	225	TI /FIL
		9/25/67	95.0	-	340	TI
SPG-CLCK	11N/48-01A	4/ 6/67	-	-	31	TI
		5/10/67	-	-	90	USGS/FIL
SPG-POTS	14N/47-02ADD	5/ 9/67	-	-	96	USGS/FIL
		5/ 9/67	-	-	95	USGS/FIL
		6/22/67	-	-	139	TI /FIL
		8/15/67	45.0	-	227	TI /FIL
		9/25/67	-	-	342	TI
SPG-BOWL	14N/47-22DCC	6/22/67	-	-	140	TI /FIL
		8/15/67	51.0	-	228	TI /FIL
		9/25/67	48.0	-	343	TI
SPG-INDN	14N/51-11BB	6/26/67	-	-	137	TI /FIL
		8/16/67	14.0	-	226	TI /FIL
SPG-FISH	16N/53-08B	4/10/67	-	-	28	TI

TABLE B-3. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
SPG-FISH	16N/53-08B	5/10/67	-	-	99	USGS/FIL
		6/23/67	-	-	141	TI /FIL
		9/28/67	16.0	-	344	TI
SPG-SPNC	17N/45-23AA	3/30/67	74.0	-	24	TI
		5/ 8/67	-	-	101	USGS/FIL
		6/23/67	-	-	142	TI /FIL
		8/15/67	70.0	-	229	TI /FIL
		9/25/67	69.0	-	345	TI
SPG-SLVN	17N/50-31BA	4/ 7/67	-	-	50	TI
SPG-KLOB	18N/50-28DB	4/ 7/67	-	-	63	TI
		6/23/67	-	-	143	TI /FIL
		8/ 5/67	-	-	237	USGS/FIL
		9/28/67	67.0	-	346	TI
TWS-MANH	08N/44-20AC	3/28/67	13.0	-	35	TI
		5/ 7/67	-	-	78	USGS/FIL
DOM-PINE	11N/46-16CD	4/ 4/67	-	-	47	TI
		5/ 7/67	-	-	88	USGS/FIL
DOM-ANDR	12N/44-25D	3/29/67	-	-	61	TI
DOM-MNTR	15N/47-08AD	4/ 1/67	-	-	57	TI
TUN-PONY	19N/44-29AB	3/30/67	8.0	-	45	TI
		5/ 8/67	-	-	103	USGS/FIL
FAD-SHAFT	19N/53-22AD	9/28/67	15.0	-	349	TI
TWS-EURK	20N/53-	4/10/67	-	-	49	TI
		5/ 9/67	-	-	105	USGS/FIL
		8/ 5/67	-	-	240	USGS

TABLE B-3. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION TOWNSHIP/RANGE	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
WEL-2	21N/53-35CC	8/ 5/67	-	-	250	TI
WEL-3	21N/53-36CD	8/ 5/67	-	-	247	TI
SPG-SIXM	08N/50-11C	5/18/67	-	-	255	USGS/FIL
		8/ 1/67	-	-	234	USGS/FIL
SPG-SQWA	10N/52-23AA	8/ 8/67	-	-	253	USGS
SPG-MQTO	11N/47-06AD	5/ 7/67	-	-	89	USGS
SPG-OLCS	15N/48-26ACC	5/ 9/67	-	-	98	USGS/FIL

TABLE B (CONTD.)

TABLE B-4. AEC WELLS IN THE CNTA

SAMPLE DESIGNATION	SAMPLE LOCATION FT-N	FT-E	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
UC-1-P-2SR	1414632	628982	4/ 9/68	-	-	450	TI /655.M
			7/31/68	-	-	553	TI /670.M
			1/15/69	-	-	647	TI /673.M
			5/13/69	-	-	648	TI /676.M
			9/24/69	-	-	742	TI /680.6M
			12/ 2/70	59.8	-	2054	TI /786.2M
			12/ 2/70	45.0	-	2053	TI /771.2M
			12/ 2/70	39.6	-	2052	TI /756.2M
			12/ 2/70	38.5	-	2051	TI /741.2M
			12/ 2/70	38.0	-	2050	TI /726.2M
			12/ 2/70	36.5	-	2049	TI /711.2M
			12/ 2/70	35.5	-	2048	TI /702.2M
			3/30/71	38.0	-	2165	TI /741.1M
			3/30/71	38.0	-	2164	TI /726.1M
			3/30/71	36.5	-	2163	TI /711.1M
			3/30/71	36.0	-	2162	TI /702.2M
			3/31/71	-	-	2169	TI /791.M
			3/31/71	-	-	2168	TI /786.M
			3/31/71	-	-	2167	TI /771.M
			3/31/71	-	-	2166	TI /756.M
UCE-3 Z-1	1535900	508900	2/11/67	-	-	321	DRI /FIL
UCE-3 Z-2	1535900	508900	2/14/67	-	-	322	USGS/FIL
UCE-3 Z-3	1535900	508900	2/15/67	-	-	323	USGS/FIL
UCE-3 Z-4	1535900	508900	2/17/67	-	-	324	USGS/FIL
UCE-3 Z-5	1535900	508900	2/18/67	-	-	64	USGS/FIL
UCE-10	1433560	558295	8/ 3/67	-	-	317	DRI /FIL
UCE-11	1401351	626475	4/22/67	-	-	67	DRI /FIL
			5/10/67	-	-	108	USGS
UCE-16 Z-1	1499400	487000	3/26/67	-	-	65	USGS/FIL
UCE-16 Z-4	1499400	487000	3/29/67	-	-	66	DRI /FIL
UCE-17 Z-1	1430622	628172	6/25/67	-	-	192	USGS
UCE-17 Z-3	1430622	628172	6/17/67	-	-	193	USGS
UCE-17 Z-5	1430622	628172	6/26/67	-	-	194	USGS
UCE-17 Z-10	1430622	628172	6/23/67	-	-	195	USGS

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TABLE B-4. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION FT-N	FT-E	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
UCE-17 Z-14	1430622	628172	6/27/67	-	-	196	DRI
UCE-18	1396833	635840	10/20/68	49.0	-	602	TI
UCE-18 Z-3	1396833	635840	6/ 1/67	-	-	197	TI
UCE-18 Z-4	1396833	635840	6/ 2/67	-	-	198	DRI
UCE-18 Z-5	1396833	635840	6/ 3/67	-	-	199	DRI
UCE-18 Z-6	1396833	635840	6/ 4/67	-	-	200	TI
UCE-18 Z-7	1396833	635840	6/ 5/67	-	-	201	DRI
UCE-18 Z-8	1396833	635840	6/ 6/67	-	-	202	DRI
UCE-18 Z-9	1396833	635840	6/ 6/67	-	-	203	DRI
UCE-18 Z-11	1396833	635840	6/ 7/67	-	-	204	DRI
UCE-18 Z-12	1396833	635840	6/12/67	-	-	205	DRI
UCE-20 Z-7	1399868	628093	1/ 6/68	-	-	390	DRI
HTH-1 Z-2	1411443	629720	7/31/67	-	-	312	DRI /FIL
HTH-1 Z-3	1411443	629720	8/ 1/67	-	-	313	USGS/FIL
HTH-1 Z-4	1411443	629720	8/ 2/67	-	-	314	USGS/FIL
HTH-1 Z-9	1411443	629720	8/ 5/67	-	-	315	USGS/FIL
HTH-1 Z-10	1411443	629720	8/ 5/67	-	-	316	TI /FIL
HTH-3	1385944	657119	8/28/68	30.0	-	554	TI
			10/28/68	-	-	603	USGS
			10/30/68	-	-	604	DRI
HTH-4 Z-1	1385981	685981	1/20/69	-	-	616	USGS
HTH-4 Z-4	1385981	685981	1/31/69	-	-	618	USGS
HTH-21-1	1397250	668506	8/22/68	-	-	556	USGS
			8/27/68	37.0	-	555	DRI
			9/ 8/68	-	-	557	DRI
HTH-23	1368087	684237	10/ 3/68	-	-	558	DRI

TABLE B-4. (CONTD.)

SAMPLE DESIGNATION	SAMPLE LOCATION FT-N	FT-E	DATE COLLECTED	TEMP DEG-C	PH	LAB NO	COLLECTOR/ REMARKS
HTH-23	1368087	684237	11/22/68	-	-	607	DRI
			12/18/68	-	-	608	USGS

APPENDIX C

Gross beta/gamma and gross alpha activity on suspended and dissolved solids are listed in Table C.

The beta/gamma activity values for dissolved solids are corrected for radioactivity contribution from K^{40}.

An asterisk (*) appearing before a number signifies "less than", SD is the abbreviation for "standard deviation", and ND means the sample was not analyzed.

TABLE C. RESULTS OF GROSS RADIOASSAYS

C-1. EIGHT-POINT NETWORK

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
WEL-BCMP	8/18/67	230	0.72	0.52	*	0.3	2.4	0.6	4.8	3.3	4.4
	9/29/67	332	1.2	0.6	*	0.4	5.0	2.2	5.0	3.9	3.9
	11/29/67	363	0.7	0.6	*	0.4	1.9	0.6	2.6	0.8	3.8
	3/27/68	437	*	1.0	*	0.5	2.2	0.8	4.1	0.8	4.2
	4/29/68	467	*	1.0	*	0.5	0.8	1.0	22	4	4.5
	6/27/68	511	*	1.0	*	0.5	2.6	0.5	7.3	1.3	4.5
	8/ 1/68	532	*	1.0	*	0.5	1.9	1.1	4.1	0.9	4.1
	10/17/68	597	*	1.0	*	0.5	3.1	1.2	4.0	2.1	4.2
	1/15/69	610	*	1.0	*	0.5	7.4	1.3	4.4	1.6	4.0
	3/18/69	641	*	1.0	*	0.5	2.7	1.1	4.4	1.0	4.0
	4/29/69	680	2.5	0.3	*	0.5	3.9	1.1	3.9	2.0	3.6
	6/24/69	688	*	1.0	*	0.5	2.9	1.1	5.2	2.3	3.5
	8/12/69	694	2.5	0.6	*	0.5	1.4	1.0	4.6	2.0	3.9
	10/21/69	784	*	1.0	*	0.5	1.8	1.1	4.6	2.2	3.8
	12/ 4/69	1180	*	1.0	*	0.5	3.5	1.2	5.6	2.7	4.6
	2/17/70	1561	*	1.0	*	0.5	2.4	1.1	6.4	2.6	4.4
	4/28/70	1693	*	1.0	*	0.5	1.9	1.1	4.1	2.3	4.5
	6/16/70	1702	1.4	0.7	*	0.5	3.2	1.2	3.5	2.0	4.5
	9/15/70	1931	ND		ND		3.2	1.1	5.3	2.7	4.0
WEL-FLNI	4/11/67	32	*	1.0	*	0.4	4.6	3.1	6.6	5.2	5.40
	5/11/67	73	0.85	0.48	*	0.2	3.7	2.7	6.4	3.7	6.1
	6/21/67	126	3.1	1.3	*	1.1	4.0	1.9	9.8	3.6	5.0
	8/16/67	222	0.63	0.52	*	0.3	2.3	0.7	12.3	6.5	5.1
	10/ 1/67	331	1.6	0.6	1.3	0.6	5.1	2.5	4.1	4.1	4.7
	11/28/67	364	1.9	0.7	0.3	0.4	3.4	0.7	4.1	1.0	4.9
	4/29/68	468	*	1.0	*	0.5	7.6	1.4	11	4	5.4
	6/27/68	512	*	1.0	*	0.5	5.2	0.5	9.3	1.4	5.7
	1/15/69	609	*	1.0	*	0.5	9.9	1.5	9.9	3.1	5.0
	3/18/69	640	*	1.0	*	0.5	8.6	1.5	14.7	4.7	4.9
	4/29/69	679	3.7	0.3	*	0.5	5.3	1.3	16	5	4.4
	6/24/69	687	*	1.0	*	0.5	4.5	1.3	8.0	4.0	4.3
	10/21/69	783	*	1.0	*	0.5	3.2	1.3	6.1	3.7	4.5
	2/17/70	1562	*	1.0	*	0.5	5.5	1.4	11	5	4.8

TABLE C-1. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	SUSPENDED SOLIDS GROSS RADIOACTIVITY ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY ALPHA PCI/L	SD	POTASSIUM MG/L
WEL-FLNI	4/28/70	1694	1.6	0.7	*	0.5	4.7	1.4	7.4	4.1	5.1
	6/16/70	1703	3.0	0.7	*	0.5	2.5	1.3	21	6	5.1
WEL-KEYS	11/29/67	365	0.8	0.6	*	0.4	1.5	1.3	3.5	2.4	2.1
	3/27/68	440	*	1.0	*	0.5	1.4	1.0	3.6	0.9	2.1
	5/ 1/68	470	*	1.0	*	0.5	1.6	1.1	2.6	1.8	2.8
	6/27/68	514	*	1.0	*	0.5	1.4	0.9	1.3	1.3	2.2
	8/ 1/68	533	*	1.0	*	0.5	1.1	1.0	2.4	0.8	2.2
	10/17/68	598	*	1.0	*	0.5	1.5	1.0	2.9	1.4	2.0
	4/29/69	682	*	1.0	*	0.5	2.1	0.9	1.6	1.5	1.8
	12/ 4/69	1181	*	1.0	0.7	0.2	1.2	1.0	3.1	1.9	2.0
WEL-TYBO	4/ 9/67	56	*	1.0	*	0.4	*	2.3	6.0	4.1	2.19
	5/11/67	74	0.96	0.47	*	0.2	3.3	2.1	*	1.5	2.4
	6/26/67	127	2.9	1.0	*	1.0	*	1.3	2.2	1.6	2.1
	6/27/68	513	*	1.0	*	0.5	0.9	0.4	1.6	0.7	2.4
	3/18/69	642	*	1.0	*	0.5	2.8	1.0	1.6	1.6	2.1
	6/24/69	689	*	1.0	*	0.5	1.2	0.9	3.2	1.5	1.9
	10/21/69	785	*	1.0	*	0.5	0.8	1.0	2.1	1.7	2.0
	2/17/70	1563	*	1.0	*	0.5	0.8	0.9	*	1.0	2.1
	4/28/70	1695	*	1.0	*	0.5	2.0	1.0	2.7	2.0	2.4
	6/16/70	1704	*	1.0	*	0.5	1.4	0.9	2.5	1.6	2.3
	9/15/70	1932	ND		ND		1.5	1.0	2.3	1.9	2.0
WEL-BJMS	4/11/67	52	*	1.0	*	0.4	1.8	2.9	*	1.9	4.63
	5/11/67	75	0.81	0.44	*	0.2	1.0	2.6	3.2	3.9	5.4
	6/21/67	128	2.2	1.0	*	1.1	2.5	1.6	3.8	2.2	4.5
	8/16/67	223	0.51	0.55	*	0.3	3.0	1.1	13.2	8.1	4.5
	10/ 1/67	333	1.2	0.6	*	0.3	2.9	2.2	*	3.0	4.4
	11/28/67	366	0.9	0.6	*	0.3	3.7	1.7	2.3	2.0	4.3
	3/26/68	441	*	1.0	*	0.5	1.8	1.4	3.6	2.9	5.0
	4/30/68	471	*	1.0	*	0.5	0.2	0.6	3.0	1.0	5.2
	6/26/68	515	*	1.0	*	0.5	3.0	1.1	3.4	2.1	5.0
	7/31/68	534	*	1.0	*	0.5	2.4	1.2	1.5	1.5	4.7

TABLE C-1. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
WEL-RJMS	10/17/68	599	*	1.0	*	0.5	2.0	1.1	2.2	1.4	4.7
	1/15/69	612	*	1.0	*	0.5	3.5	1.2	4.2	2.4	4.4
	3/18/69	643	*	1.0	*	0.5	4.1	1.2	3.5	2.0	4.4
	4/29/69	683	*	1.0	*	0.5	2.7	1.1	4.2	2.1	4.1
	6/24/69	690	*	1.0	*	0.5	3.7	1.1	4.0	1.7	4.0
	8/12/69	695	1.3	0.5	*	0.5	3.8	1.1	2.1	1.8	4.3
	10/21/69	786	*	1.0	*	0.5	1.53	1.1	3.7	2.1	4.3
	12/ 4/69	1182	2.1	0.4	*	0.5	2.9	1.2	8.7	3.2	4.3
	2/17/70	1564	*	1.0	*	0.5	2.1	1.2	5.3	2.4	4.4
	4/28/70	1696	2.7	0.7	*	0.5	2.0	1.1	3.4	2.2	4.7
	6/16/70	1705	1.1	0.6	*	0.5	1.3	1.1	4.8	2.3	4.8
	9/15/70	1933	ND		ND		2.4	1.1	2.8	2.1	4.6
SPG-BLUJ	8/ 2/67	251	0.62	0.56	0.3	0.32	1.1	0.9	5.1	5.0	8.3
	11/29/67	368	2.2	0.7	1.1	0.6	4.3	1.9	3.5	2.7	7.5
	3/27/68	443	*	1.0	*	0.5	3.7	1.8	3.7	3.0	8.0
	4/ 8/68	480	*	1.0	*	0.5	0.0	1.5	8.3	4.8	8.6
	5/ 1/68	473	1.5	0.1	0.6	0.1	5.3	1.7	9.7	5.1	8.4
	6/27/68	517	1.2	0.1	*	0.5	3.9	1.5	6.1	4.4	8.9
	8/ 1/68	536	*	1.0	*	0.5	3.7	1.7	7.6	1.7	8.0
	10/17/68	600	*	1.0	*	0.5	4.0	1.7	4.0	3.8	8.1
	1/15/69	613	2.1	0.3	*	0.5	13.7	2.0	19.6	7.8	8.4
	3/18/69	644	5.6	0.5	0.6	0.2	4.6	1.6	16.2	7.2	8.0
	6/24/69	691	1.8	0.8	*	0.5	4.3	1.5	9.0	3.0	6.8
	8/12/69	698	2.4	0.6	*	0.5	3.5	1.3	8.5	4.8	7.5
	12/ 4/69	1183	*	1.0	*	0.5	5.7	1.7	14	6	7.6
	6/16/70	1706	1.6	0.7	*	0.5	3.6	1.6	7.1	5.4	8.1
	9/15/70	1934	ND		ND		4.1	1.6	13	7	7.2
SPG-RSNK	5/11/67	107	3.2	1.8	*	1.1	0.0	2.2	4.0	2.8	0.9
	7/30/68	537	*	1.0	*	0.5	2.3	1.0	7.7	1.0	0.9
	10/17/68	601	*	1.0	*	0.5	0.4	0.8	1.6	1.1	1.0
	1/15/69	614	*	1.0	*	0.5	3.4	0.9	4.4	2.0	0.9
	3/18/69	645	3.4	0.4	*	0.5	26.3	1.7	3.5	1.5	1.8

TABLE C-1. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	SUSPENDED SOLIDS GROSS RADIOACTIVITY ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY ALPHA PCI/L	SD	POTASSIUM MG/L
SPG-RSNK	4/29/69	686	* 1.0		* 0.5		3.9	1.0	6.8	2.0	1.6
	4/29/69	684	* 1.0		* 0.5		4.0	1.0	5.8	2.2	1.7
	6/24/69	692	* 1.0		* 0.5		2.1	0.9	3.2	1.9	0.9
	8/12/69	696	* 1.0		* 0.5		2.1	0.9	3.3	1.7	0.9
	10/21/69	787	72	2	13	1	0.9	0.9	5.2	2.0	0.9
	2/17/70	1565	20.0	0.8	8.6	0.7	1.4	0.9	7.0	2.1	0.9
	4/28/70	1697	16	1	12	1	2.2	0.9	6.8	2.3	1.0
	6/16/70	1707	1.9	0.7	0.7	0.2	2.6	0.9	8.5	2.5	1.0
	9/15/70	1935	ND		ND		2.2	0.9	3.7	1.9	0.9
WEL-SIXM	4/ 9/67	39	* 1.0		* 0.7		3.2	2.0	* 2.5		7.23
	5/11/67	81	1.8	0.5	0.4	0.3	0.0	2.8	* 2.9		8.4
	6/26/67	131	2.7	1.4	* 1.0		3.9	1.6	3.9	1.8	7.9
	10/ 2/67	336	1.2	0.4	* 0.3		3.2	2.3	2.9	3.3	6.7
	11/29/67	371	2.1	0.7	* 0.4		3.4	0.5	1.5	0.7	6.7
	3/27/68	446	* 1.0		* 0.5		3.7	0.7	3.1	1.0	7.0
	5/ 1/68	476	* 1.0		* 0.5		0.4	1.3	3.1	0.9	8.0
	5/ 1/68	475	1.0	0.3	* 0.5		3.4	1.3	1.9	1.3	7.7
	6/27/68	520	* 1.0		* 0.5		1.8	1.2	6.0	2.3	7.3
	1/15/69	615	* 1.0		* 0.5		3.5	1.2	3.7	1.7	6.9
	3/18/69	646	* 1.0		* 0.5		3.5	1.2	3.8	0.8	6.7
	4/29/69	685	* 1.0		* 0.5		2.5	1.1	2.8	1.4	6.1
	6/24/69	693	* 1.0		* 0.5		2.4	1.1	3.8	1.7	6.1
	8/12/69	697	* 1.0		* 0.5		3.2	1.2	* 1.0		6.9
	2/17/70	1566	* 1.0		* 0.5		2.1	1.2	3.5	1.9	7.1
	6/16/70	1708	1.3	0.7	* 0.5		3.6	1.3	4.0	2.0	7.0
	9/15/70	1936	ND		ND		4.6	1.3	2.2	1.8	6.8

TABLE C. (CONTD.)

C-2. THIRTY-POINT NETWORK

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
WEL-FRED	11/29/67	353	0.7	0.4	*	0.3	3.6	3.5	*	5.0	7.8
	4/30/68	456	*	1.0	*	0.5	1.0	2.1	16	7	8.1
WEL-DBLO	11/29/67	354	1.0	0.4	*	0.2	4.4	1.9	2.2	2.0	6.7
	3/28/68	430	*	1.0	*	0.5	5.1	1.6	3.8	0.9	7.3
	4/30/68	457	*	1.0	*	0.5	1.9	0.9	2.8	1.6	6.9
	6/26/68	500	*	1.0	*	0.5	5.7	1.4	2.3	1.8	7.0
	7/30/68	524	*	1.0	*	0.5	2.9	1.3	3.1	1.9	7.4
WEL-APRT	3/30/67	21	ND		ND		0.7	3.1	*	2.0	9.32
	5/ 8/67	68	0.73	0.39	*	0.2	0.0	2.4	*	1.7	10.0
	6/24/67	120	2.2	1.1	*	1.1	4.5	2.1	1.3	1.4	9.1
	9/27/67	326	1.1	0.6	*	0.4	2.6	2.3	*	3.0	9.6
	11/30/67	376	1.0	0.6	*	0.3	7.3	1.4	4.0	1.7	5.9
	3/28/68	431	*	1.0	*	0.5	1.9	1.7	2.6	2.0	9.1
	4/29/68	458	*	1.0	*	0.5	2.2	0.5	2.6	0.9	8.8
	6/27/68	501	*	1.0	*	0.5	1.2	1.3	2.4	1.7	9.2
WEL-CHAS	11/29/67	355	0.7	0.4	*	0.3	2.8	1.3	*	2.0	4.2
	3/28/68	432	*	1.0	*	0.5	1.5	0.5	1.1	0.6	4.3
	4/30/68	459	*	1.0	*	0.5	1.4	0.3	*	1.0	4.5
	6/26/68	502	*	1.0	*	0.5	1.7	0.4	0.4	0.4	4.4
	7/31/68	525	*	1.0	*	0.5	1.6	1.1	1.9	1.6	4.7
WEL-FD/S	11/29/67	356	0.6	0.4	*	0.2	5.8	1.7	*	2.0	7.1
	4/30/68	460	*	1.0	*	0.5	0.4	1.2	*	3.0	7.8
	6/26/68	503	*	1.0	*	0.5	2.3	0.6	*	1.0	7.4
	7/30/68	526	*	1.0	*	0.5	0.3	1.4	0.7	0.8	7.6
WEL-TN11	5/ 8/67	69	0.91	0.42	*	0.2	1.1	2.9	2.3	2.8	6.6
	6/19/67	121	1.9	1.0	*	1.0	5.4	2.0	2.7	2.0	6.0
	9/27/67	327	1.2	0.6	0.7	0.5	4.0	2.1	*	3.0	6.0
	11/30/67	357	0.5	0.5	*	0.3	5.0	1.9	2.4	2.5	5.6
	3/28/68	433	*	1.0	*	0.5	1.9	1.4	*	2.0	5.9

TABLE C-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
WEL-TN11	4/29/68	461	*	1.0	*	0.5	1.0	0.5	22	2	6.0
	6/25/68	504	*	1.0	*	0.5	1.5	1.1	4.1	1.9	6.4
WEL-TS60	4/11/67	38	*	1.0	*	0.4	6.2	2.5	*	2.6	12.5
	6/21/67	124	1.8	1.4	*	1.1	6.9	2.8	2.7	2.4	12.5
	8/ 2/67	233	0.71	0.53	*	0.3	8.1	1.1	6.1	3.7	11.1
	8/16/67	221	0.90	0.51	*	0.3	4.5	0.8	10.5	6.6	11.1
	9/29/67	329	1.3	0.6	1.1	0.6	4.0	0.6	3.2	3.4	11.8
	11/29/67	360	1.8	0.6	*	0.3	12.9	2.5	5.5	3.0	11.6
WEL-MC/C	5/ 2/68	465	*	1.0	*	0.5	3.6	0.4	11	1	12.0
	6/27/68	509	*	1.0	*	0.5	8.9	1.4	16	4	11.7
	7/30/68	531	*	1.0	*	0.5	8.7	1.8	9.1	4.2	12.0
WEL-JOES	11/29/67	362	0.9	0.8	*	0.4	2.2	1.4	2.6	1.8	6.4
	4/30/68	466	*	1.0	*	0.5	2.9	0.4	1.9	0.6	6.7
	6/27/68	510	*	1.0	*	0.5	2.5	0.6	3.8	1.0	6.3
WEL-4	3/26/68	439	*	1.0	*	0.5	3.3	1.5	6.2	1.8	9.8
	4/30/68	469	*	1.0	*	0.5	1.5	1.5	6.8	3.2	10.2
WEL-WELL	11/28/67	373	1.6	0.7	0.4	0.5	2.5	0.6	1.3	0.8	9.8
	3/28/68	448	*	1.0	*	0.5	2.5	1.2	2.3	1.8	10.1
	4/30/68	478	*	1.0	*	0.5	0.3	1.2	1.9	2.1	9.5
	6/26/68	522	*	1.0	*	0.5	1.1	1.4	2.2	2.0	9.9
	7/29/68	541	*	1.0	*	0.5	2.7	1.5	5.1	2.7	9.7
SPG-WARM	4/11/67	30	*	1.0	*	0.7	66.1	6.6	94	17	23.0
	5/11/67	71	0.70	0.44	0.2	0.3	102	6	194	18	21.0
	6/21/67	122	1.2	1.1	*	1.1	90.0	6.2	86.8	14.3	23.8
	8/ 3/67	232	1.6	0.6	1.1	0.5	85.6	5.3	72.7	14.7	19.7
	9/29/67	328	2.1	0.6	*	0.4	119	6	135	18	18.0
	11/29/67	358	0.9	0.5	*	0.2	121.6	6.2	101.5	13.3	23.1
	3/28/68	434	*	1.0	*	0.5	115	5	ND		24

TABLE C-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
SPG-WARM	4/29/68	462	* 1.0		* 0.5		118	6	230	45	26
	6/27/68	505	* 1.0		* 0.5		120	4	230	20	22.2
	8/ 1/68	527	* 1.0		* 0.5		111	5	290	40	23.5
SPG-GOAT	8/ 3/67	249	1.5	0.6	1.9	0.7	47.4	5.7	27.0	9.2	19.7
	6/27/68	506	* 1.0		0.6	0.2	68	3	190	20	23
	8/ 1/68	528	* 1.0		* 0.5		66	5	180	30	23.5
SPG-CAIN	8/ 2/67	231	1.3	0.6	* 0.3		8.0	1.0	3.6	3.6	13.8
	11/29/67	359	1.0	0.6	* 0.4		6.8	2.5	11.3	4.6	14.8
	3/27/68	435	* 1.0		* 0.5		5.4	1.6	16.0	4.2	15.1
	5/ 2/68	463	* 1.0		* 0.5		5.0	0.8	21	3	14.8
	6/27/68	507	1.7	0.3	* 0.5		5.9	0.6	9.8	1.5	9.4
	7/30/68	529	1.1	0.3	* 0.5		11.6	2.1	15	5	15.5
SPG-TWIN	4/11/67	42	* 1.0		* 0.4		1.7	2.0	2.4	3.1	9.86
	5/11/67	72	1.1	0.5	* 0.2		2.6	2.6	4.6	3.9	11.6
	8/ 2/67	241	8.1	1.0	2.8	0.8	5.9	0.6	4.6	3.3	13.1
	8/16/67	220	0.82	0.47	* 0.3		2.5	0.5	* 2.9		11.0
	11/29/67	361	* 0.8		* 0.6		5.6	1.7	6.8	2.9	10.0
	3/27/68	436	* 1.0		* 0.5		4.7	1.6	4.8	2.9	10.6
	5/ 2/68	464	* 1.0		* 0.5		6.3	0.7	5.7	1.2	10.2
	6/27/68	508	* 1.0		* 0.5		4.0	1.2	5.8	2.1	10.0
	7/30/68	530	* 1.0		* 0.5		5.3	1.6	11	4	10.3
SPG-ABEL	11/28/67	367	0.9	0.6	0.6	0.5	33.0	3.3	61.7	8.6	20.4
	3/26/68	442	* 1.0		* 0.5		33.4	1.4	109	12	20.3
	4/30/68	472	* 1.0		* 0.5		47.7	1.5	120	13	21.4
	6/26/68	516	* 1.0		* 0.5		42.1	2.6	100	12	22
	7/30/68	535	* 1.0		* 0.5		45.7	3.9	130	15	21.5
SPG-DUGN	4/ 9/67	58	* 1.0		* 0.7		0.0	2.7	* 2.5		6.67
	5/11/67	79	0.79	0.36	* 0.2		0.0	3.3	* 4.1		7.9
	6/20/67	129	2.2	1.3	* 1.0		3.4	2.2	3.5	2.8	6.8

TABLE C-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
SPG-DUGN	7/31/67	246	3.4	0.8	*	0.3	3.7	0.7	3.0	3.0	7.0
	9/29/67	334	1.0	0.6	*	0.4	3.0	2.0	*	3.0	6.0
	11/30/67	369	1.0	0.5	*	0.3	1.9	1.2	*	2.0	6.6
	3/27/68	444	*	1.0	*	0.5	4.1	1.2	*	2.0	7.0
	6/27/68	518	*	1.0	*	0.5	1.3	0.6	2.5	1.1	8.0
	8/ 1/68	538	*	1.0	*	0.5	2.5	1.4	4.4	2.8	7.1
SPG-UHCR	4/ 9/67	37	*	1.0	*	0.7	3.7	3.8	*	5.6	13.8
	5/11/67	80	0.84	0.45	*	0.2	2.4	3.2	7.1	6.2	12.4
	6/20/67	130	2.1	1.3	*	1.1	2.4	3.2	4.0	3.4	14.2
	7/31/67	242	5.4	0.9	*	0.3	7.5	1.3	*	3.1	11.0
	9/26/67	335	1.3	0.6	0.3	0.4	6.3	3.0	*	3.0	13.2
	11/30/67	370	1.8	0.5	0.4	0.3	6.0	1.8	1.8	1.8	13.3
	3/27/68	445	*	1.0	*	0.5	6.6	1.6	3.6	2.7	12.9
	5/ 1/68	474	*	1.0	*	0.5	0.0	2.4	6.6	6.5	13.7
	6/27/68	519	*	1.0	*	0.5	6.3	0.9	4.3	2.2	13.1
	8/ 1/68	539	*	1.0	*	0.5	7.4	2.1	8.8	5.6	13.0
SPG-LCKS	4/ 8/67	53	*	1.0	*	0.7	0.0	3.1	13.5	6.8	10.6
	6/27/67	132	1.6	1.4	*	1.1	18.0	2.5	25.9	5.4	10.7
	8/ 7/67	245	0.79	0.50	*	0.3	13.9	1.8	15.1	5.8	10.0
	9/27/67	337	1.0	0.4	*	0.2	20.6	2.3	27.9	8.2	10.3
	11/28/67	372	0.7	0.6	*	0.3	15.4	0.8	21.7	1.5	10.0
	3/26/68	447	*	1.0	*	0.5	11.7	1.9	46.7	3.2	11.9
	4/30/68	477	*	1.0	*	0.5	16.3	0.9	42	3	10.8
	6/26/68	521	*	1.0	*	0.5	20.8	2.1	59	10	10.3
	7/30/68	540	*	1.0	*	0.5	18.1	2.6	60	9	11.0
SPG-MORS	4/11/67	51	*	1.0	*	0.4	1.1	2.7	4.8	3.7	5.49
	5/11/67	85	0.51	0.33	*	0.2	0.8	2.8	4.3	4.2	6.4
	6/20/67	135	2.1	1.2	*	1.1	4.4	1.7	7.5	2.9	5.3
	10/ 1/67	339	1.0	0.6	*	0.3	3.9	2.3	2.6	2.9	5.2
	11/29/67	374	0.6	0.6	*	0.3	4.2	0.5	5.0	0.7	5.3
SPG-DUCK	4/ 8/67	34	*	1.0	*	0.7	3.5	2.9	*	2.2	6.87

TABLE C-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
SPG-DUCK	6/21/67	138	1.8	1.3	*	1.0	3.0	1.9	6.4	3.0	6.7
	8/ 7/67	244	6.0	0.9	1.7	0.7	9.7	1.5	6.5	4.0	7.0
	9/27/67	341	1.3	0.6	*	0.3	4.6	2.7	5.2	4.8	6.3
	11/28/67	375	1.1	0.6	*	0.4	6.4	1.4	17.7	3.4	6.8
	3/26/68	449	*	1.0	*	0.5	5.4	1.3	10.2	3.2	6.7
	4/30/68	479	*	1.0	*	0.5	9.4	1.4	24	5	6.9
	6/26/68	523	*	1.0	*	0.5	10.6	1.6	29	6	7.0

TABLE C. (CONTD.)

C-3. SIXTY-POINT NETWORK

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
WEL-TN09	3/28/67	26	ND		ND		3.7	2.8	*	2.8	6.88
WEL-TS14	4/11/67	36	ND		ND		4.0	3.1	*	2.3	11.0
	6/21/67	125	3.4	1.3	*	1.0	5.0	2.1	4.0	2.3	10.8
	8/ 2/67	238	0.75	0.57	*	0.3	7.8	1.2	3.8	3.7	9.2
	9/29/67	330	1.6	0.6	*	0.4	3.2	2.9	5.7	5.5	10.1
WEL-TRUD	5/ 7/67	77	0.86	0.46	*	0.2	0.0	2.3	2.6	2.1	7.6
	5/ 7/67	76	1.3	0.5	0.3	0.3	2.8	2.7	1.2	1.8	5.8
WEL-RMT1	3/29/67	41	*	1.0	*	0.7	*	2.1	3.2	2.2	1.60
WEL-RMT2	3/29/67	25	ND		ND		2.0	2.3	*	1.8	1.28
WEL-MVW1	4/ 4/67	62	*	1.0	*	0.7	3.2	2.3	*	3.1	6.46
WEL-LFLR	4/ 6/67	46	*	1.0	*	0.7	3.1	3.1	*	2.8	3.52
	5/11/67	83	0.99	0.64	0.2	0.3	1.2	2.3	*	4.4	3.5
	6/22/67	133	2.7	1.3	*	1.0	2.7	1.0	3.4	1.6	3.0
WEL-CRVR	3/28/67	60	*	1.0	*	0.4	2.0	2.2	*	1.9	0.94
	5/ 7/67	87	*	0.5	*	0.2	*	2.2	3.3	3.0	0.8
WEL-ROIR	3/29/67	48	*	1.0	*	0.4	*	2.1	*	1.2	0.79
	5/17/67	91	0.91	0.46	*	0.2	1.3	1.8	*	1.9	0.7
WEL-MQTO	4/ 4/67	55	*	1.0	*	0.7	2.3	2.8	*	1.8	5.35
WEL-TURK	3/29/67	27	ND		ND		2.7	2.3	*	1.7	1.66
	5/ 7/67	92	*	0.5	*	0.3	2.5	2.4	*	1.4	1.6
WEL-MVW3	4/ 3/67	40	*	1.0	*	0.4	0.7	2.8	*	3.9	5.40
	5/ 9/67	93	1.2	0.5	*	0.2	0.6	3.6	*	6.3	6.9
WEL-J--S	3/30/67	44	*	1.0	*	0.4	*	2.1	*	1.3	1.02

TABLE C-3. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
WEL-J--S	5/ 8/67	94	* 0.5		* 0.3		0.6	2.3	* 1.1		0.9
WEL-BSV1	3/30/67	29	ND		ND		0.9	1.7	* 2.2		2.05
	5/ 8/67	97	4.8	2.3	* 1.0		* 2.2		3.1	3.3	2.0
WEL-MVW5	4/ 1/67	22	ND		ND		1.9	2.6	3.1	3.3	4.33
WEL-FISH	5/10/67	100	2.2	2.0	* 1.0		0.2	2.3	3.3	2.9	8.2
WEL-MVW6	4/ 1/67	23	ND		ND		3.6	3.3	* 2.4		8.28
	5/ 9/67	102	3.0	1.8	* 1.0		0.8	2.7	* 3.8		9.3
WEL-KCHN	4/ 7/67	59	* 1.0		* 0.7		5.3	4.2	* 1.8		8.93
	6/23/67	144	1.9	1.2	* 1.0		2.1	2.0	* 0.8		8.7
	8/ 5/67	236	0.98	0.59	* 0.3		5.4	1.0	* 2.1		7.7
	9/28/67	347	1.1	0.5	* 0.3		5.4	1.9	* 3.0		8.5
WEL-BART	4/11/67	43	* 1.0		* 0.7		1.9	3.2	* 2.7		11.0
	5/ 9/67	104	* 2.0		* 1.0		0.0	1.8	* 1.3		11.8
	6/23/67	145	2.4	1.3	* 1.1		4.0	2.2	4.1	2.4	10.8
	9/28/67	348	1.4	0.6	* 0.3		2.5	2.6	* 3.3		10.9
WEL-SIMP	5/ 9/67	106	4.0	1.7	* 1.0		1.3	2.5	* 2.0		3.8
SPG-STON	5/10/67	70	0.65	0.14	* 0.2		5.0	3.0	* 1.5		7.5
	7/27/67	243	1.6	0.7	1.0	0.6	2.4	0.6	* 1.9		7.0
	9/26/67	350	1.3	0.5	* 0.3		1.1	2.0	* 3.0		6.5
SPG-BLMT	4/ 5/67	54	* 1.0		* 0.4		2.9	5.5	4.8	1.4	1.34
	5/ 7/67	82	* 0.5		* 0.2		2.8	2.3	3.4	3.4	1.3
SPG-LFLV	5/10/67	84	1.1	0.5	0.4	0.4	1.2	2.6	2.2	2.4	4.9
	6/22/67	134	2.0	1.1	* 1.0		4.0	1.6	5.1	2.3	4.2
	8/ 3/67	235	* 0.5		* 0.3		3.6	1.0	2.5	2.3	3.5

TABLE C-3. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
SPG-LFLV	9/28/67	338	0.8	0.6	*	0.4	3.7	2.2	*	3.1	4.0
SPG-DARO	3/28/67	33	ND		ND		0.0	2.2	*	3.3	2.71
	5/ 7/67	86	0.77	0.45	*	0.3	1.2	2.7	*	1.9	2.7
	6/23/67	136	1.8	1.1	*	1.0	* 1.6		*	1.0	2.5
	8/15/67	225	0.59	0.56	*	0.3	1.3	0.7	*	2.4	2.5
	9/25/67	340	0.5	0.5	*	0.4	1.3	1.9	*	3.5	2.6
SPG-CLCK	4/ 6/67	31	ND		ND		1.0	2.4	*	1.6	2.21
	5/10/67	90	1.2	0.5	*	0.3	1.3	2.0	1.4	1.6	1.8
SPG-POTS	5/ 9/67	96	3.99	0.52	6.67	0.87	31.0	5.5	25.4	7.6	13.5
	5/ 9/67	95	4.77	1.26	4.19	0.69	34.0	5.5	23.9	8.5	14.0
	6/22/67	139	2.3	1.4	*	1.1	38.6	4.9	37.4	10.3	13.8
	8/15/67	227	0.76	0.52	*	0.3	10.0	1.6	25.1	8.9	12.1
	9/25/67	342	1.0	0.6	*	0.4	47.9	3.6	74.1	11.9	12.8
SPG-BOWL	6/22/67	140	2.4	1.4	*	1.0	17.1	2.2	4.9	2.0	16.0
	8/15/67	228	0.81	0.53	*	0.3	11.7	1.4	6.9	5.0	15.1
	9/25/67	343	1.0	0.6	*	0.3	23.1	2.2	16.7	5.8	12.0
SPG-INDN	6/26/67	137	4.4	1.4	1.9	0.9	1.8	1.3	5.2	2.6	2.9
	8/16/67	226	1.4	0.5	*	0.3	2.9	1.0	*	2.7	2.9
SPG-FISH	4/10/67	28	ND		ND		1.8	2.1	*	2.2	6.07
	5/10/67	99	4.0	2.0	*	1.0	0.3	2.7	4.4	4.4	6.8
	6/23/67	141	2.1	1.5	*	1.1	2.0	1.6	4.4	1.9	5.9
	9/28/67	344	1.2	0.6	*	0.4	3.3	2.6	*	4.1	5.8
SPG-SPNC	3/30/67	24	* 1.0		*	0.7	8.5	5.6	*	5.2	32.5
	5/ 8/67	101	2.9	2.2	2.3	1.7	2.4	4.0	14.1	6.5	34.0
	6/23/67	142	2.1	1.1	*	1.0	23.4	4.3	13.5	4.9	33.7
	8/15/67	229	1.1	0.6	*	0.3	0.0	4.1	*	3.4	33.0
	9/25/67	345	1.5	0.6	*	0.3	43.8	3.0	22.5	8.1	26.0

TABLE C-3. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
SPG-SLVN	4/ 7/67	50	*	1.0	*	0.4	1.8	2.3	*	1.4	1.70
SPG-KLOR	4/ 7/67	63	*	1.0	*	0.4	1.8	2.3	*	1.8	0.60
	6/23/67	143	1.5	1.1	*	1.1	0.0	1.0	2.3	1.6	0.7
	8/ 5/67	237	0.58	0.71	*	0.3	0.6	0.6	*	1.8	0.6
	9/28/67	346	0.8	0.6	*	0.4	2.3	1.3	*	3.0	0.9
TWS-MANH	3/28/67	35	1.8	1.0	*	0.4	6.7	3.0	19.2	7.9	2.39
	5/ 7/67	78	2.4	0.5	0.2	0.2	4.3	2.7	19.2	7.5	2.5
DOM-PINE	4/ 4/67	47	*	1.0	*	0.7	*	2.1	*	1.8	0.71
	5/ 7/67	88	1.3	0.5	0.4	0.4	*	2.1	*	1.0	0.6
DOM-ANDR	3/29/67	61	*	1.0	*	0.7	0.6	1.7	*	1.3	2.38
DOM-MNTR	4/ 1/67	57	*	1.0	*	0.4	3.4	2.7	*	3.1	4.91
TUN-PONY	3/30/67	45	3.3	1.1	*	0.4	2.6	2.5	13.2	4.6	3.41
	5/ 8/67	103	5.3	2.1	2.6	1.7	10.2	2.4	13.1	3.7	4.0
FAD-SHAFT	9/28/67	349	0.9	0.5	*	0.4	2.4	2.0	2.9	3.7	1.6
TWS-FURK	4/10/67	49	*	1.0	*	0.7	0.0	0.6	*	2.5	3.49
	5/ 9/67	105	3.3	2.1	*	1.1	0.2	1.8	*	3.0	3.8
	8/ 5/67	240	1.7	0.7	0.34	0.36	2.3	0.8	*	2.1	2.0

TABLE C-3. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
WEL-2	8/ 5/67	250	1.1	0.6	*	0.3	1.8	0.6	*	1.5	2.3
WEL-3	8/ 5/67	247	0.53	0.49	*	0.3	1.4	0.7	*	2.1	1.2
SPG-SIXM	8/ 1/67	234	1.4	0.6	0.24	0.31	1.0	0.7	*	1.6	1.0
SPG-HOTC	8/ 2/67	252	0.94	0.53	*	0.3	3.5	1.2	2.9	2.6	1.2
	8/ 2/67	239	ND		ND		5.0	0.6	*	3.2	11.5
SPG-SQWA	8/ 8/67	253	1.4	0.6	0.46	0.39	3.7	1.8	2.9	3.6	1.4
SPG-MQTO	5/ 7/67	89	1.1	0.5	*	0.2	*	2.3	*	2.6	1.4
SPG-OLCS	5/ 9/67	98	8.8	2.7	5.7	2.4	3.8	2.6	2.6	2.2	5.5

TABLE C. (CONTD.)

C-4. AEC WELLS IN THE CNTA

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
UC-1-P-2SR	4/ 9/68	450	222	10	60	20	5540	70	* 30		2.3
	7/31/68	553	24.7	2.0	5.0	1.1	158	10	8.4	4.6	2.4
	1/15/69	647	14.3	1.4	4.7	1.5	13.1	1.2	* 1.0		2.0
	5/13/69	648	7.1	0.8	2.4	0.6	10.0	1.2	* 0.5		2.0
	9/24/69	742	28	2	2.6	0.9	9.1	1.3	1.3	2.3	2.0
	12/ 2/70	2054	605	7	11.0	3.0	79.2	2.8	* 1.0		1.9
	12/ 2/70	2053	556	7	18.0	4.0	46.8	2.2	2.5	1.5	1.9
	12/ 2/70	2052	294	5	6.1	1.9	31.4	1.8	1.6	1.2	1.9
	12/ 2/70	2051	295	5	7.1	2.0	23.8	1.7	* 1.0		1.9
	12/ 2/70	2050	134	3	4.9	1.8	6.7	1.1	1.6	1.4	1.9
	12/ 2/70	2049	95.0	2.9	8.5	2.4	3.3	1.0	1.6	1.3	1.9
	12/ 2/70	2048	11.2	1.1	2.8	1.0	1.8	0.9	1.4	1.2	1.9
	3/30/71	2165	294	5	6.2	2.0	16.7	1.5	1.9	1.5	1.7
	3/30/71	2164	150	4	8.6	2.7	5.1	1.1	1.6	1.4	1.7
	3/30/71	2163	59.9	2.4	7.4	2.7	1.8	0.9	* 1.0		1.7
	3/30/71	2162	8.7	1.0	3.6	1.4	1.1	0.9	1.4	1.3	1.8
	3/31/71	2169	9720	70	197	44	216	5	4.3	2.0	1.6
	3/31/71	2168	712	8	10.0	3.0	72.8	2.7	1.1	1.2	1.8
	3/31/71	2167	626	7	7.0	2.6	58.5	2.4	1.3	1.3	1.8
	3/31/71	2166	520	7	10.0	3.0	47.9	2.2	1.3	1.3	1.8
UCE-3 Z-5	2/18/67	64	49.4	3.0	63.2	7.6	8.51	3.1	14.1	0.5	8.92
UCE-10	8/ 3/67	317	ND		ND		8.64	2.52	6.1	3.7	5.6
UCE-11	4/22/67	67	197	16	10.4	4.4	1.95	3.1	* 4.7		6.80
	5/10/67	108	7.8	2.5	6.6	2.4	2.4	1.6	2.6	1.1	7.5
UCE-16 Z-1	3/26/67	65	11.0	1.0	3.5	1.2	9.97	4.4	* 3.7		27.0
UCE-16 Z-4	3/29/67	66	69.4	3.2	31.6	6.4	3.50	3.0	* 4.8		7.94
UCE-17 Z-1	6/25/67	192	4.1	0.8	6.1	2.1	5.0	3.1	6.3	5.6	3.6
UCE-17 Z-3	6/17/67	193	2.5	0.7	0.8	0.5	2.2	2.7	* 3.0		3.6

TABLE C-4. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
UCE-17 Z-5	6/26/67	194	7.6	1.0	2.7	0.9	0.2	3.1	* 6.0		5.7
UCE-17 Z-10	6/23/67	195	30.8	1.8	2.2	0.8	11.8	3.9	10	6	6.1
UCE-17 Z-14	6/27/67	196	2.1	0.6	2.1	0.7	5.8	3.3	18	7	9.0
UCE-18 Z-3	6/ 1/67	197					113	9	289	40	
	6/ 1/67	197	4.4	0.8	2.7	0.8	174	38	408	93	7.5
UCE-18 Z-4	6/ 2/67	198					2690	60	1600	150	
	6/ 2/67	198	41.0	1.5	27.6	1.7	2434	115	2130	206	7.5
UCE-18 Z-5	6/ 3/67	199					2470	50	1970	160	
	6/ 3/67	199	17.8	1.0	11.3	1.2	2568	61	2342	161	9.3
UCE-18 Z-6	6/ 4/67	200					972	36	2060	190	
	6/ 4/67	200	37.4	2.2	26.7	2.7	1216	83	1784	187	7.7
UCE-18 Z-7	6/ 5/67	201					1360	40	2510	170	
	6/ 5/67	201	30.9	2.0	21.6	2.4	1613	94	2053	195	8.1
UCE-18 Z-8	6/ 6/67	202					1000	30	1430	110	
	6/ 6/67	202	6.7	0.9	7.8	1.2	1384	87	1197	151	7.9
UCE-18 Z-9	6/ 6/67	203					340	20	259	43	
	6/ 6/67	203	12.0	1.1	3.8	0.9	329	45	601	97	7.0
UCE-18 Z-11	6/ 7/67	204	4.3	0.8	2.5	0.9	430	49	525	87	5.3
UCE-18 Z-12	6/12/67	205	8.1	1.0	5.6	1.2	427	50	700	104	7.4
HTH-1 Z-2	7/31/67	312	3.50	1.36	7.7	1.9	32.9	3.8	3.2	3.7	3.0
HTH-1 Z-3	8/ 1/67	313	14.5	2.0	9.4	2.1	74.0	5.2	14	6	2.8

TABLE C-4. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NUMBER	SUSPENDED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	DISSOLVED SOLIDS GROSS RADIOACTIVITY BETA-GAMMA PCI/L	SD	ALPHA PCI/L	SD	POTASSIUM MG/L
HTH-1 Z-4	8/ 2/67	314	6.66	1.68	9.4	2.3	24.5	3.9	19	8	9.0
HTH-1 Z-9	8/ 5/67	315	4.28	1.50	0.8	0.9	5.63	1.62	2.9	2.1	3.5
HTH-1 Z-10	8/ 5/67	316	9.15	1.90	3.1	1.6	22.2	3.2	3.2	3.0	6.4

APPENDIX D

Results of tritium analyses on water samples collected in the CNTA are listed in Table D. Table D-1 contains tritium data for the 8-point network, Table D-2 for the 30-point and 60-point networks, and Table D-3 lists results for samples from AEC wells.

In the "tritium content" column, an asterisk (*) preceding a number signifies "less than" and is confirmed by the absence of a standard deviation (STD DEV) value: (*) following a number refers to samples analyzed by liquid scintillation methods instead of low-level gas proportional counting. Tritium content is given in tritium units (TU). One TU is equivalent to 3.3×10^{-3} pCi/ml.

TABLE D. RESULTS OF TRITIUM ANALYSES

D-1. EIGHT-POINT NETWORK

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
WEL-BCMP	8/18/67	230	* 350*	
	9/29/67	332	80.0	20.0
	3/27/68	437	* 500*	
	1/15/69	610	117.0	6.0
	3/18/69	641	22.8	4.1
	4/29/69	680	16.6	5.9
	6/24/69	688	30.1	6.1
	8/12/69	694	37.1	6.9
	10/21/69	784	30.6	5.5
	12/ 4/69	1180	25.9	5.8
	2/17/70	1561	18.0	6.0
	4/28/70	1693	24.7	9.4
	6/16/70	1702	19.3	6.6
WEL-FLNI	4/11/67	32	* 960*	
	4/11/67	32	148.0	29.0
	5/11/67	73	* 810*	
	6/21/67	126	* 700*	
	8/16/67	222	* 350*	
	8/16/67	222	30.0	10.0
	10/ 1/67	331	138.0	16.0
	1/15/69	609	91.8	5.2
	3/18/69	640	3.1	3.9
	4/29/69	679	14.1	6.1
	6/24/69	687	8.7	6.3
	10/21/69	783	47.8	6.0
	2/17/70	1562	22.3	6.2
	4/28/70	1694	58.8	9.2
	6/16/70	1703	11.5	5.4
WEL-KEYS	11/29/67	365	* 600*	
	3/27/68	440	* 500*	
	4/29/69	682	30.4	4.6
	12/ 4/69	1181	40.1	8.9
WEL-TYBO	4/ 9/67	56	* 960*	
	4/ 9/67	56	141.0	36.0
	5/11/67	74	* 810*	
	6/26/67	127	* 700*	
	3/18/69	642	7.9	3.9
	6/24/69	689	21.1	4.3
	10/21/69	785	31.0	5.6
	2/17/70	1563	14.7	6.0
	4/28/70	1695	20.0	9.1
	6/16/70	1704	11.6	4.4

TABLE D-1. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
WEL-BJMS	4/11/67	52	* 960*	
	4/11/67	52	50.0	10.0
	5/11/67	75	* 810*	
	6/21/67	128	* 700*	
	8/16/67	223	* 350*	
	8/16/67	223	18.0	6.0
	10/ 1/67	333	137.0	16.0
	3/26/68	441	* 500*	
	1/15/69	612	25.1	4.3
	3/18/69	643	50.0	4.8
	4/29/69	683	9.5	4.3
	6/24/69	690	13.1	6.4
	8/12/69	695	38.7	4.4
	10/21/69	786	22.7	6.0
	12/ 4/69	1182	24.8	8.3
	2/17/70	1564	15.9	6.1
	4/28/70	1696	27.5	5.0
	6/16/70	1705	10.8	5.1
SPG-BLUJ	8/ 2/67	251	* 350*	
	11/29/67	368	* 600*	
	3/27/68	443	* 500*	
	1/15/69	613	108.0	12.0
	3/18/69	644	96.3	5.9
	6/24/69	691	5.1	6.0
	8/12/69	698	43.0	6.6
	12/ 4/69	1183	57.5	25.6
	6/16/70	1706	27.1	7.5
SPG-RSNK	5/11/67	107	* 810*	
	7/30/68	537	14.8	4.3
	10/17/68	601	0.0	3.8
	1/15/69	614	0.7	3.9
	3/18/69	645	210.0	8.0
	4/29/69	686	97.0	5.6
	6/24/69	692	56.7	4.6
	8/12/69	696	40.6	8.7
	10/21/69	787	31.8	6.8
	2/17/70	1565	37.9	4.2
	4/28/70	1697	19.7	6.2
	6/16/70	1707	16.7	3.9
WEL-SIXM	4/ 9/67	39	* 960*	
	4/ 9/67	39	17.0	8.0
	5/11/67	81	* 810*	

TABLE D-1. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
WEL-SIXM	5/11/67	81	66.0	8.0
	6/26/67	131	* 700*	
	6/26/67	131	14.0	6.0
	10/ 2/67	336	76.0	10.0
	3/27/68	446	* 500*	
	1/15/69	615	59.0	5.1
	3/18/69	646	70.3	5.3
	4/29/69	685	4.8	3.7
	6/24/69	693	19.2	6.3
	8/12/69	697	37.1	6.7
	2/17/70	1566	29.6	6.7
	6/16/70	1708	11.5	5.4

TABLE D. (CONTD.)

D-2. THIRTY- AND SIXTY-POINT NETWORKS

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
WEL-FRED	11/29/67	353	* 600*	
WEL-DBLO	11/29/67	354	* 600*	
	3/28/68	430	* 500*	
WEL-APRT	3/30/67	21	* 960*	
	3/30/67	21	234.0	56.0
	5/ 8/67	68	* 810*	
	6/24/67	120	* 700*	
	3/28/68	431	* 500*	
WEL-CHAS	11/29/67	355	* 600*	
	3/28/68	432	* 500*	
WEL-ED/S	11/29/67	356	* 600*	
WEL-TN11	5/ 8/67	69	* 810*	
	6/19/67	121	* 700*	
	3/28/68	433	* 500*	
WEL-TS60	4/11/67	38	* 960*	
	4/11/67	38	18.0	16.0
	6/21/67	124	* 700*	
	8/ 2/67	233	* 350*	
	8/16/67	221	* 350*	
WEL-JOES	11/29/67	362	* 600*	
WEL-WELL	11/28/67	373	* 600*	
	3/28/68	448	* 500*	
SPG-WARM	4/11/67	30	* 960*	
	4/11/67	30	63.0	20.0
	5/11/67	71	* 810*	
	6/21/67	122	* 700*	
	8/ 3/67	232	* 350*	
	3/28/68	434	* 500*	
SPG-GOAT	8/ 3/67	249	* 350*	
SPG-CAIN	8/ 2/67	231	* 350*	
	11/29/67	359	* 600*	
	3/27/68	435	* 500*	
SPG-TWIN	4/11/67	42	* 960*	

TABLE D-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
SPG-TWIN	4/11/67	42	28.0	8.0
	5/11/67	72	* 810*	
	8/ 2/67	241	* 350*	
	8/16/67	220	* 350*	
	3/27/68	436	* 500*	
SPG-ABEL	11/28/67	367	* 600*	
	3/26/68	442	* 500*	
SPG-DUGN	4/ 9/67	58	* 960*	
	4/ 9/67	58	8.0	6.0
	5/11/67	79	* 810*	
	6/20/67	129	* 700*	
	7/31/67	246	* 350*	
	9/29/67	334	29.0	10.0
	3/27/68	444	* 500*	
SPG-UHCR	4/ 9/67	37	* 960*	
	4/ 9/67	37	19.0	16.0
	5/11/67	80	* 810*	
	6/20/67	130	* 700*	
	7/31/67	242	* 350*	
	9/26/67	335	88.0	18.0
	3/27/68	445	* 500*	
SPG-LCKS	4/ 8/67	53	* 960*	
	6/27/67	132	* 700*	
	8/ 7/67	245	* 350*	
	3/26/68	447	* 500*	
SPG-MORS	4/11/67	51	* 960*	
	4/11/67	51	87.0	17.0
	5/11/67	85	* 810*	
	6/20/67	135	* 700*	
SPG-DUCK	4/ 8/67	34	* 960*	
	4/ 8/67	34	13.0	6.0
	6/21/67	138	* 700*	
	8/ 7/67	244	* 350*	
	3/26/68	449	* 500*	

TABLE D-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
WEL-TN09	3/28/67	26	* 960*	
	3/28/67	26	55.0	28.0
WEL-TS14	4/11/67	36	* 960*	
	4/11/67	36	127.0	20.0
	6/21/67	125	* 700*	
	8/ 2/67	238	* 350*	
	9/29/67	330	96.0	14.0
WEL-RMT1	3/29/67	41	* 960*	
WEL-RMT2	3/29/67	25	* 960*	
WEL-MVW1	4/ 4/67	62	* 960*	
WEL-LFLR	4/ 6/67	46	* 960*	
	5/11/67	83	* 810*	
	6/22/67	133	* 700*	
WEL-CRVR	3/28/67	60	* 960*	
	3/28/67	60	61.0	22.0
	5/ 7/67	87	* 810*	
WEL-ROIR	3/29/67	48	* 960*	
	5/17/67	91	* 810*	
WEL-MQTO	4/ 4/67	55	* 960*	
WEL-TURK	3/29/67	27	* 960*	
	5/ 7/67	92	* 810*	
WEL-MVW3	4/ 3/67	40	* 960*	
	5/ 9/67	93	* 810*	
WEL-J--S	3/30/67	44	* 960*	
	3/30/67	44	28.0	22.0
	5/ 8/67	94	* 810*	
WEL-BSV1	3/30/67	29	* 960*	
	5/ 8/67	97	* 810*	
WEL-MVW5	4/ 1/67	22	* 960*	
WEL-FISH	5/10/67	100	* 810*	
WEL-MVW6	4/ 1/67	23	* 960*	

TABLE. D-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
WEL-MVW6	5/ 9/67	102	* 810*	
WEL-KCHN	4/ 7/67	59	* 960*	
	6/23/67	144	* 700*	
	8/ 5/67	236	* 350*	
WEL-BART	4/11/67	43	* 960*	
	4/11/67	43	36.0	10.0
	5/ 9/67	104	* 810*	
	6/23/67	145	* 700*	
WEL-SIMP	5/ 9/67	106	1260.0*	800.0
SPG-STON	5/10/67	70	* 810*	
	7/27/67	243	* 350*	
SPG-BLMT	4/ 5/67	54	* 960*	
	5/ 7/67	82	* 810*	
SPG-LFLV	5/10/67	84	* 810*	
	6/22/67	134	* 700*	
	8/ 3/67	235	* 350*	
SPG-DARO	3/28/67	33	* 960*	
	5/ 7/67	86	* 810*	
	6/23/67	136	* 700*	
	8/15/67	225	* 350*	
SPG-CLCK	4/ 6/67	31	* 960*	
	5/10/67	90	* 810*	
SPG-POTS	5/ 9/67	96	* 810*	
	5/ 9/67	95	* 810*	
	6/22/67	139	* 700*	
	8/15/67	227	* 350*	
SPG-BOWL	6/22/67	140	* 700*	
	8/15/67	228	* 350*	
SPG-INDN	6/26/67	137	* 700*	
	8/16/67	226	* 350*	
SPG-FISH	4/10/67	28	* 960*	
	4/10/67	28	16.0	6.0
	5/10/67	99	* 810*	

TABLE D-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
SPG-FISH	6/23/67	141	* 700*	
SPG-SPNC	3/30/67	24	* 960*	
	5/ 8/67	101	* 810*	
	6/23/67	142	* 700*	
	8/15/67	229	* 350*	
SPG-SLVN	4/ 7/67	50	* 960*	
	4/ 7/67	50	9.0	6.0
SPG-KLOB	4/ 7/67	63	* 960*	
	4/ 7/67	63	0.0	6.0
	6/23/67	143	* 700*	
	8/ 5/67	237	* 350*	
TWS-MANH	3/28/67	35	* 960*	
	5/ 7/67	78	940.0*	790.0
DOM-PINE	4/ 4/67	47	* 960*	
	5/ 7/67	88	* 810*	
DOM-ANDR	3/29/67	61	* 960*	
DOM-MNTR	4/ 1/67	57	* 960*	
TUN-PONY	3/30/67	45	* 960*	
	3/30/67	45	55.0	24.0
	5/ 8/67	103	* 810*	
TWS-EURK	4/10/67	49	* 960*	
	4/10/67	49	76.0	8.0
	5/ 9/67	105	* 810*	
	8/ 5/67	240	* 350*	

TABLE D-2. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
WEL-2	8/ 5/67	250	* 350*	
WEL-3	8/ 5/67	247	* 350*	
SPG-SIXM	8/ 1/67	234	* 350*	
SPG-HOTC	8/ 2/67	252	* 350*	
	8/ 2/67	239	* 350*	
SPG-SQWA	8/ 8/67	253	* 350*	
SPG-MQTO	5/ 7/67	89	* 810*	
SPG-OLCS	5/ 9/67	98	* 810*	

TABLE D. (CONTD.)

D-3. AEC WELLS IN THE CNTA

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
UC-1-P-2SR	4/ 9/68	450	930.0*	9.0
	7/31/68	553	176.0*	3.0
	1/15/69	647	95.8*	1.5
	5/13/69	648	134.0*	1.5
	9/24/69	742	251.0*	3.0
	12/ 2/70	2054	837.0*	8.3
	12/ 2/70	2053	834.0*	8.3
	12/ 2/70	2052	763.0*	7.6
	12/ 2/70	2051	887.0*	8.8
	12/ 2/70	2050	331.0*	3.3
	12/ 2/70	2049	205.0*	2.0
	12/ 2/70	2048	121.0*	1.0
	3/30/71	2165	504.0*	5.0
	3/30/71	2164	272.0*	2.7
	3/30/71	2163	190.0*	1.9
	3/30/71	2162	106.0*	1.0
	3/31/71	2169	473.0*	4.7
	3/31/71	2168	426.0*	4.2
	3/31/71	2167	525.0*	5.2
	3/31/71	2166	562.0*	5.6
UCE-11	4/22/67	67	32.0	8.0
	5/10/67	108	* 810*	
UCE-17 Z-1	6/25/67	192	* 800*	
UCE-17 Z-3	6/17/67	193	* 800*	
UCE-17 Z-5	6/26/67	194	* 800*	
UCE-17 Z-10	6/23/67	195	* 800*	
UCE-17 Z-14	6/27/67	196	* 800*	
UCE-18 Z-3	6/ 1/67	197	* 800*	
UCE-18 Z-4	6/ 2/67	198	* 800*	
UCE-18 Z-5	6/ 3/67	199	* 800*	
UCE-18 Z-6	6/ 4/67	200	* 800*	
UCE-18 Z-7	6/ 5/67	201	* 800*	
UCE-18 Z-8	6/ 6/67	202	* 800*	

TABLE D-3. (CONTD.)

SAMPLE DESIGNATION	DATE COLLECTED	LAB NO	TRITIUM CONTENT (TU)	STD DEV (TU)
UCE-18 Z-9	6/ 6/67	203	* 800*	
UCE-18 Z-11	6/ 7/67	204	* 800*	
UCE-18 Z-12	6/12/67	205	* 800*	

APPENDIX E

Water samples collected for specific radionuclide analyses were filtered shortly after collection, acidified and treated with cesium, strontium, lead, and barium carriers. The volume of the sample was reduced by evaporation to several hundred ml; the solution is neutralized with NaOH, and Na_2CO_3 is added. Carbonates of Ba(Ra), Sr, and Pb are separated by decanting and centrifuging. Supernatant liquid is saved for cesium separation. Carbonates of Ba(Ra), Sr, and Pb are dissolved in HCl, the solution diluted and saturated with H_2S gas. The solution is allowed to stand at least 12 hours in order to allow the PbS to precipitate completely. The PbS is separated by centrifuging, and the supernatant liquid is then acidified and evaporated to dryness. The Ba(Ra) and Sr are dissolved in a minimum of dilute nitric acid, and two precipitations of the nitrates with fuming nitric acid are performed in order to separate calcium. Strontium and barium-radium are separated by precipitating barium-radium chromate out of a slightly acid solution. Separated barium-radium chromate is dissolved in HCl, diluted, and finally precipitated as the sulfate carrying Ra. Strontium is precipitated as oxalate, redissolved in 6N NaOH, and precipitated finally as the carbonate. Lead sulfide is dissolved in nitric acid, diluted with water, and filtered in order to remove any sulfur which may have formed. Lead is then precipitated as the sulfate in which form it is radioassayed. Cesium is separated on ammonium phosphomolybdate and finally precipitated with chloroplatinic acid. The separated barium-radium fraction and the lead fraction are transferred to two-inch diameter stainless steel planchets for radioassay. The samples are stored for 30 days for the Pb^{210} and Ra^{226} to attain secular equilibrium with their daughter products before measuring. Strontium and cesium are filtered onto a glass fiber filter disk of 3.8 cm^2 circular area. The precipitate is covered with mylar and mounted on a nylon holder. All the samples are counted on Sharp Low Beta proportional counters.

Standards of Sr^{90} -Y^{90}, Cs^{137} -Ba^{137}, and Pb^{210} -Bi^{210}, with the weight of carrier precipitate varied, are prepared and radioassayed with the identical mounting technique and counting procedure used for the samples in order to apply the proper self-absorption and detector counting efficiency

factors. Standards of Ra^{226} are not used. Instead the same conversion curve correcting for self-absorption and counter efficiency for the gross alpha measurements is used in calculating the Ra^{226} data. This technique permits more direct comparison between the gross alpha measurements and the Ra^{226} data.

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