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INEL SITE ENVIRONMENTAL SURVEILLANCE DATA FOR THE THIRD QUARTER 1992

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Prepared by the Environmental Sciences Branch
Radiological and Environmental Sciences Laboratory
Idaho Field Office
U.S. Department of Energy
785 DOE Place
Idaho Falls, Idaho 83401-1562

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Reid C. Robertson 4/15/93

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INEL SITE ENVIRONMENTAL SURVEILLANCE DATA - THIRD QUARTER 1992

General Information

This report summarizes data from analyses of samples collected at INEL Site locations by the Environmental Sciences Branch (ESB) of the Radiological and Environmental Sciences Laboratory (RESL), U.S. Department of Energy Idaho Field Office during the third quarter of calendar year 1992. Data from analyses of some water samples collected by the INEL Project Office of the U.S. Geological Survey (USGS) are also included. Data were obtained from analyses of air, well and surface water samples, and from direct radiation measurements. Table I summarizes the onsite radiological sampling program. The approximate minimum detectable concentrations (~MDC) shown in Table I and the results of the air and water radiological surveillance program are compared to the derived concentration guides (DCG) listed in DOE Order 5400.5 dated February 8, 1990. Nonradiological pollutants are compared to appropriate EPA standards.

The RESL Analytical Chemistry Branch (ACB) and Laboratory Quality Branch (LQB) report analytical results with the estimated analytical uncertainty "1s" where all analytical uncertainties have been propagated. RESL has adopted the following interpretation of results near the minimum detectable concentration (MDC). If the result is less than or equal to twice the estimated analytical uncertainty, the material is not considered to be detected by the analysis. If the result lies in the range of two to three times its estimated analytical uncertainty, detection of the material by the analysis may be questionable because of statistical fluctuations. Due to the questionable nature of results between "2s" and "3s", they will be reported but generally not discussed. If the result exceeds three times its estimated analytical uncertainty, there is confidence that the material was detected by the analysis, and the data will be discussed.

TABLE I

ONSITE RADIOLOGICAL ENVIRONMENTAL SURVEILLANCE PROGRAM SUMMARY

Type of Analysis	Frequency of Analysis	Number of Samples	Sample Size	Count Time	-MDC[a]	% DCG
AIR						
Low-Volume Samplers						
Gross Beta	Weekly	12	330 m^3	20 min.	8 E-15 μCi/mL	0.3[b]
Am	Quarterly	6	4000	1000	8 E-18	0.04
Pu	Quarterly	6	4000	1000	6 E-18	$\leq$0.03
Specific gamma	Quarterly	12	4000	60	1-10 E-15	$\leq$0.01
Sr-90	Quarterly	2	4000	50	1 E-16	0.001
High-Volume Samplers						
Gross Gamma	Daily	2	2000	10	N/A[c]	N/A
Specific gamma	Monthly	2	56000	60	[-10 E-16	$\leq$0.001[d]
Other Sampler						
H-3 as HTO	3 to 7 weeks	2	10-20	20	1 E-11	0.01
WATER						
Production Wells						
Gross Beta	Monthly	26	250 mL	20	5 E-9 μCi/mL	5[b]
Gross Alpha	Monthly	26	100	60	3 E-9	10[e]
Sr-90	Monthly	2	4000	20	0.5 E-9	0.05
H-3 as HTO	Monthly	26	10	20	0.4 E-6	0.02
Observation Wells						
Gamma Scans:	Quarterly	6	400	60	10-100 E-9	$\leq$6[d]
	Semiannually	12	400	60	10-100 E-9	$\leq$6[d]
	Annually	18	400	60	10-100 E-9	$\leq$6[d]
Sr-90	Quarterly	14	400	20	5 E-9	0.5
	Semiannually	39	400	20	5 E-9	0.5
Am	Semiannually	6	500	1000	0.05 E-9	0.2
Pu	Semiannually	7	500	1000	0.04 E-9	0.1
	Annually	3	500	1000	0.04 E-9	0.1
H-3 as HTO	Quarterly	28	10	20	0.4 E-6	0.02
	Semiannually	82	10	20	0.4 E-6	0.02
SOIL						
Specific gamma	Annually[f]	Varies	400 g	1000	4 E-8 μCi/g	N/A
Pu	Annually	Varies	10	1000	2 E-9	N/A
Am	Annually	Varies	10	1000	3 E-7	N/A
Sr-90	Annually	Varies	10	50	9 E-8	N/A
ENVIRONMENTAL RADIATION						
Thermoluminescent Dosimeters	Semiannually	135	5 TLDs per dosimeter	N/A	5 mR	N/A
Gamma Radiation Surveys	Annually[g]	N/A	N/A	N/A	N/A	N/A

a. Approximate minimum detectable concentration.

b. DCG based on the most restrictive beta emitter (Ra-228).

c. Not applicable.

d. For principle gamma-emitting radionuclides.

e. DCG based on Am-241, Pu-239 and Pu-240.

f. Onsite soil sampling is performed each year at a different facility. Facilities are sampled on a rotating seven-year schedule.

g. Surveys performed each year at different facilities on a rotating 3-year schedule.

ATMOSPHERIC SAMPLING

Low-Volume Samplers

Atmospheric low-volume samplers are in operation at 12 onsite locations just outside facility security fences, seven INEL perimeter (boundary) locations, and four distant (background) locations (Figure A-1). Each low-volume air sampler contains two filters: a membrane prefilter for measurement of airborne particulates and a charcoal cartridge for collection of iodine. ESB personnel change the filters weekly and submit them to the ACB for analysis.

The gross alpha activity is determined weekly for particulate filters from eight selected locations--four offsite and four onsite--as a nonspecific screening technique for alpha-emitting radionuclides. Results are tabulated and inspected each week for anomalies.

Gross gamma activity is determined weekly for the charcoal cartridges to screen for gamma-emitters such as radioiodines. If activity greater than a specified level is detected, the cartridges are analyzed by gamma spectrometry for I-131 and any other gamma-emitters present.

The gross beta activity is determined weekly for the particulate filters from each location as a screening technique to give timely information in the event of INEL releases, worldwide fallout, etc. This information may be difficult to interpret due to local variations in gross beta levels at any given time or location. Any of several factors may be responsible for the variations observed, including: loading of dust or soot on certain individual filters and varying concentrations of natural or fallout radioactivity as a result of diverse local meteorological conditions. If unusually high gross

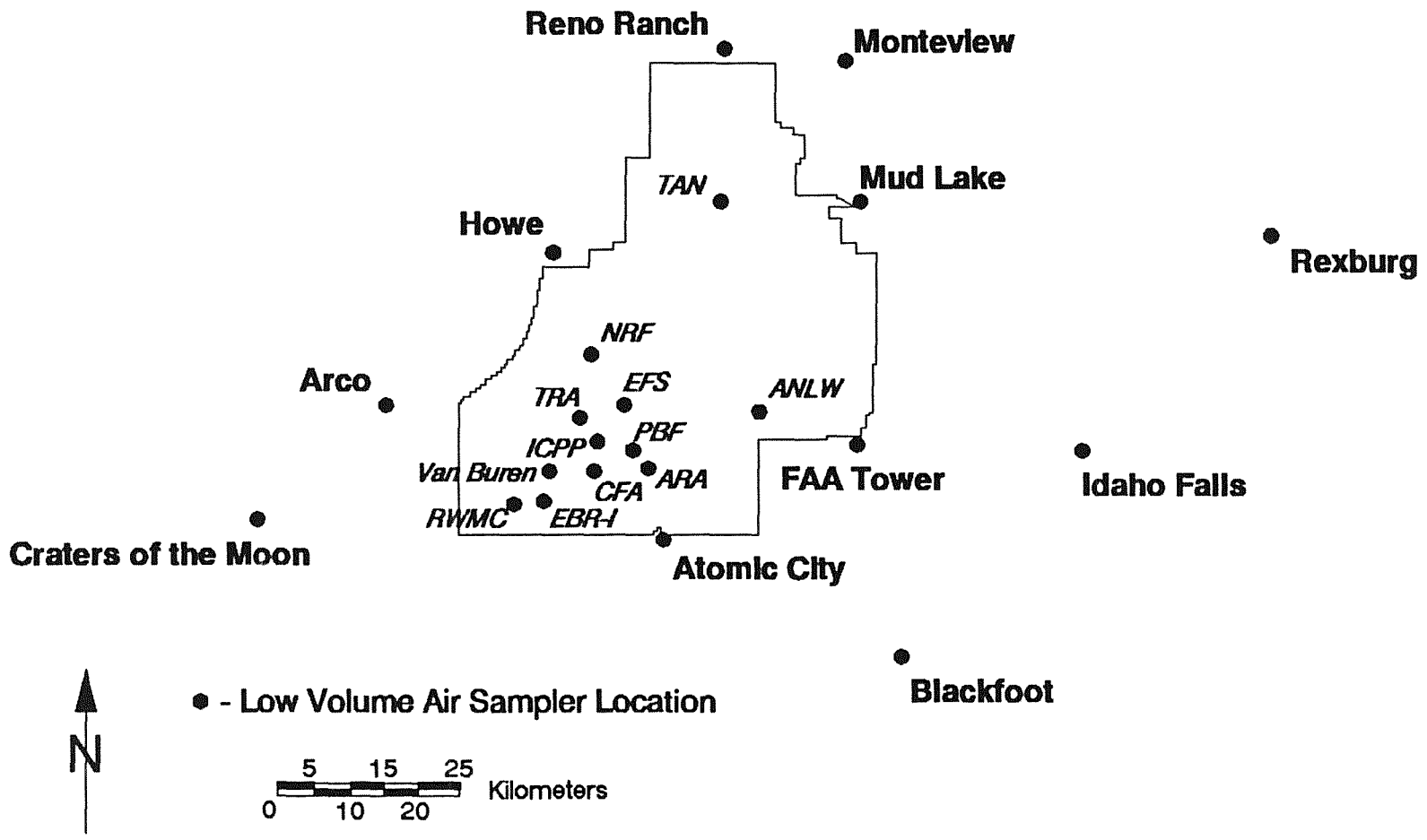

Figure A-1. Low-volume Air Sampling Locations

beta activity is detected on the filters, they may be submitted for gamma spectrometry for more information.

At the end of each quarter, composites of the particulate filters for each location are submitted to ACB and to the Laboratory Quality Branch (LQB) for specific nuclide analyses. When interpreting air sampling data to assess possible INEL impact, more reliance is placed upon results from analyses for specific man-made radionuclides than upon gross alpha or gross beta concentrations. Gross alpha and gross beta analyses are used primarily as screening techniques to detect sudden increases over natural background radioactivity.

Gross Alpha

Gross alpha concentrations were, in general, typical of those normally measured. Gross alpha activity is generally higher at Blackfoot than at boundary or onsite locations due to contributions from non-INEL sources. During the third quarter, the mean gross alpha concentration at Blackfoot was 2.2 E-15 μCi/mL (11% DCG), compared to an onsite location mean of 1.7 E-15 μCi/mL (9% DCG).

Gross Beta

Results from analyses of particulate filters for all locations are interpreted with the help of statistical comparisons as described in the following sections.

Weekly Comparisons. The gross beta activities for all sampling locations are analyzed each week using an analysis-of-variance test, a lognormal plot,

and comparisons between individual locations and the distant community group mean.

Weekly gross beta concentrations ranged from 4 ± 2 E-15 to 3.9 ± 0.3 E-14 μCi/mL. There were three weeks when one or more individual location gross beta concentrations were statistically greater than the distant group mean concentration:

1) The gross beta concentration at Van Buren (2.3 ± 0.2 E-14 μCi/mL) was statistically greater than the background mean during the week of July 10 through July 17, but the lognormal plot appears to show a typical population distribution.

2) The gross beta concentration was also statistically significant at Van Buren during the week of August 7 to August 14, but the lognormal plot again appeared to show a typical population distribution. The gross beta concentration during this week was 3.1 ± 0.3 E-14 μCi/mL.

3) During the week of September 18 to September 25, the gross beta concentrations were statistically greater than the background mean of 2.1 E-14 μCi/mL at three locations: TAN (2.5 ± 0.2 E-14 μCi/mL), Monteview (2.6 ± 0.2 E-14 μCi/mL), and the FAA Tower (2.7 ± 0.3 E-14 μCi/mL). The lognormal plot showed a typical population distribution during this week.

Monthly Comparisons. Figures A-2 through A-13 graphically illustrate monthly gross beta mean concentrations of onsite and distant groups.

Each month, the weekly data for each onsite location are grouped and statistically compared to the corresponding set of data from the distant community locations using an unpaired t-test (α=0.05).

The mean gross beta concentrations at the following locations were statistically greater than the background group mean gross beta concentration:

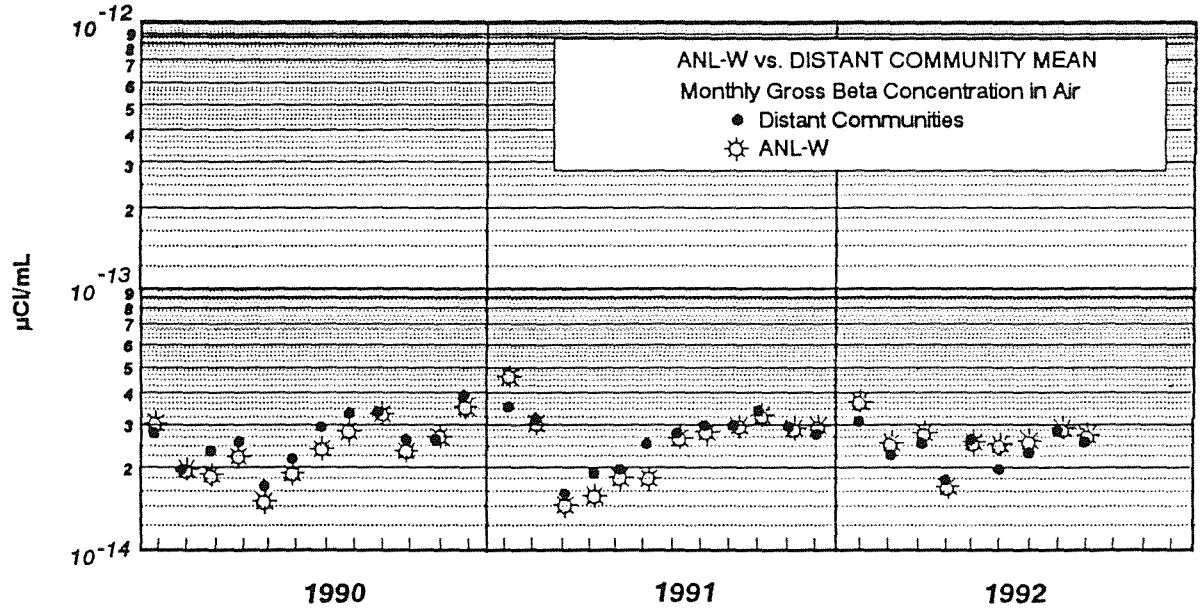

Figure A-2. ANL-W vs. Distant Community Mean Gross Beta Concentration

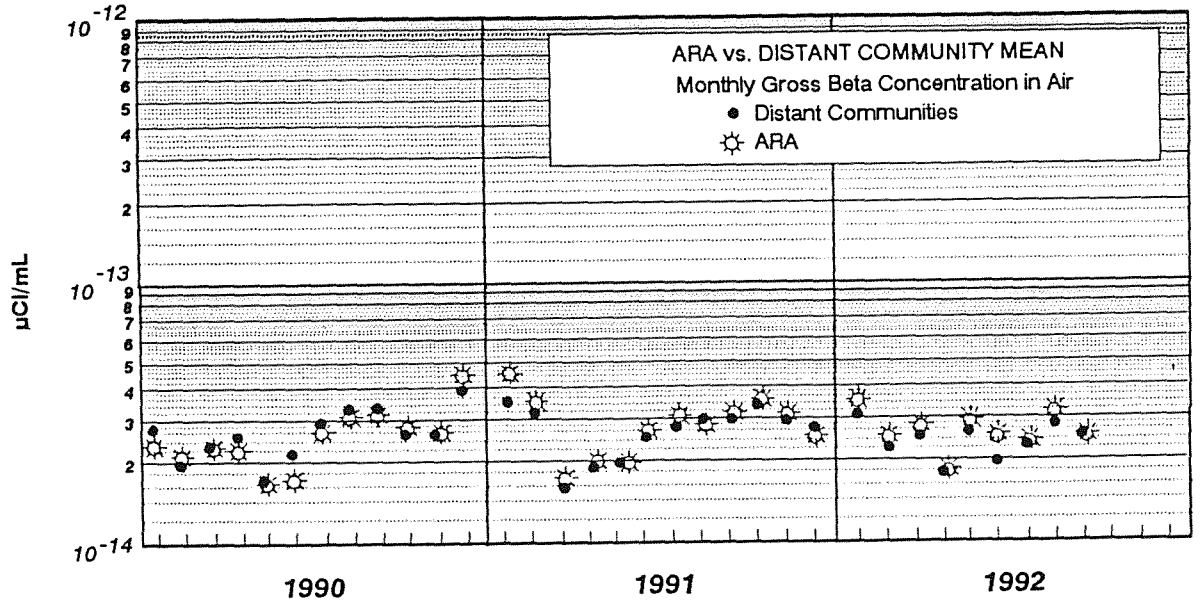

Figure A-3. ARA vs. Distant Community Mean Gross Beta Concentration

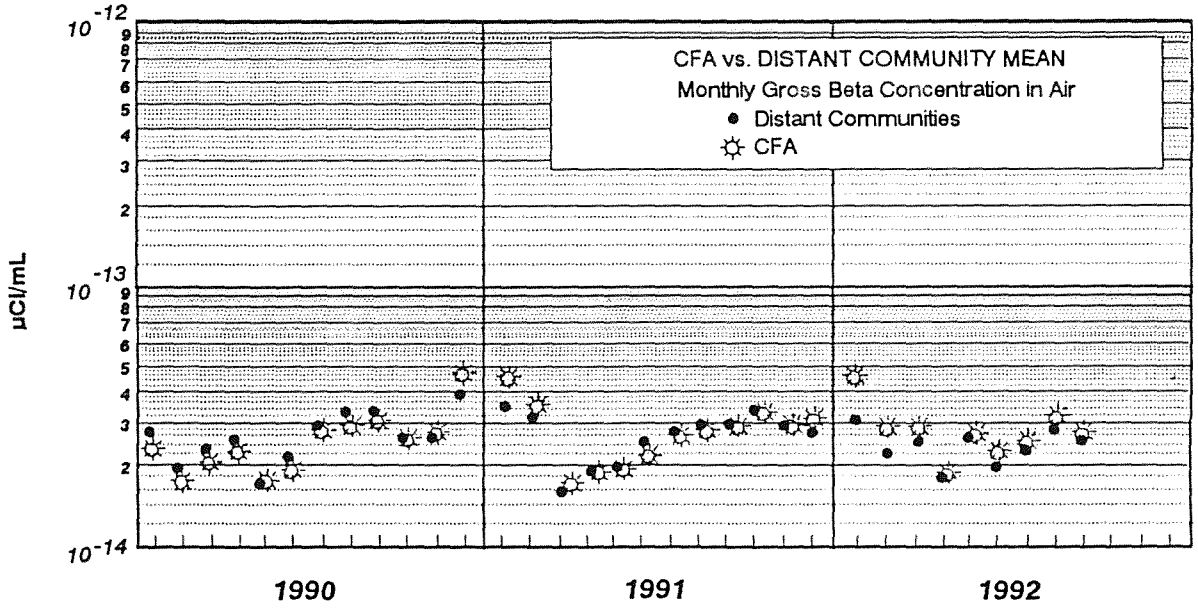

Figure A-4. CFA vs. Distant Community Mean Gross Beta Concentration

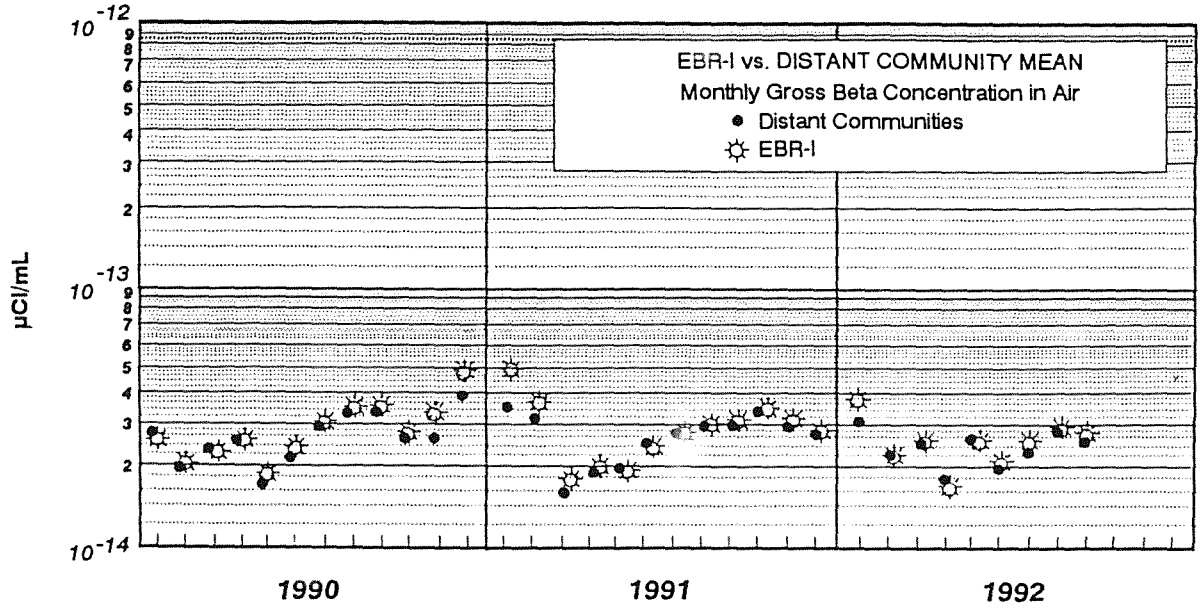

Figure A-5. EBR-I vs. Distant Community Mean Gross Beta Concentration

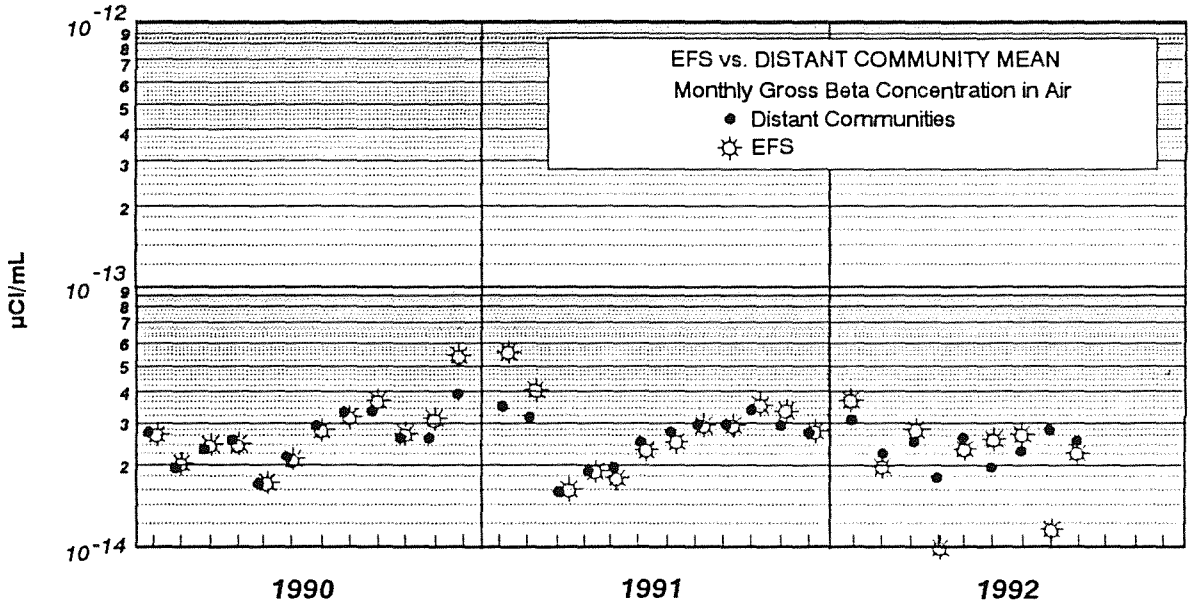

Figure A-6. EFS vs. Distant Community Mean Gross Beta Concentration

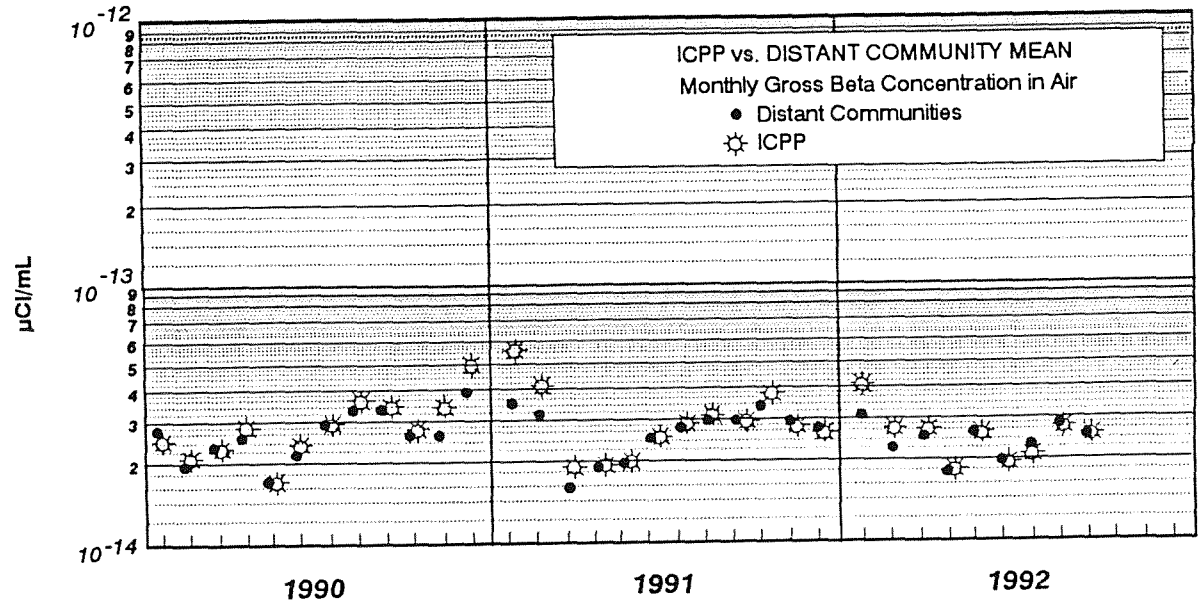

Figure A-7. ICPP vs. Distant Community Mean Gross Beta Concentration

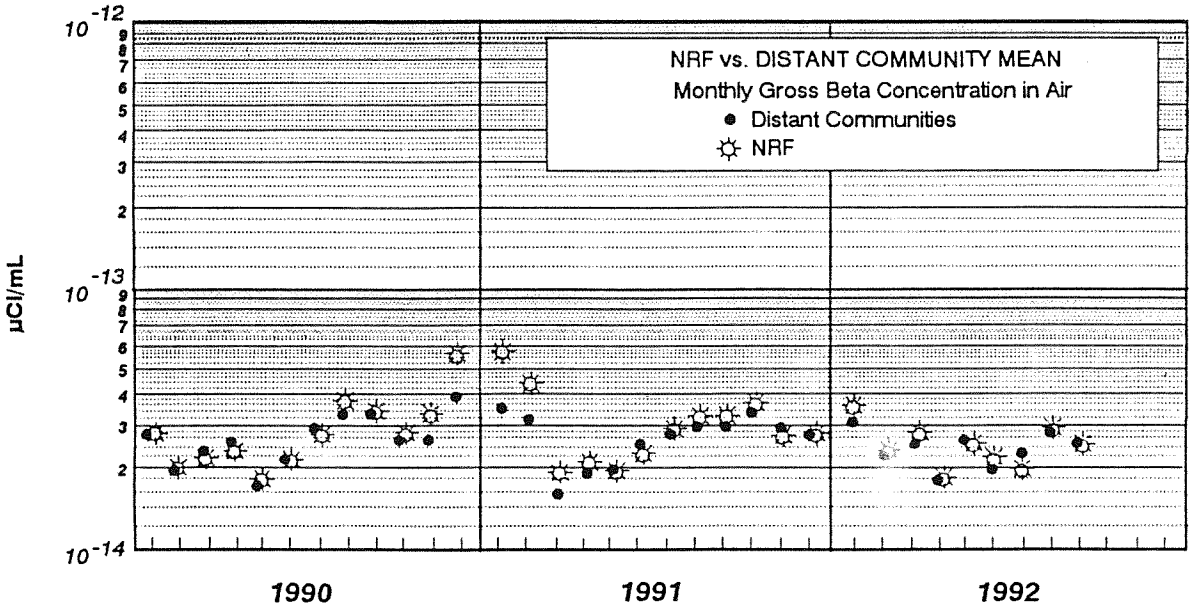

Figure A-8. NRF vs. Distant Community Mean Gross Beta Concentration

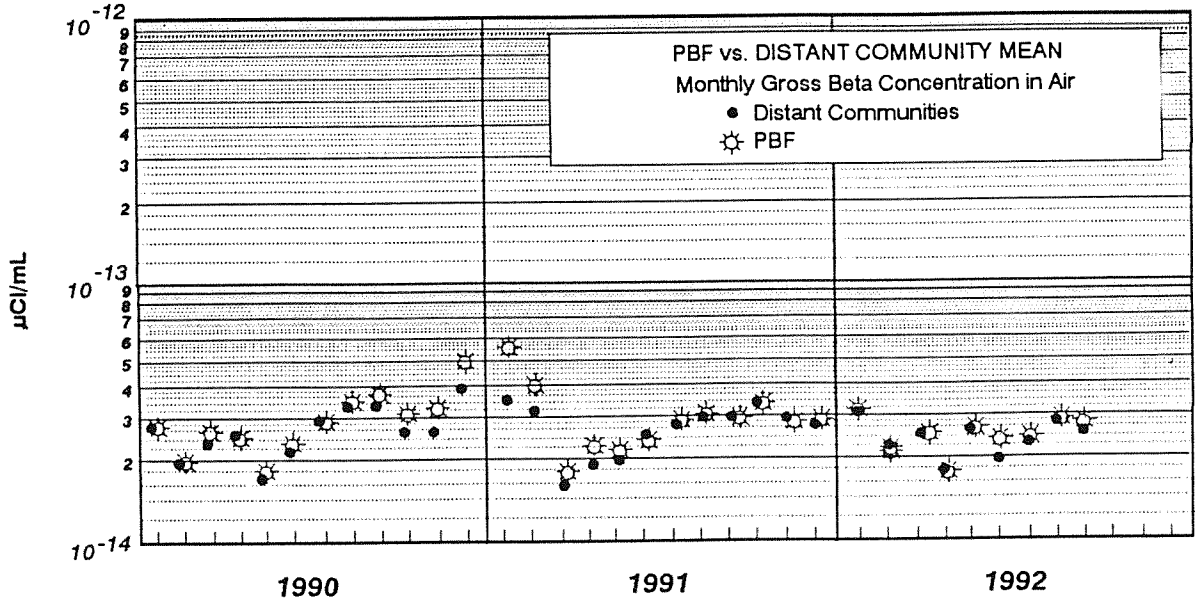

Figure A-9. PBF vs. Distant Community Mean Gross Beta Concentration

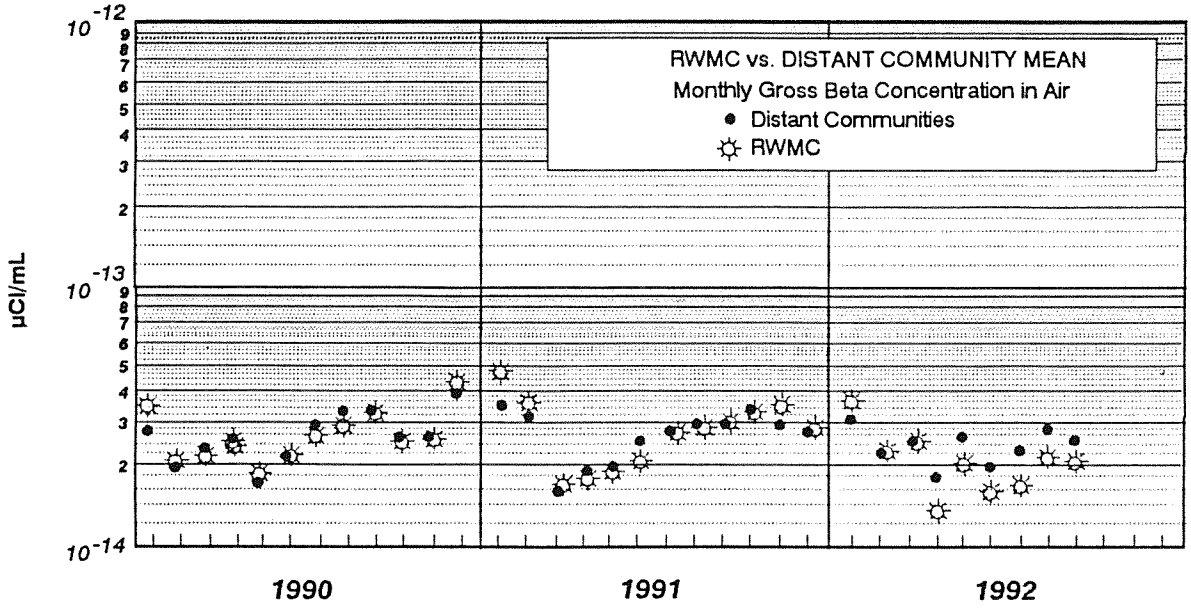

Figure A-10. RWMC vs. Distant Community Mean Gross Beta Concentration

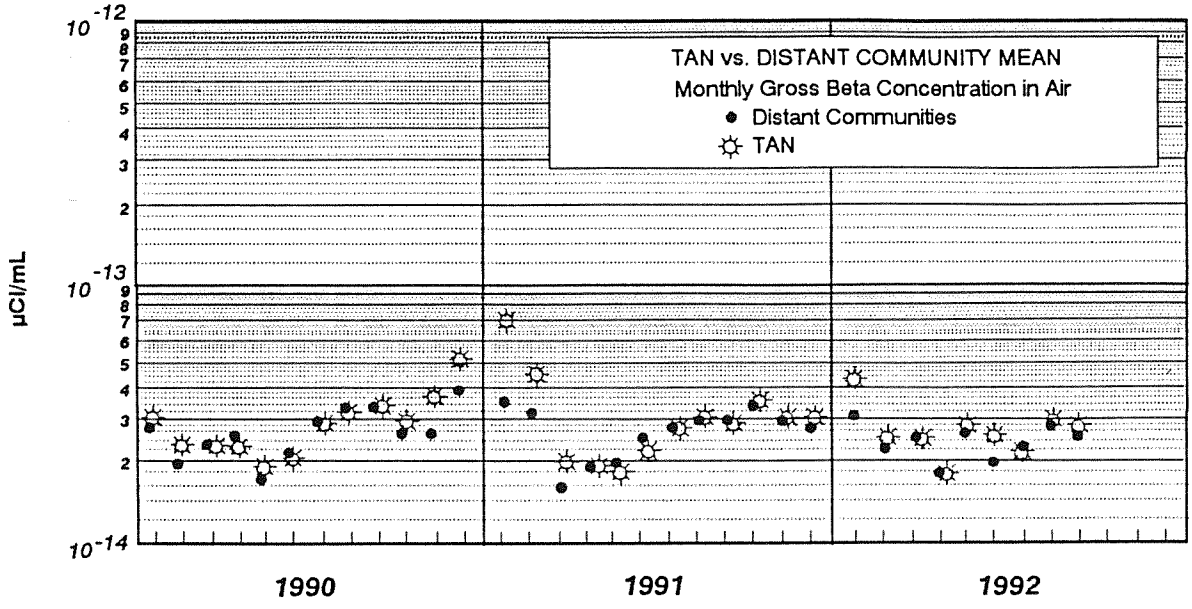

Figure A-11. TAN vs. Distant Community Mean Gross Beta Concentration

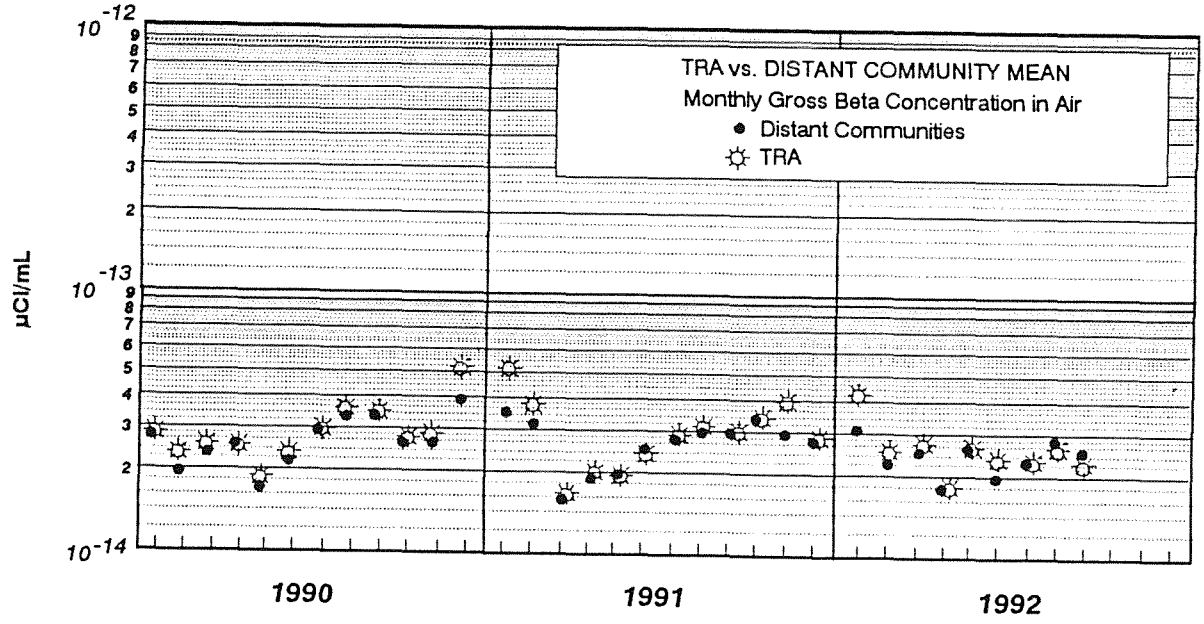

Figure A-12. TRA vs. Distant Community Mean Gross Beta Concentration

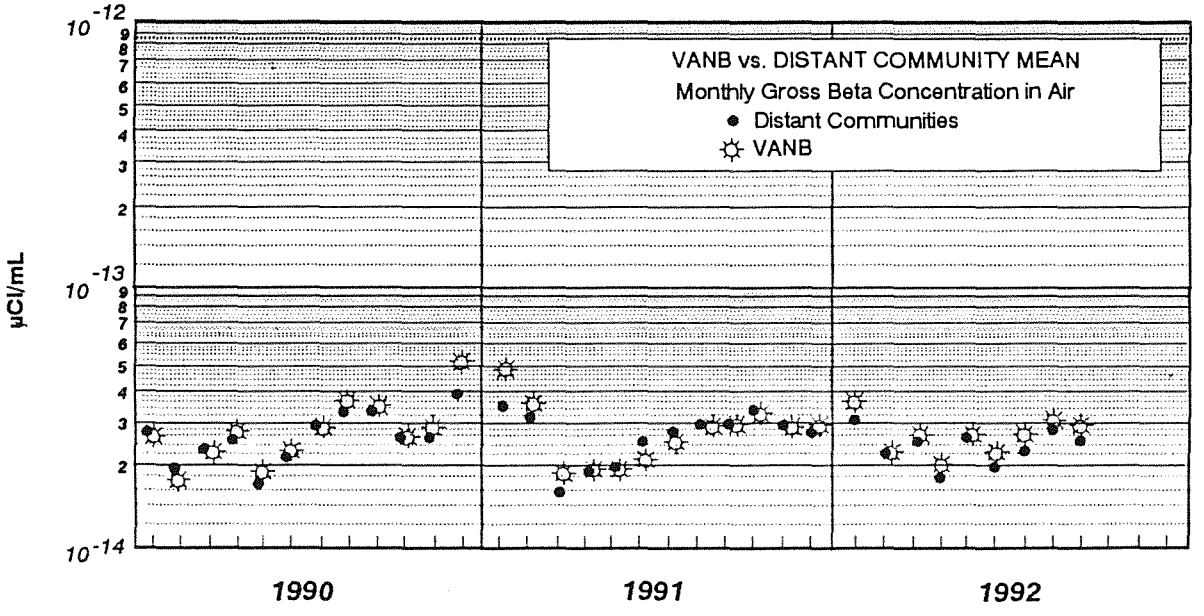

Figure A-13. VANB vs. Distant Community Mean Gross Beta Concentration

ARA in August, and FAA Tower and Van Buren during September. Neither the onsite nor the boundary group mean gross beta concentration was statistically greater than the distant group mean gross beta concentration during any month. Review of the specific nuclide results discussed below, as well as the release information reported in the Radioactive Waste Management Information System (RWMIS) report did not indicate an INEL origin for any of the statistical differences.

Quarterly Comparisons. Each quarter, the weekly gross beta concentration data for each onsite location are grouped and compared to the corresponding data from the distant community group using an unpaired t-test (α=0.05).

During the third quarter of 1992, the mean gross beta concentration at Howe, FAA Tower, EBR-1, CFA, and Van Buren were statistically greater than the background mean gross beta concentration. Neither the onsite nor boundary group mean gross beta concentrations were statistically above the background group mean gross beta concentration. As stated above, review of the specific nuclide results discussed below, information from the RWMIS report, and the geographic distribution of the results did not indicate an INEL origin for any of the statistical differences. The highest quarterly gross beta concentration, at Van Buren, was 2.9 E-14 μCi/mL or 1.0% of the annual DCG.

Specific Nuclides

After gross beta analyses are completed each week, the particulate filters are retained to make up a quarterly composite of filters from each sampling location. At the end of the quarter, ACB and LQB analyze these composites for specific radionuclides.

Gamma-Emitting Nuclides. Each quarter the composited particulate filters for each location are submitted to LQB and analyzed by gamma spectrometry. Spectra are specifically examined for 11 gamma-emitting radionuclides (Be-7, Ce-141, Ce-144, Co-60, Cs-134, Cs-137, Mn-54, Ru-103, Ru-106, Sb-125, and Zr-95). Any other nuclides detected are also reported. The data for radionuclides detected at any location are then statistically examined using an analysis-of-variance test and unpaired t-test comparisons (α=0.05) between the distant community and the onsite group means and between individual onsite location results and the distant group mean.

One gamma-emitting nuclide, other than naturally occurring Be-7, was detected on a third quarter particulate filter composite. Cerium-141 was indicated at Van Buren at a concentration of 5 $\pm$ 2 E-15 μCi/mL (0.0005% DCG).

Strontium-90. Selected composites of the third quarter filters were analyzed for Sr-90. This nuclide was not detected on any of the six sets of composites submitted for analysis.

Transuranic Nuclides. Selected composites of the third quarter filters were analyzed by alpha spectrometry for Pu-238, Pu-239/240, and Am-241. The americium fraction was lost in the chemical analysis and no results were available. Pu-238 was not detected on any of the composites. Pu-239/240 was reported on the filters from three offsite locations at the following concentrations, all at or less than 3s: Craters of the Moon, 3.3 $\pm$ 1.4 E-18 μCi/mL (0.017%DCG); Monteview, 2.7 $\pm$ 1.3 E-18 μCi/mL (0.014% DCG); and FAA Tower, 6 $\pm$ 2 E-18 μCi/mL (0.03% DCG).

High-Volume Samplers

Two onsite high-volume air samplers (CFA and EFS) continuously sample air for particulate airborne radioactivity from any source: natural radioactivity, INEL releases, weapons testing, domestic or foreign reactor accidents, etc. Filters from these samplers are analyzed each workday for gross gamma activity and decay curves are plotted. When indicated by unusual decay curves (different from naturally-occurring radon daughters) or suspected nuclear incidents, individual filters may be submitted for gamma spectrometry. No unusual curves were noted and no individual filters were submitted for analysis during the third quarter.

At the end of each month, the filters at each location are composited and submitted for gamma spectrometry. No manmade gamma-emitting radionuclides were found on any of the third quarter composites.

Atmospheric Tritium Samplers

Samplers for tritium in water vapor are located offsite in Idaho Falls and onsite at EFS and Van Buren. In these samplers, air is passed through a column of silica gel at a rate of 0.3 L/min. Columns are changed when the silica gel becomes saturated. Tritium concentrations are determined by liquid scintillation counting of water extracted from the columns.

Two samples covering a part of the second quarter were collected from each location. No tritium was detected in either the set of samples collected between May 15 to August 7 or those collected from August 7 to November 6.

Precipitation Samplers

Monthly precipitation samples are collected at Idaho Falls and CFA. These samples are analyzed for tritium and pH. Weekly samples from EFS are also collected and analyzed for tritium.

A total of eight precipitation samples were collected during the third quarter. Tritium was not detected in any of the samples.

Nitrogen Oxides Samplers

Two stations, one located at the intersection of Van Buren Boulevard and Highway 20/26 and another at EFS, continuously monitor the air for nitrogen oxides (NO and NO_2). Both analyzers are designated as equivalent methods by EPA.

The mean NO_2 concentration measured during the third quarter of 1992 was 4.5 ppb (8.5 $\mu g/m^3$) at EFS and 3.5 ppb (6.6 $\mu g/m^3$) at Van Buren. These respective concentrations are 8% and 7% of the annual primary and secondary ambient air quality standards for NO_2. Data recovery for the quarter was 94% at EFS and 91% at Van Buren.

Performance checks were made at least biweekly on both samplers by testing the response of both the NO and NO_x channels of the analyzers to purified air and to air with a known concentration of nitric oxide (NO). Details of the performance checks have been sent to the State of Idaho.

Sulfur Dioxide Sampler

A sulfur dioxide monitoring station was in service at the intersection of Van Buren Boulevard and U.S. Highway 20/26 during the third quarter. The analyzer is designated as an equivalent method by EPA.

The mean SO_2 concentration measured during the quarter was 0.48 ppb (1.3 $\mu g/m^3$). This concentration is 1.6% of the annual primary air quality standard. The maximum daily mean SO_2 concentration during third quarter was 1.3 ppb (3.5 $\mu g/m^3$), or 1.0% of the 24-hour primary ambient air quality standard, on August 20. The maximum 3-hour mean SO_2 concentration of 1.7 ppb (4.6 $\mu g/m^3$), on September 28, was 0.4% of the secondary air quality standard.

Weekly performance checks were made by testing the SO_2 analyzer response to purified air and to air with a known concentration of SO_2. Valid data were collected during 90% of the hours in the quarter.

WATER SAMPLING

Production Wells

NOTE: DOE Order 5400.1 recommends the use of units of μCi/mL for concentrations of radionuclides in water. However, 40 CFR 141 states standards in units of pCi/L. For the convenience of readers of this report, concentrations in the Water Sampling section are given with exponents which allow easy conversion to the EPA units:
1 E-9 μCi/mL = 1 pCi/L
1 E-6 μCi/mL = 1000 pCi/L.

Each month, contractor personnel collect water samples from production wells that are in use. These samples are then analyzed by ACB. Figures B-1 and B-2 show most well locations. Gross alpha activity was detected in 16 of the 78 production well samples collected during the third quarter. Detectable concentrations were all near the minimum detectable concentration shown in Table 1, ranging from 2.1 ± 1.0 E-9 μCi/mL (7% DCG) to 2.8 ± 1.3 E-9 μCi/mL (9% DCG). Gross beta activity was reported in only 1 of the 78 samples at a concentration of 5 ± 2 E-9 μCi/mL (5% DCG) or less. Examination of the data for trends with time or geographic location revealed no clear patterns. It is probable that the detectable gross alpha and gross beta activities in the water samples were due to statistical variations in analyses and/or to natural radionuclides derived from rocks that make up the aquifer.

CFA

The tritium concentrations for CFA production wells (CFA-1 and CFA-2 in Figure B-1) are plotted in Figure B-3. As described in the Second Quarter 1991 report, samples from December 1989 through May 1991 did not come from CFA #1 but came instead from the distribution system (consisting mostly of water from CFA #2). EG&G resumed sampling CFA #1 in June 1991. Since October 1991, however, concentrations of tritium in samples from CFA #1 and CFA #2,

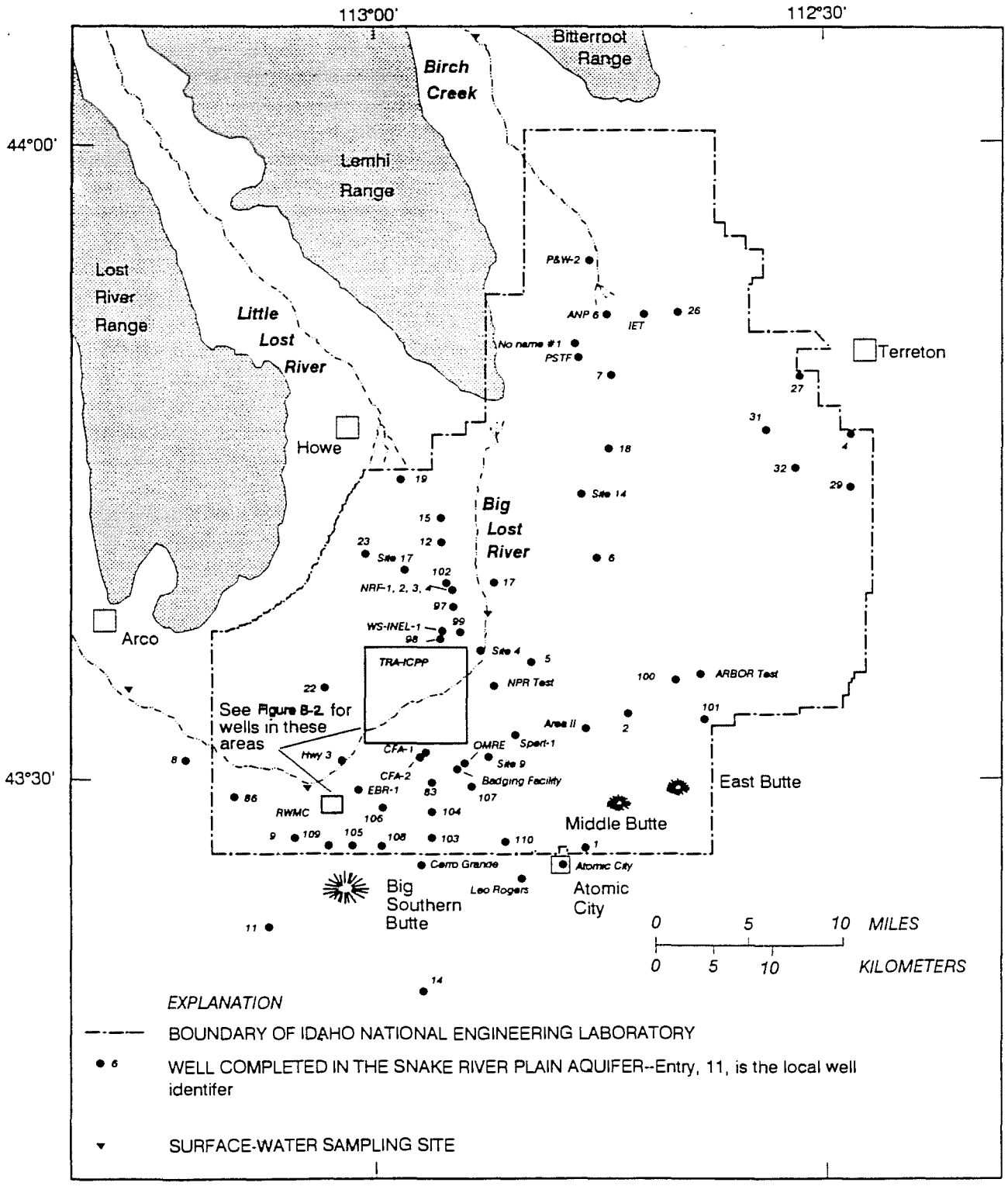

Figure B-1. USGS Well Locations for the INEL Site and Vicinity

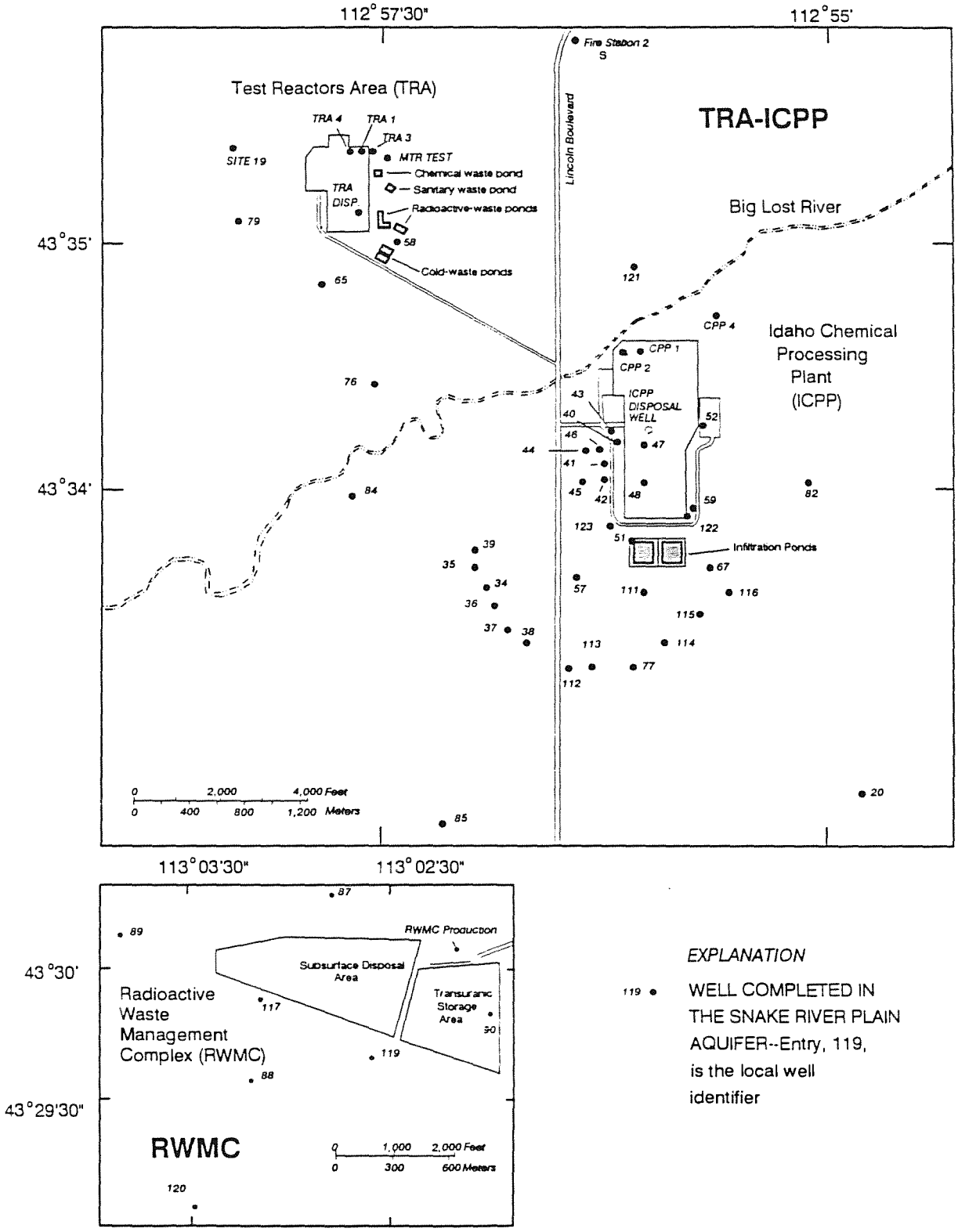

Figure B-2. USGS Detailed Sample Location Map for ICPP, TRA, RWMC

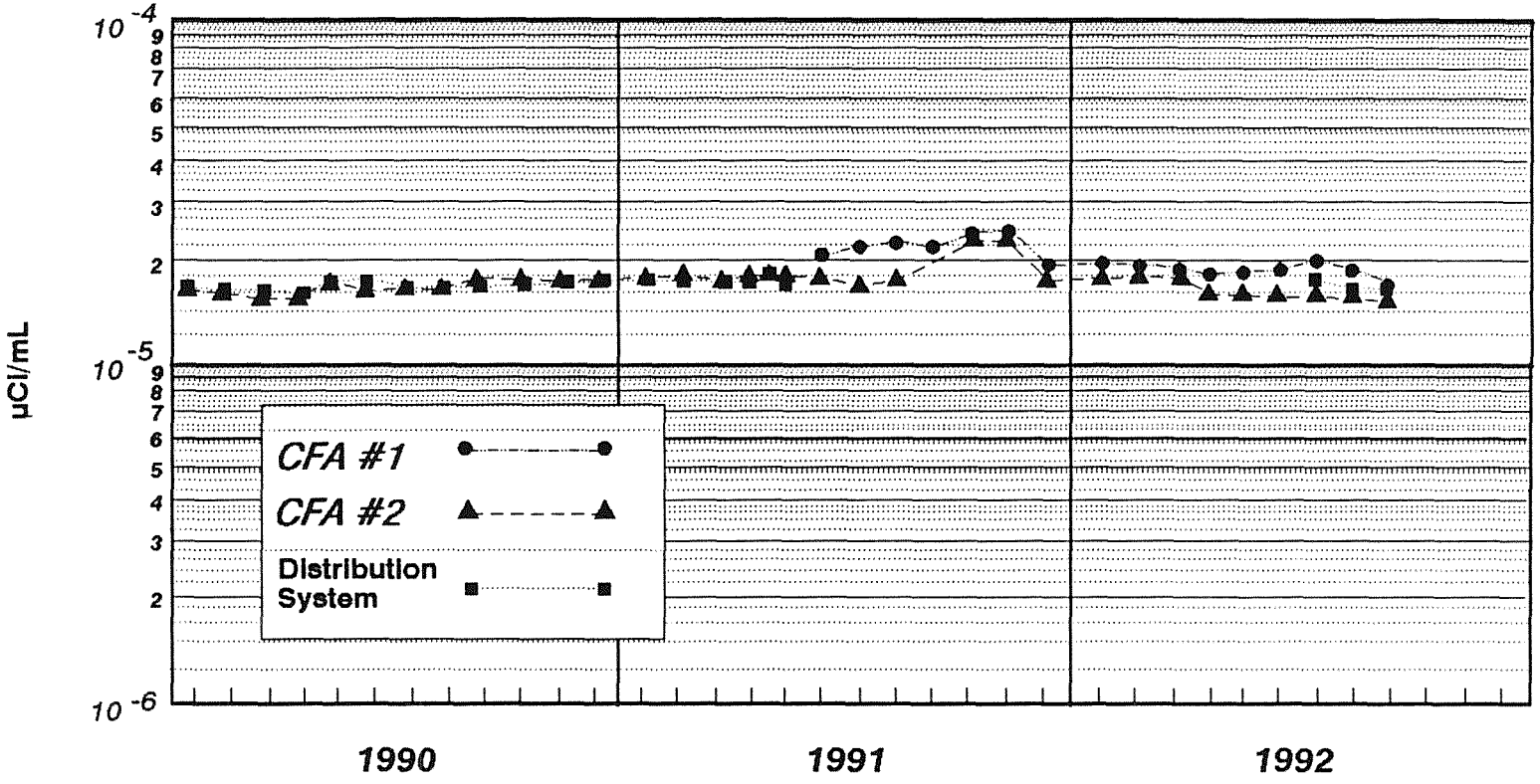

Figure B-3. Tritium Concentrations in CFA Production Wells

have not been at expected levels. Detailed examination of the plumbing, valves, and sampling ports for the two wells as well as pump tests conducted in October 1992 provided no explanation for the concentration changes.

In the third quarter, the mean tritium concentration in water from well CFA #1 was 18.4 E-6 μCi/mL (0.9% DCG), about the same as in the second quarter but lower than pre-1992 measurements. Third quarter samples from CFA #2 had a mean tritium concentration of 15.2 E-6 μCi/mL (0.9% DCG), lower than in the second quarter. EG&G began sampling the CFA distribution system in July; the mean tritium concentration in the third quarter was 16.7 E-6 μCi/mL (0.8% DCG).

ICPP

The monitoring results for ICPP production wells (CPP 1 and CPP 2 in Figure B-2) are summarized in Figures B-4 and B-5. Well ICPP #2 was sampled in July and September, and well #1 was sampled in August. The tritium concentration in all three samples was below the minimum detectable concentration shown in Table 1. Sr-90 was detected in the August well #1 sample at a concentration of 0.50 ± 0.13 E-9 μCi/mL (0.05% DCG).

The drinking water well, ICPP #4, is sampled each month, and has never shown detectable concentrations of tritium. Strontium-90 was not detected in any of the third quarter samples. The only previously detected Sr-90 concentrations in samples from this well were in April 1985 and February 1991, both at concentrations of 0.8 ± 0.2 E-9 μCi/mL (0.08% DCG).

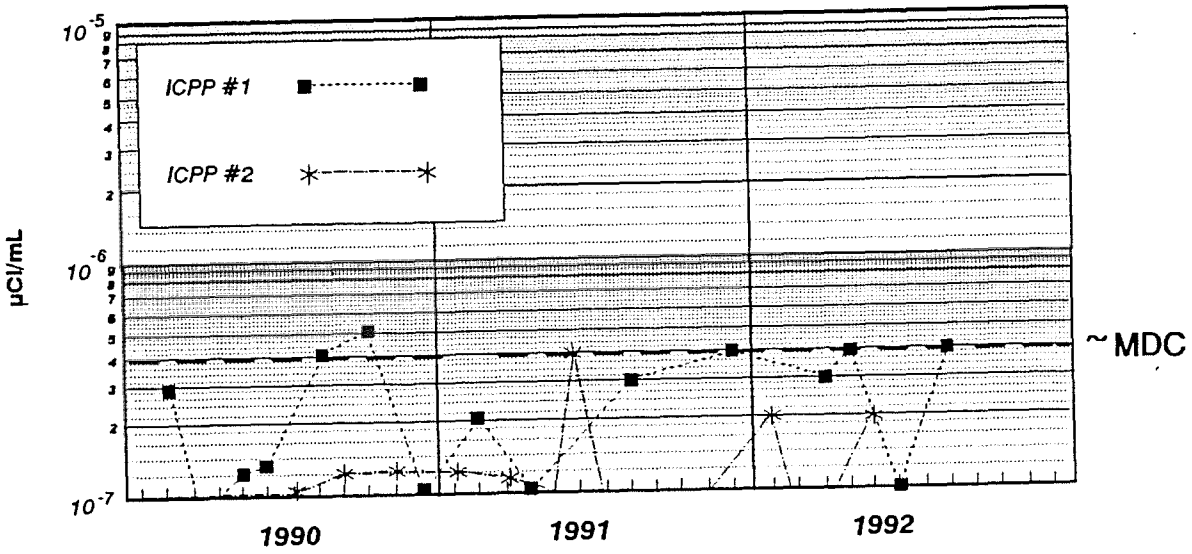

Figure B-4. Tritium Concentrations in ICPP Production Wells

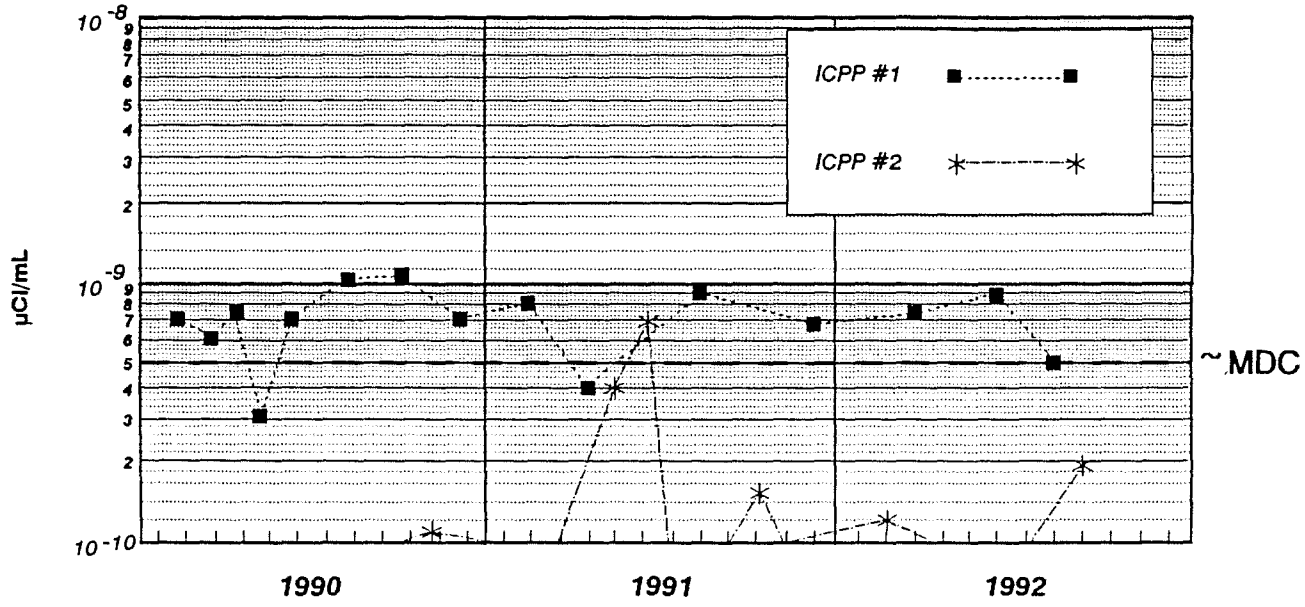

Figure B-5. Strontium-90 Concentrations in ICPP Production Wells

Rifle Range

The PTI Rifle Range is located northwest of CFA about halfway between well #85 and well Highway 3. Third quarter samples had a mean tritium concentration of 4.4 E-6 μCi/mL (0.2% DCG). This concentration is consistent with those reported previously, with the exception of the sample from April 1990 in which the tritium concentration was below the minimum detectable concentration.

RWMC

During the third quarter, the mean tritium concentration in water samples from the RWMC production well was 1.6 E-6 μCi/mL (0.08% DCG), about the same as that measured in the previous quarter.

Observation Wells

The U.S. Geological Survey (USGS) has access to about 300 observation wells and auger holes on or near the INEL Site. About 160 of these are sampled on varied schedules depending on USGS hydrologic studies in progress and on the needs of the environmental surveillance program. USGS personnel measure water levels periodically for an indication of the amount of recharge to the ground-water system and the amount of water in storage in the Snake River Plain aquifer and perched-water bodies. The specific conductance of each sample is measured in the field to provide an indication of dissolved electrolytes at a given location. Other analyses performed are determined by the needs of the USGS in following the movement of specific waste constituent plumes.

Analyses of samples from several observation wells located between CFA and the southern INEL boundary show detectable concentrations of tritium.

Well #106, about 6 km (3.5 mi) north of the southern INEL boundary (Figure B-1), had a tritium concentration of 2.0 ± 0.2 E-6 μCi/mL (0.10% DCG) in the second quarter of 1992. Neither this well nor any of the wells just inside the southern INEL boundary (wells #103, #105, #108, #109, #110) were sampled during the third quarter and these are now on a semiannual sampling schedule. Low concentrations of tritium have been detected in some samples from three of the boundary wells in the past, most recently in third quarter 1986, but tritium from INEL operations has not been detected in water from the nearest offsite wells south of the INEL boundary. For more information on concentrations and movement of tritium in the aquifer, see the USGS report, Tritium in Ground Water at the Idaho National Engineering Laboratory, Idaho: USGS Water-Resources Investigations Report 90-4090, DOE/ID-22090, June 1990.

Results of sample analyses from a few wells around ICPP, TRA, and RWMC are discussed below. Hydrographs are provided for selected wells as an indication of recharge to the aquifer and the amount of water in storage.

ICPP

Since February 1984, ICPP service wastes have been discharged to the ICPP infiltration ponds south of the facility. Well #57, located southwest of the ICPP infiltration ponds, and wells #111 through #116, south of the ponds, are used to monitor the aquifer downgradient from the ponds. Well #40 is used to sample the aquifer about 215 m southwest of the old ICPP disposal well, which was not used for routine discharges after 1984. The disposal well was formally capped in November 1989.

Well #40 was not sampled in the third quarter due to a malfunction in the pump. Water from well #57 contained tritium at a concentration of 22.5 ± 0.6 E-6 μCi/mL (1.2% DCG), similar to the concentration in the second

quarter (Figure C-1). The strontium-90 concentration in well #57 samples has remained about the same in the previous few years, except for sharply lower concentrations reported in the second quarters of 1989 and 1991, and during the current quarter (Figure C-2). The water level measurements in well #40 are shown in Figure C-3. Gamma spectrometric analysis was performed on the third quarter sample from well #50, and no manmade gamma-emitting radionuclides were detected.

The tritium concentration decreased slightly in the well #50 sample (deep perched water), and Figure C-1 indicates that tritium concentrations decreased from 1988 through mid-1989, leveled off during late 1989 and 1990, and may be slowly decreasing again. The Sr-90 concentration in water from this well decreased throughout 1988 and 1989, remained fairly constant during 1990 and 1991, and dropped during the fourth quarter 1991 (Figure C-2). The Sr-90 analytical results were not yet available for this well, but will be reported in the next report. The water level in well #50 is shown in Figure C-4.

Third quarter samples from wells #112 through #116 all contained tritium at concentrations ranging from 6.7 ± 0.3 E-6 μCi/mL to 26.8 ± 0.7 E-6 μCi/mL (0.3% to 1.3% DCG). Strontium-90 was also detected in water from wells #112 and #113 at 34 ± 4 E-9 μCi/mL (3% DCG) and 15 ± 4 E-9 μCi/mL (1.5% DCG), respectively. For more information on waste material plumes, their extent and direction of movement, see the USGS report, Hydrologic Conditions at the Idaho National Engineering Laboratory, 1986 to 1988: USGS Water-Resources Investigations Report 91-4047, DOE/ID-22096, March 1991.

TRA

Tritium, specific conductance, and total chromium levels were measured in water from wells #54, #65 and #A-77. No samples were available from well

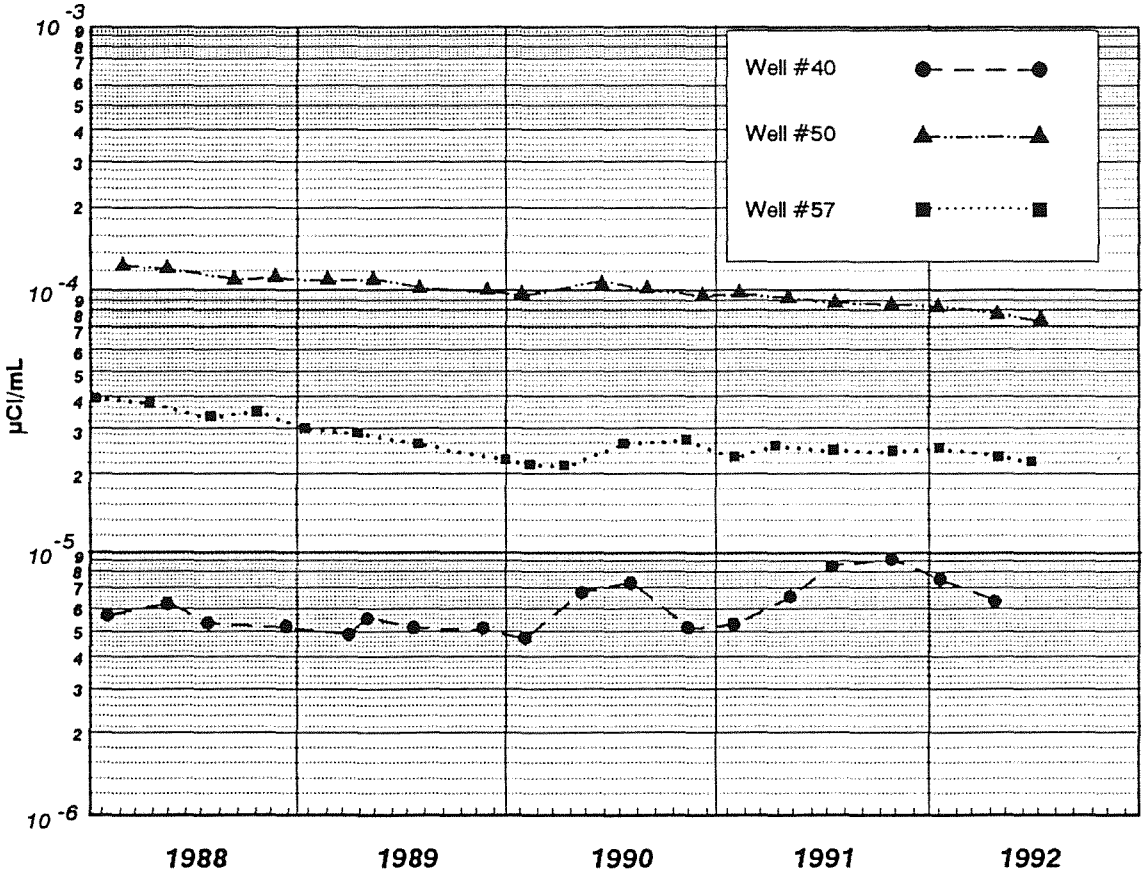

Figure C-1. Tritium in ICPP Area Ground Water

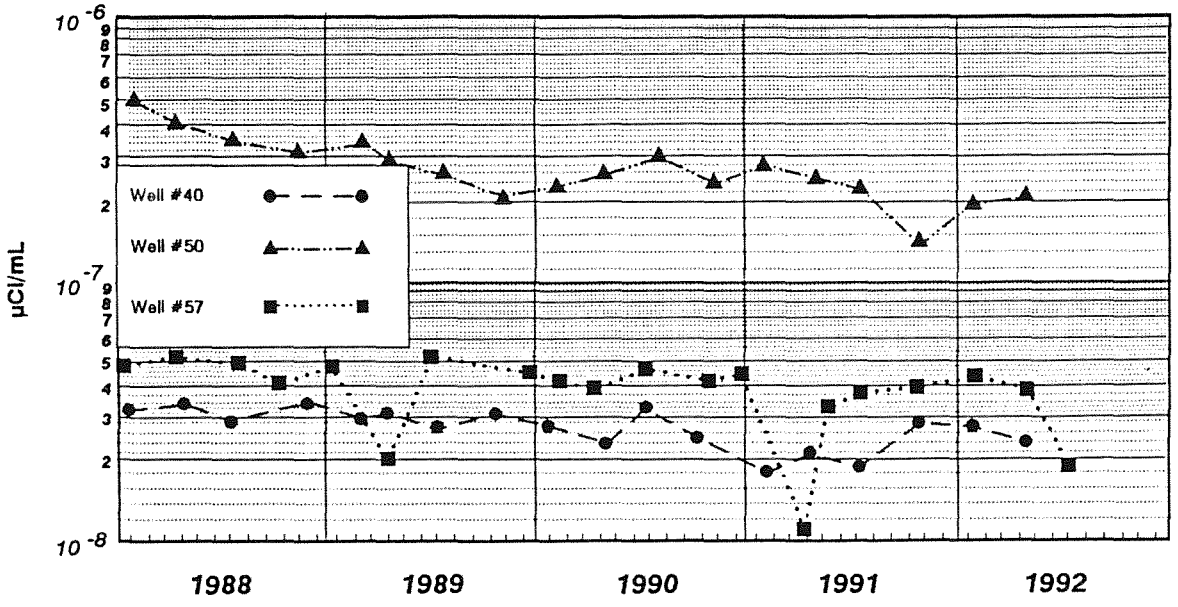

Figure C-2. Strontium-90 in ICPP Area Ground Water

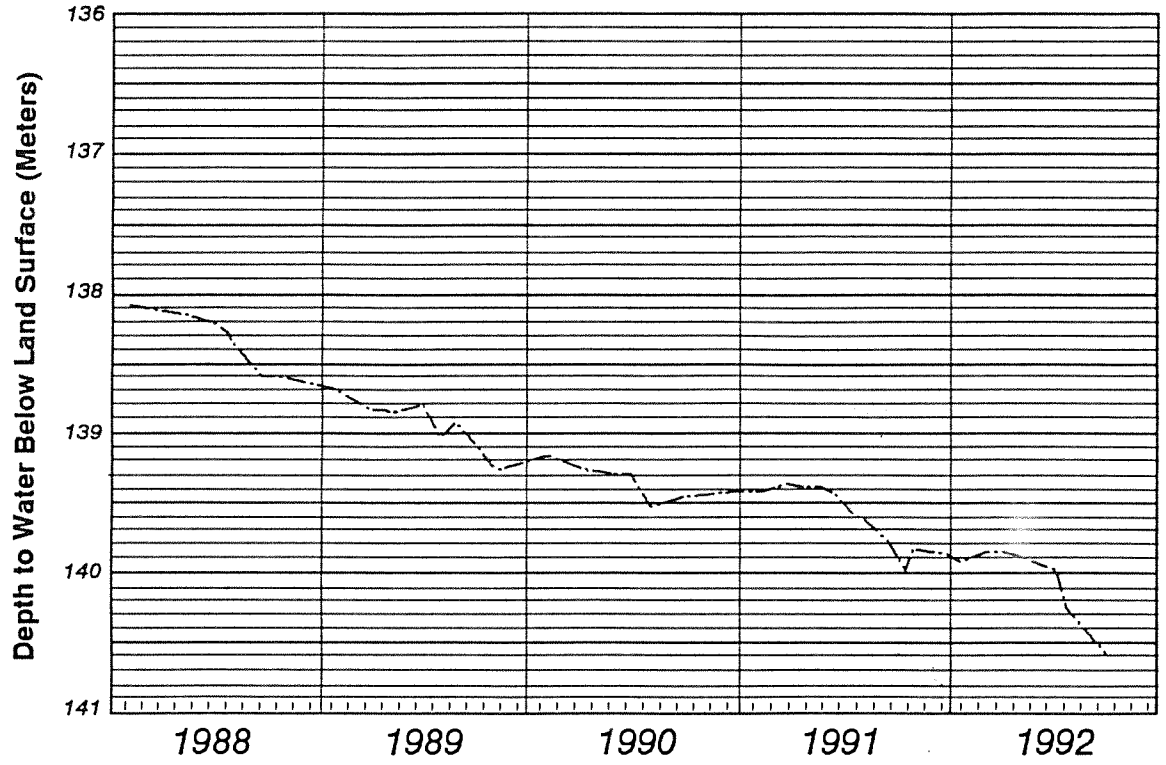

Figure C-3. Hydrograph of USGS Well #40 (Aquifer Ground Water)

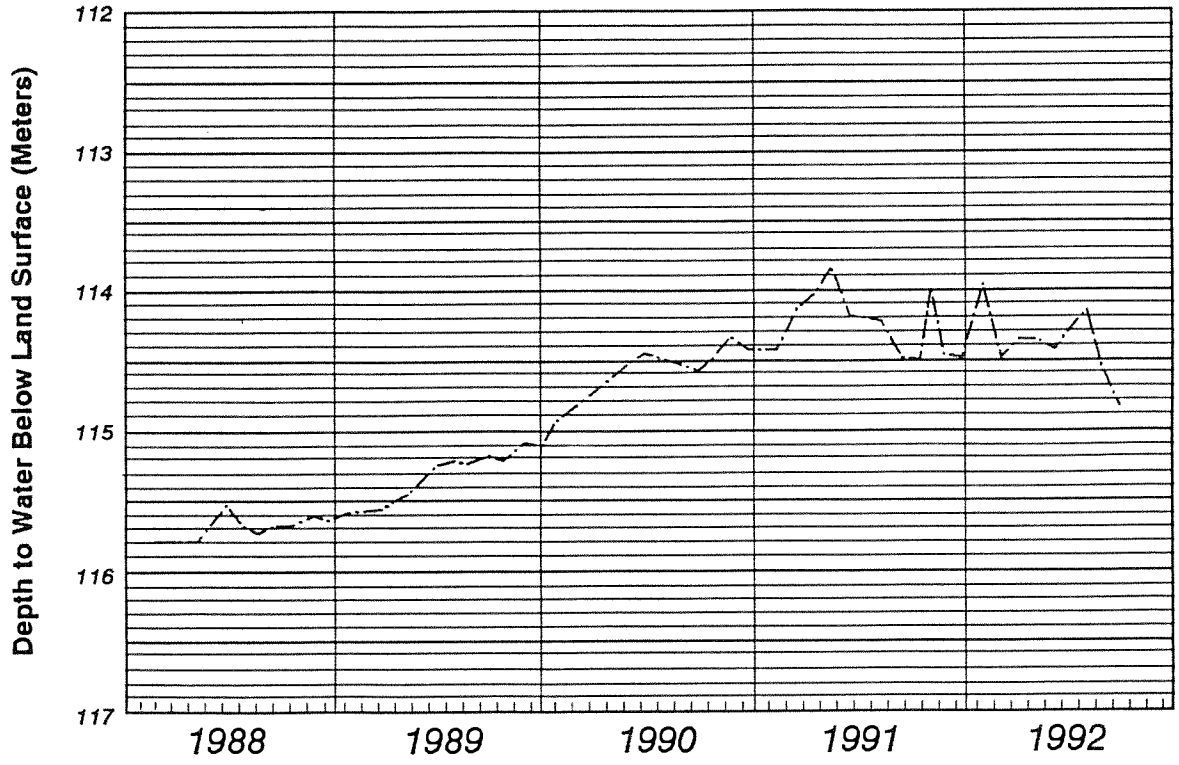

Figure C-4. Hydrograph of USGS Well #50 (Deep Perched)

#A-13 from the third quarter because it was dry. Well #65 is used to sample Snake River Plain aquifer water and well #54 is used to sample a deep perched-water zone. Auger-holes #A-77 and #A-13 penetrate a shallow perched-water zone near the TRA 1964 radioactive infiltration pond and the 1982 nonradioactive infiltration pond. Well #65 and auger-hole #A-77 are used to monitor the downward movement of tritium from the retention basin and the radioactive infiltration pond. Auger-hole #A-77, which is used to sample a shallow perched-water zone below the retention basin, is located near the basin and about 100 m west of the TRA radioactive infiltration pond. The retention basin consists of two rectangular concrete tanks separated by a 30-cm thick concrete wall. The west side of the basin apparently leaks more rapidly than the east side and soon affects the water levels in perched-water bodies. When the side of the retention basin receiving waste fills to a certain level, its pumps are activated and the contents of the basin are discharged to the TRA radioactive waste infiltration pond.

The tritium concentration in water from well #65 has decreased gradually over the last five years (Figure D-1). The concentration measured in the third quarter sample was 34.2 ± 0.8 E-6 μCi/mL (1.7% DCG), down slightly from the previous quarter. Gamma spectrometric analysis was performed on a sample from well #65 and no manmade nuclides were detected.

The tritium concentration in auger-hole #A-77 increased during the third quarter as shown in Figure D-1. Tritium concentrations in samples from #A-77 generally follow the trend of tritium concentrations in discharges from the retention basin to the TRA radioactive waste infiltration pond (Figure D-2). The USGS has begun performing Sr-90 analyses on water from this well. This radionuclide has been detected at concentrations ranging from 1.36 ± 0.04 E-6 to 4.95 ± 0.13 E-6 μCi/mL (136% to 495% DCG) in samples analyzed since the

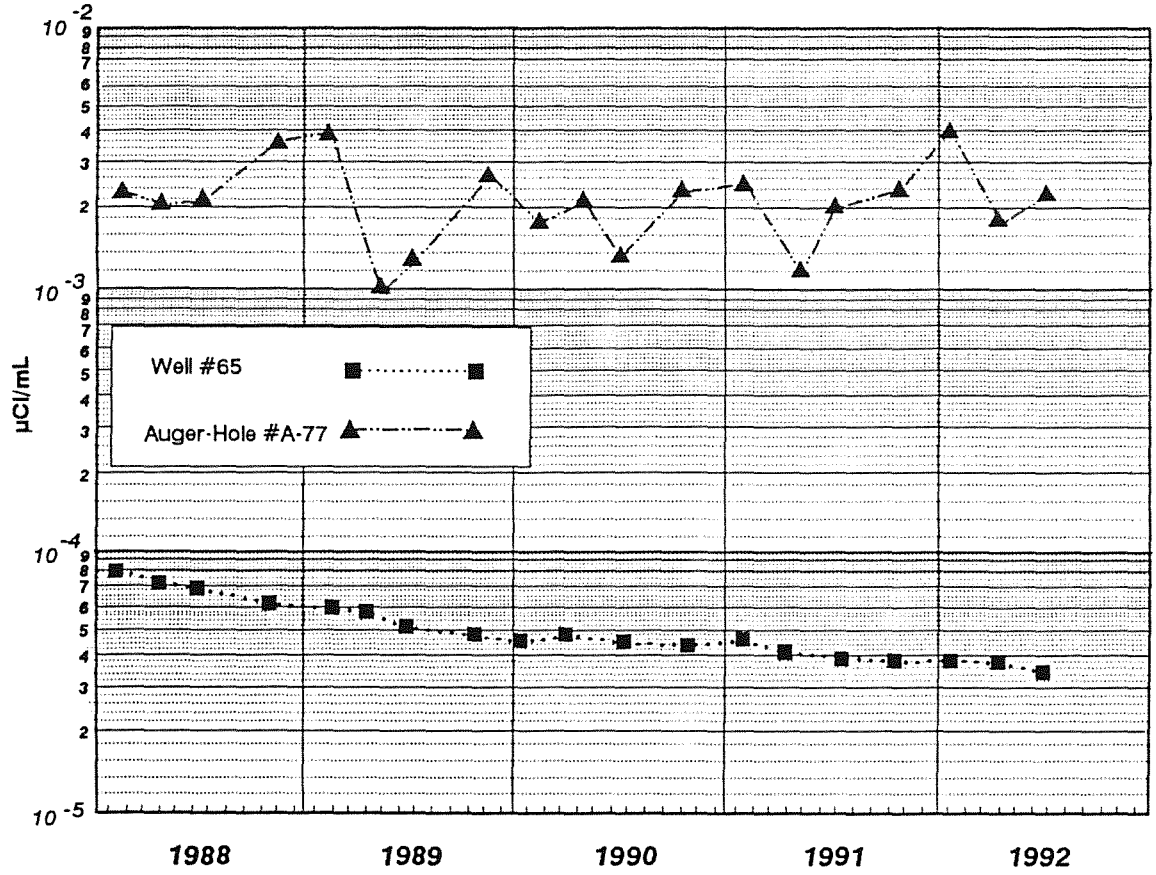

Figure D-1. Tritium in TRA Area Ground Water

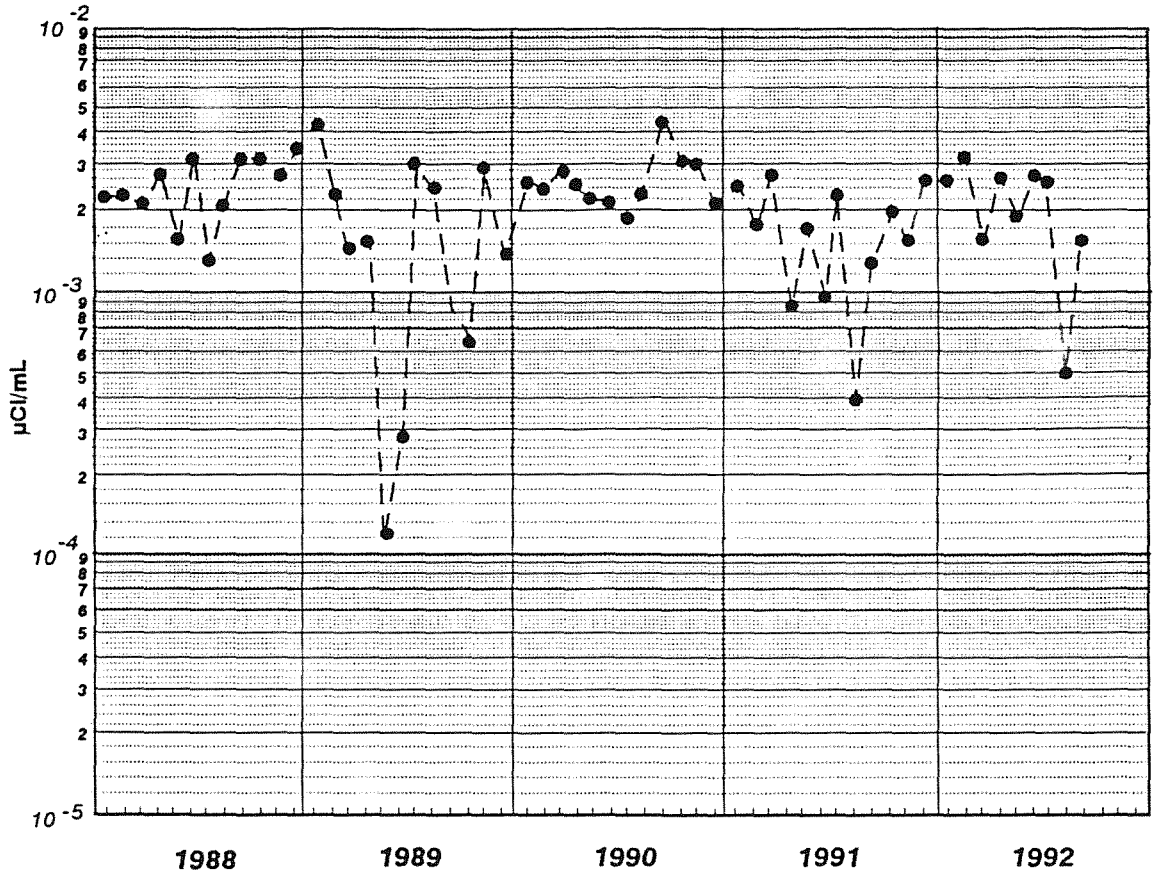

Figure D-2. Tritium Concentration in Discharges to TRA Radioactive Infiltration Pond

beginning of 1991. The concentration measured in the third quarter of 1992 was 2.53 $\pm$ 0.07 E-6 μCi/mL (253% DCG).

Since March of 1983, samples from auger-hole #A-13 and well #54 have generally shown specific conductance at higher levels than in other wells in the area. This is probably due to recharge containing dissolved ions from the nonradioactive infiltration pond reaching the perched water bodies penetrated by these two wells. Over the past few years, specific conductance has been fluctuating in samples from well #54 (Figure D-3); water from well #65 showed a gradual increase until 1989 but has leveled off. Specific conductance in samples from auger-hole #A-77 has generally stayed at about the same level, but showed a fairly substantial increase during the second quarter of 1992.

Figure D-4 shows the chromium concentration of water from wells #65, #A-77, #A-13, and #54, none of which provides water for a drinking water system. (For comparison, the EPA Drinking Water Standard for chromium is 1 E-6 mol/L or 0.05 mg/L). Data shown in Figure D-4 prior to fourth quarter 1989 were measurements of dissolved chromium made by the RESL Analytical Chemistry Branch, whose minimum detectable concentration was 0.05 mg/L. Starting in October 1989, measurements have been made at the USGS Laboratory in Arvada, Colorado. This lab has a reporting level of 0.001 mg/L. Data from October 1989 through April 1990 are of both dissolved and suspended chromium, while measurements after April 1990 are of dissolved chromium only.

Chromium concentrations were below the minimum detectable concentration in well #A-13 from 1985 until the change in analytical laboratories, and have stayed at levels less than 0.05 mg/L since. Well #54 was similarly less than 0.05 mg/L until the first quarter of 1992 when a concentration of 0.06 mg/L was reported. The higher concentration coincides with a lower water level in the well. In the third quarter the chromium concentration was at the RESL MDC

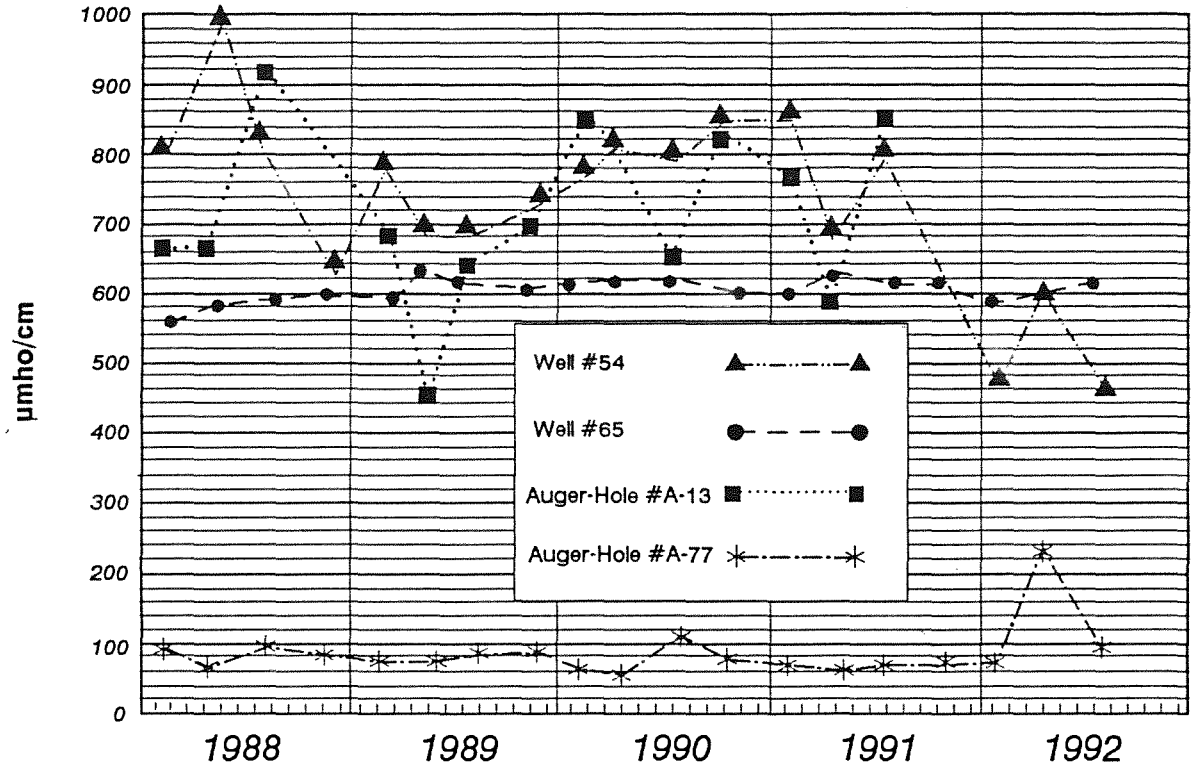

Figure D-3. Specific Conductance in TRA Area Ground Water

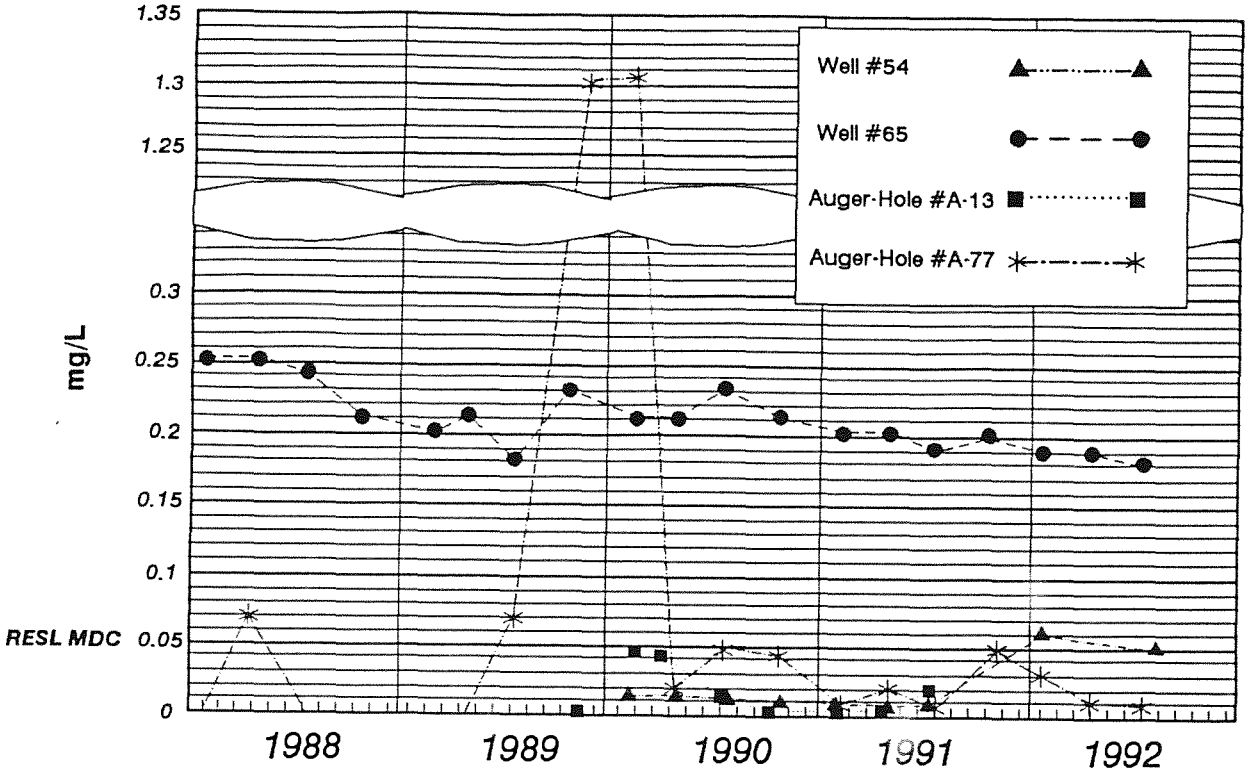

Figure D-4. Total Chromium in TRA Area Ground Water

of 0.05 mg/L. Well #A-77 was only occasionally above detectable levels, generally at 0.06-0.08 mg/L, until October 1989. The increase during October 1989 and January 1990 possibly reflects the inclusion of suspended chromium in the samples, as discussed in previous quarterly reports. Measurements of water from well #65 have remained about the same over the last three years, and a chromium concentration of 0.18 mg/L was reported for the third quarter.

Figures D-5 through D-8 present water levels in these wells plus those of well #58, a regional aquifer well.

Changes in water levels in #A-77 were probably due to operational shifts in liquid waste disposal back and forth between the east side of the retention basin and the faster-leaking west side mentioned earlier. The changes in water levels of #A-13 and #54 are related to discharges made to the nonradioactive infiltration ponds. When the north pond is being used, water levels in #A-13 and #54 rise several meters.

RWMC

The tritium concentrations in water from aquifer wells #87 and #90 and in USGS samples of the RWMC production well are plotted in Figure E-1. Since tritium is rarely detected in wells #88 and #89, data from these wells are not included in Figure E-1. Water levels for wells #87 and #90 are plotted in Figure E-2, and for #88 and #89 in Figure E-3.

Third quarter samples from the RWMC wells were analyzed for gamma-emitting radionuclides, Sr-90, and transuranic elements. No gamma-emitters or Sr-90 were reported in any of the samples measured. The transuranic analyses were not complete at the time of report preparation.

USGS has continued sampling wells at the RWMC for purgeable organic compounds during 1992. Results are consistent with those reported previously

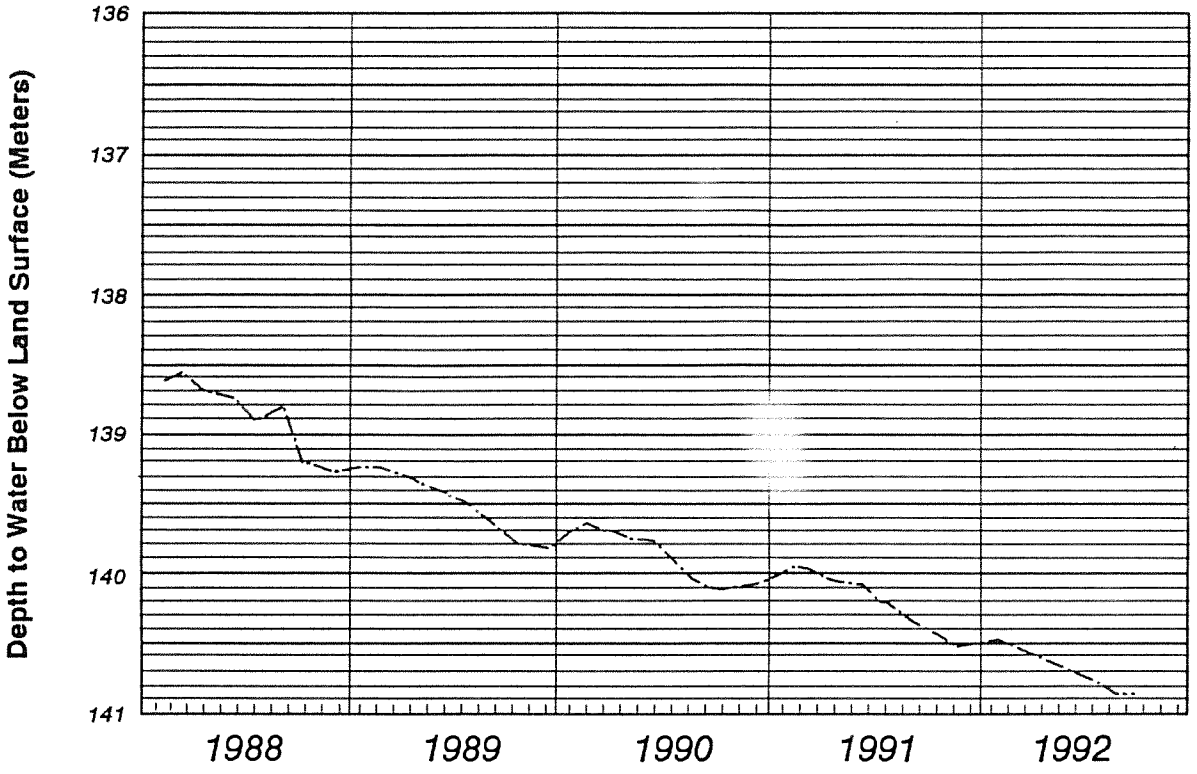

Figure D-5. Hydrograph of USGS Well #58 (Regional Ground Water)

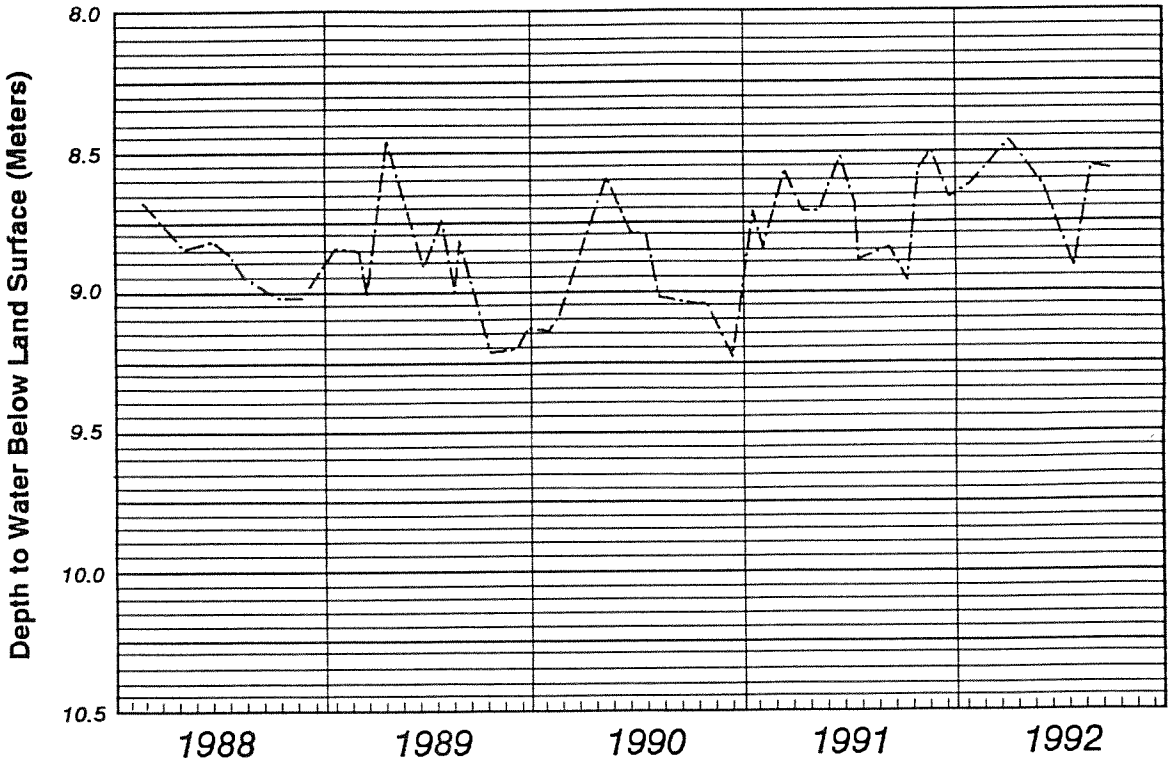

Figure D-6. Hydrograph of Auger Hole TRA #A-77 (Shallow Perched)

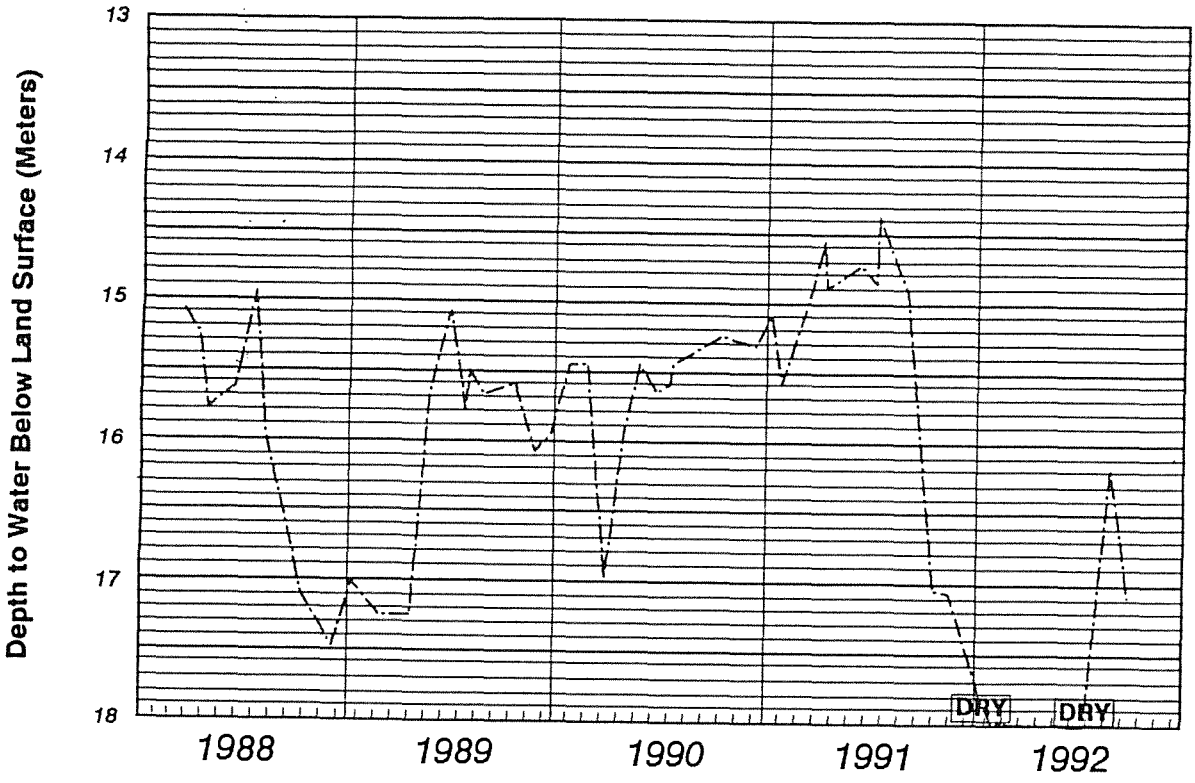

Figure D-7. Hydrograph of Auger Hole TRA #A-13 (Shallow Perched)

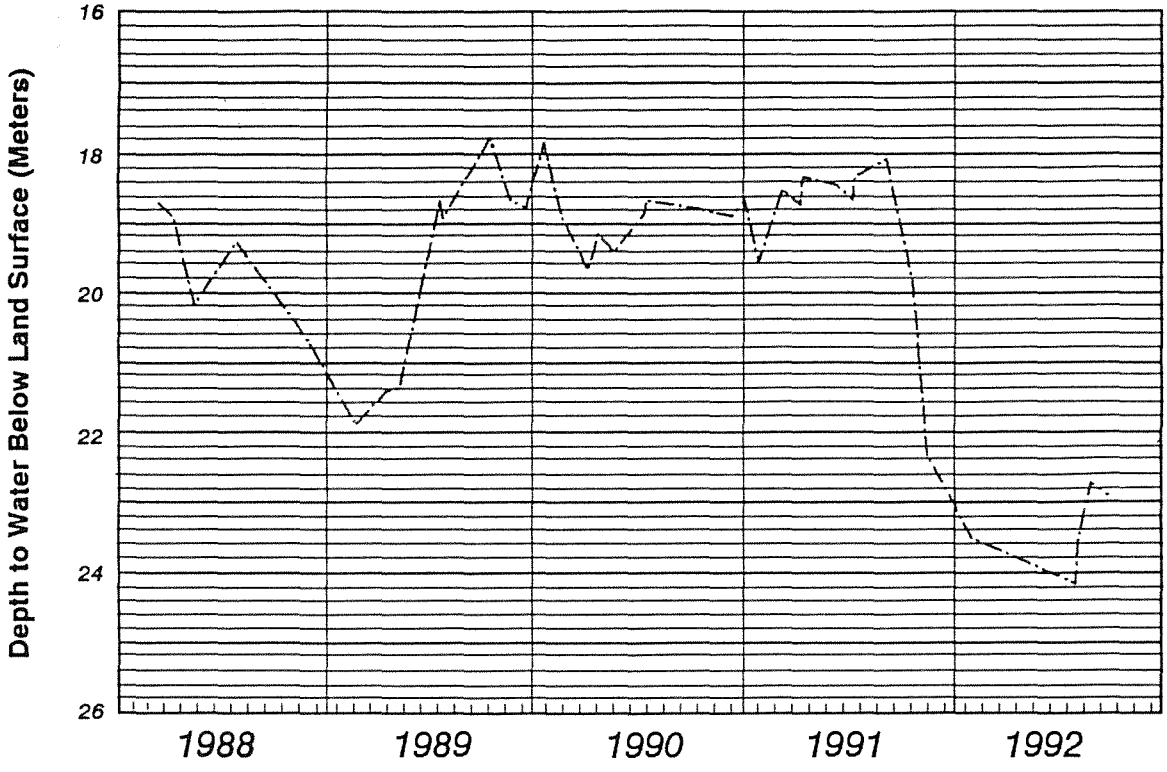

Figure D-8. Hydrograph of USGS Well #54 (Deep Perched)

by USGS. For example, the mean concentration of carbon tetrachloride in three third quarter RWMC production well samples was 1.8 μg/L.

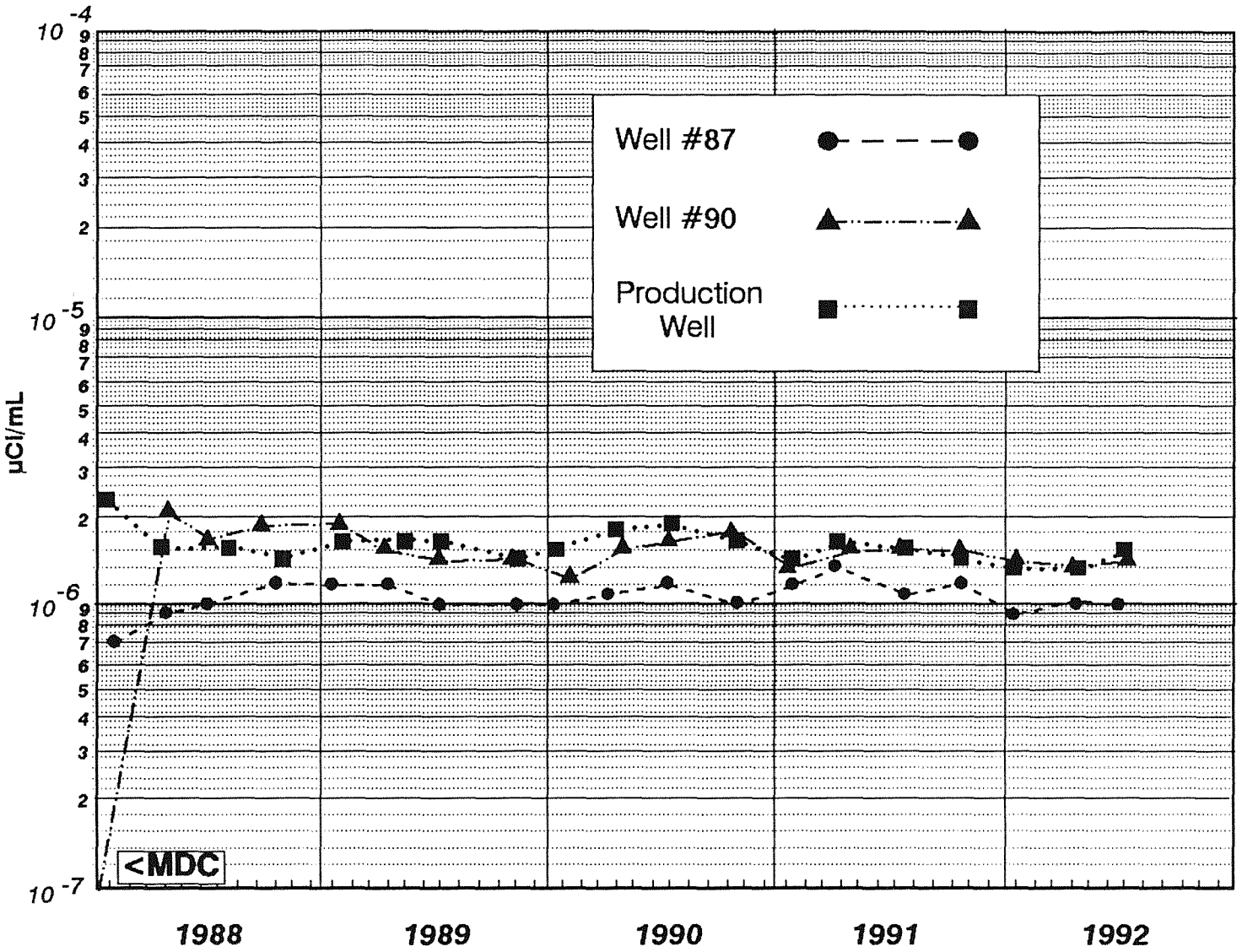

Figure E-1. Tritium Concentrations in RWMC Wells

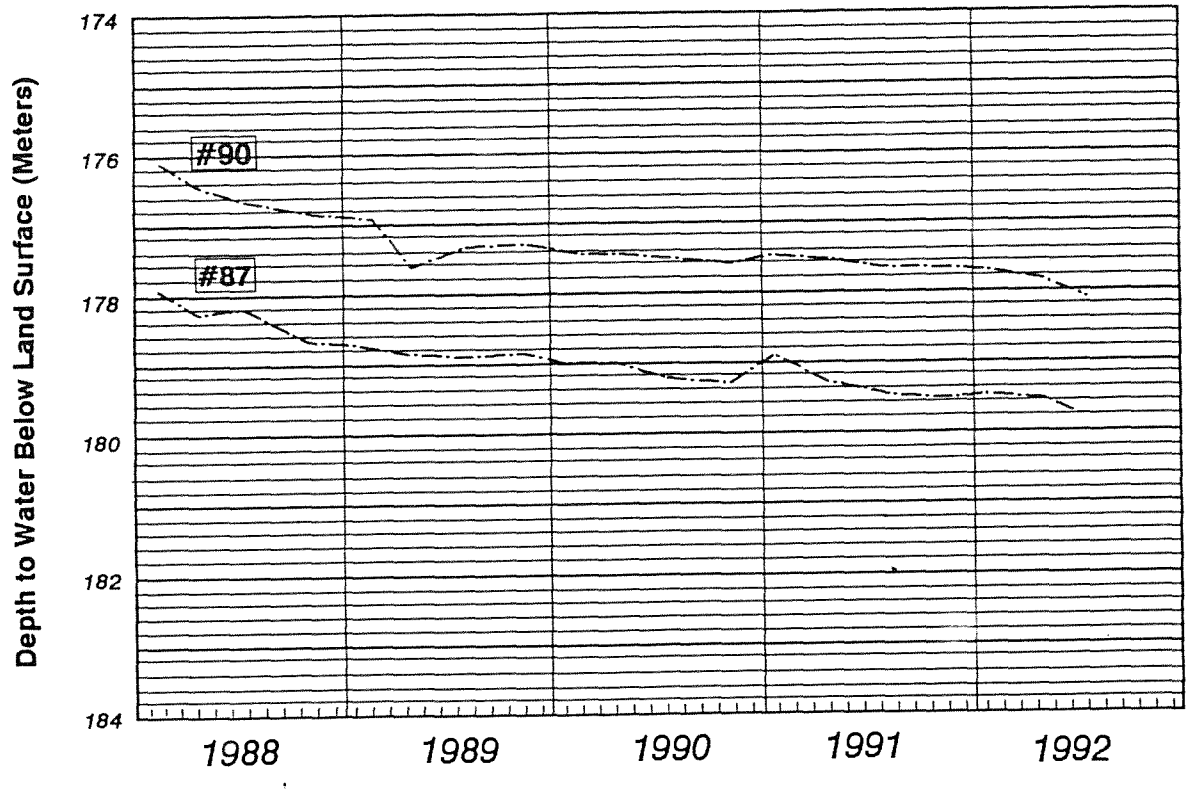

Figure E-2. Hydrographs of RWMC Wells #87 and #90

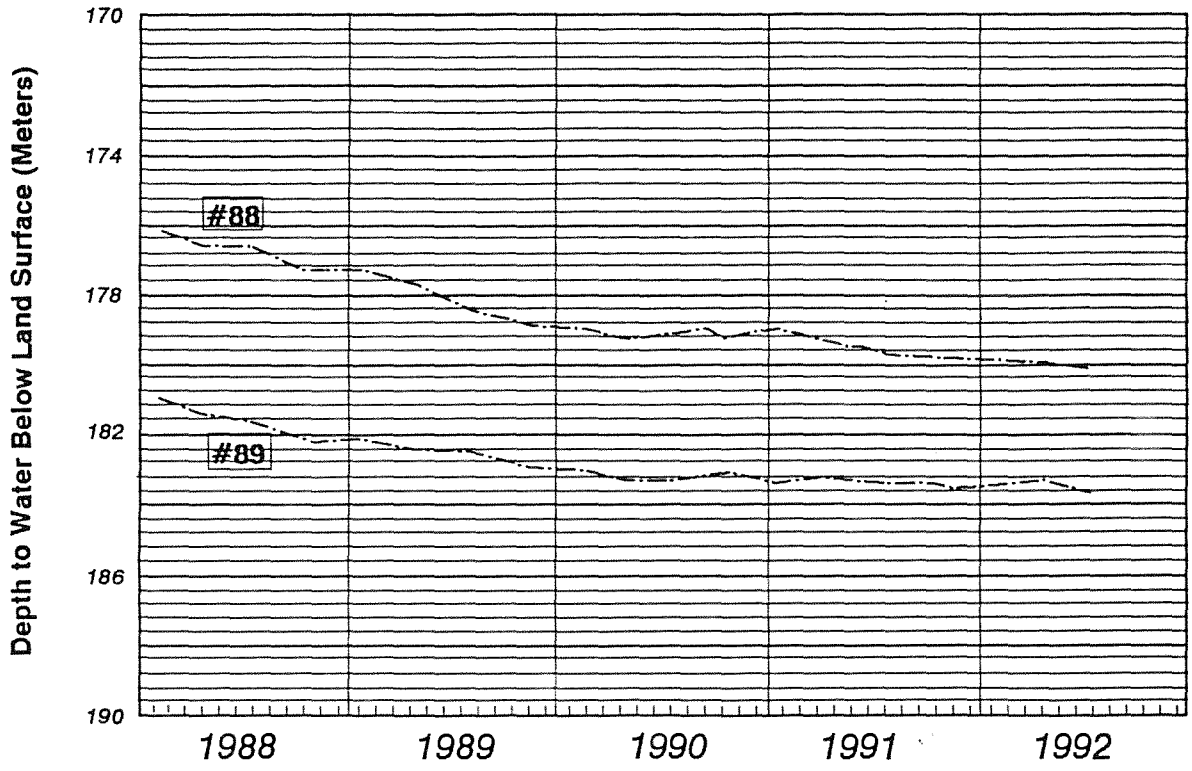

Figure E-3. Hydrograph of RWMC Wells #88 and #89

ENVIRONMENTAL RADIATION

Gamma Radiation Surveys

Direct gamma radiation surveys were conducted around TAN, ICPP, and the CFA Drainfield areas during the third quarter of 1992. Results of these surveys along with results of the same surveys conducted in 1989 are shown in Figures F-1 through F-6.

Additional areas at the ICPP and the CFA Sewage Disposal facility were fenced off as Soil Contamination areas due to pre-existing contamination between 1989 and 1992, and these areas were not surveyed.

At each of the areas surveyed, the 15 to 30 μR/hr field appears slightly larger than in 1989. These fields are similar to or somewhat smaller than those measured in 1986, however. Much of the area designated on these maps as >15 μR/hr was at 16 or 17 μR/hr at the time of the 1992 surveys. The same areas at the time of the 1989 surveys were reading 14 or 15 μR/hr. This variation may be the result of a slight change in the response of the meter used or a small change in ambient background.

Changes in the gamma radiation field on the southwest side of the ICPP are due to changes in the location and amount of radioactive material stored on that side of the facility.

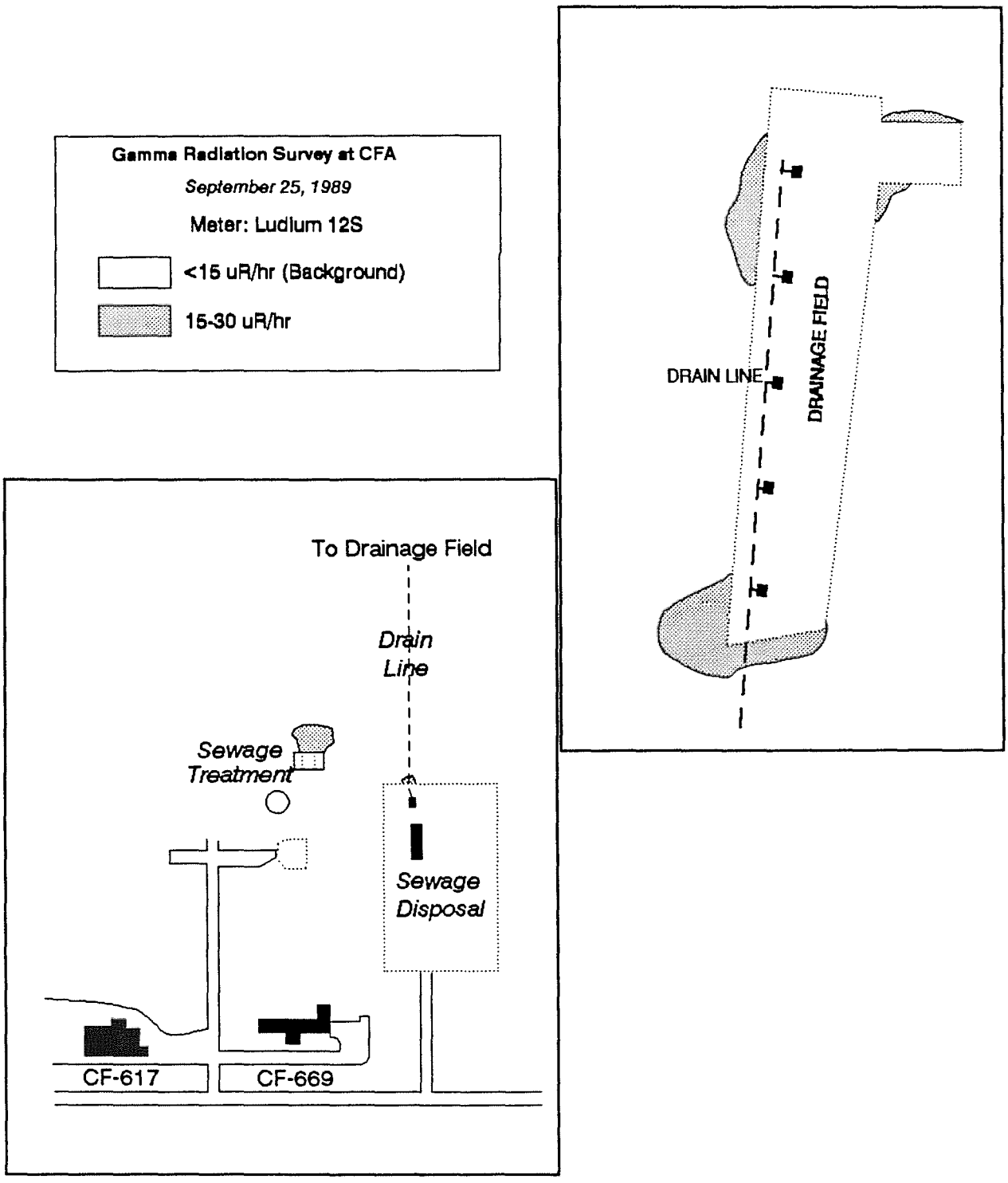

Figure F-1. Gamma Radiation Intensities at CFA Drainfield–1989

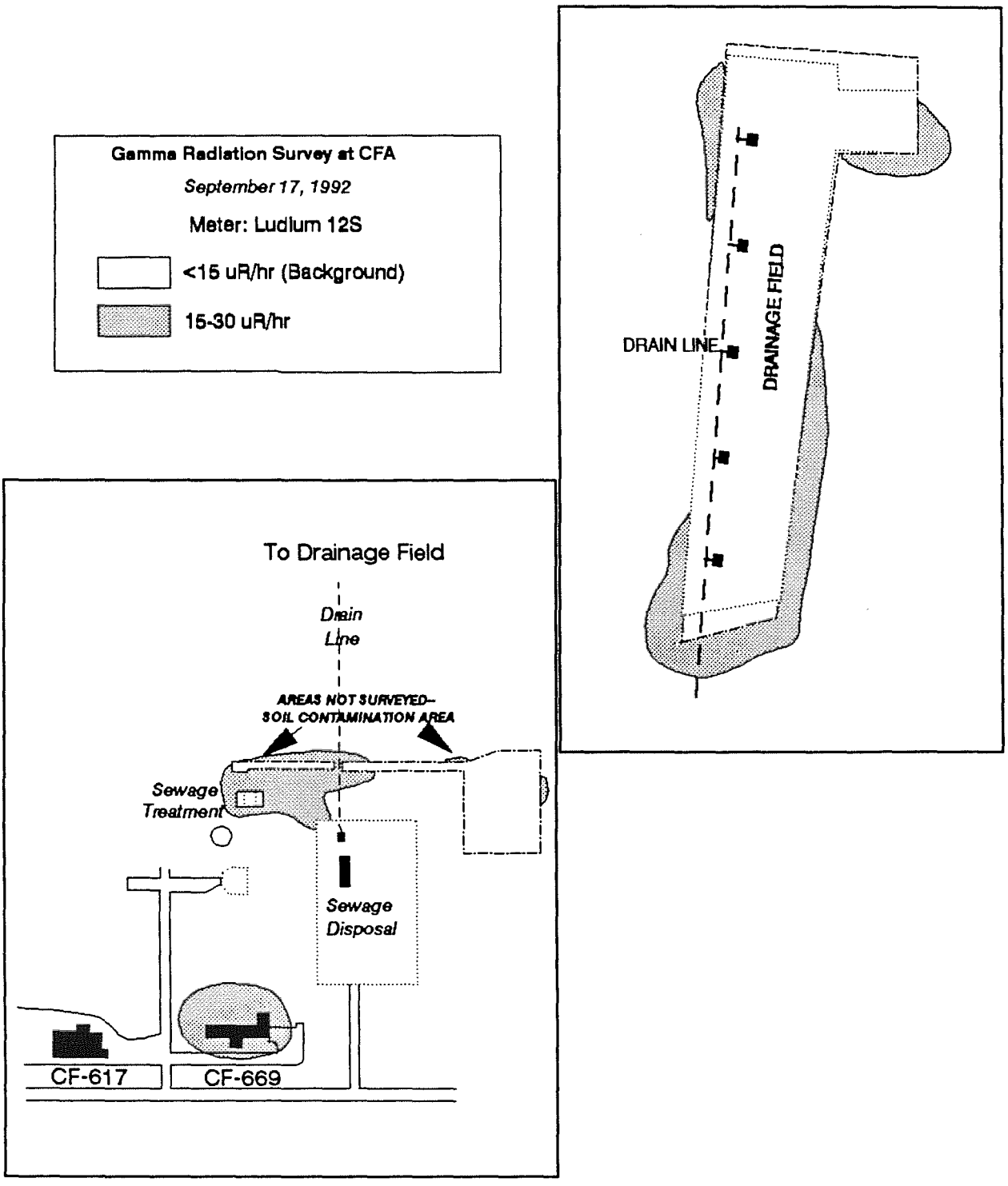

Figure F-2. Gamma Radiation Intensities at CFA Drainfield–1992

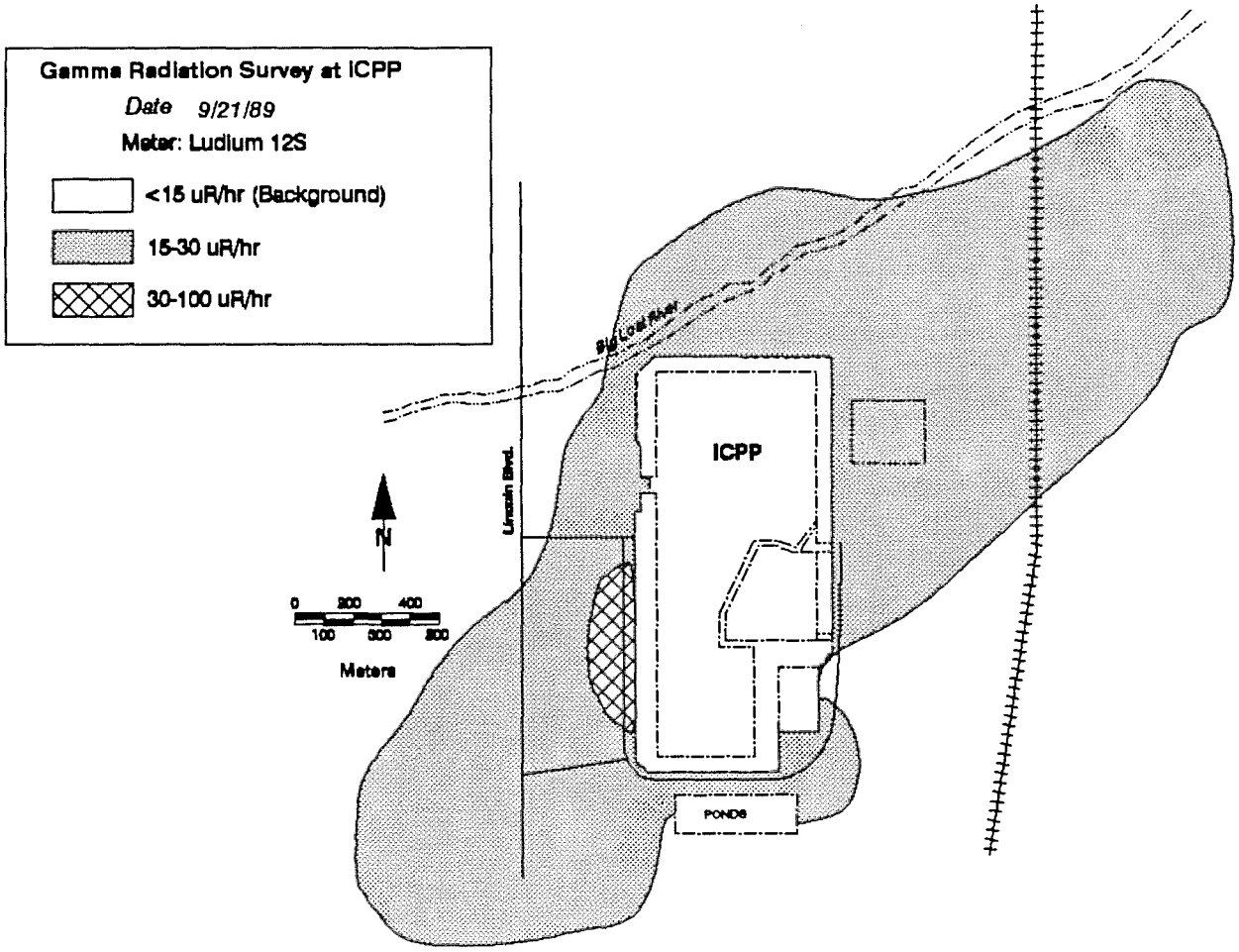

Figure F-3. Gamma Radiation Intensities at ICPP–1989

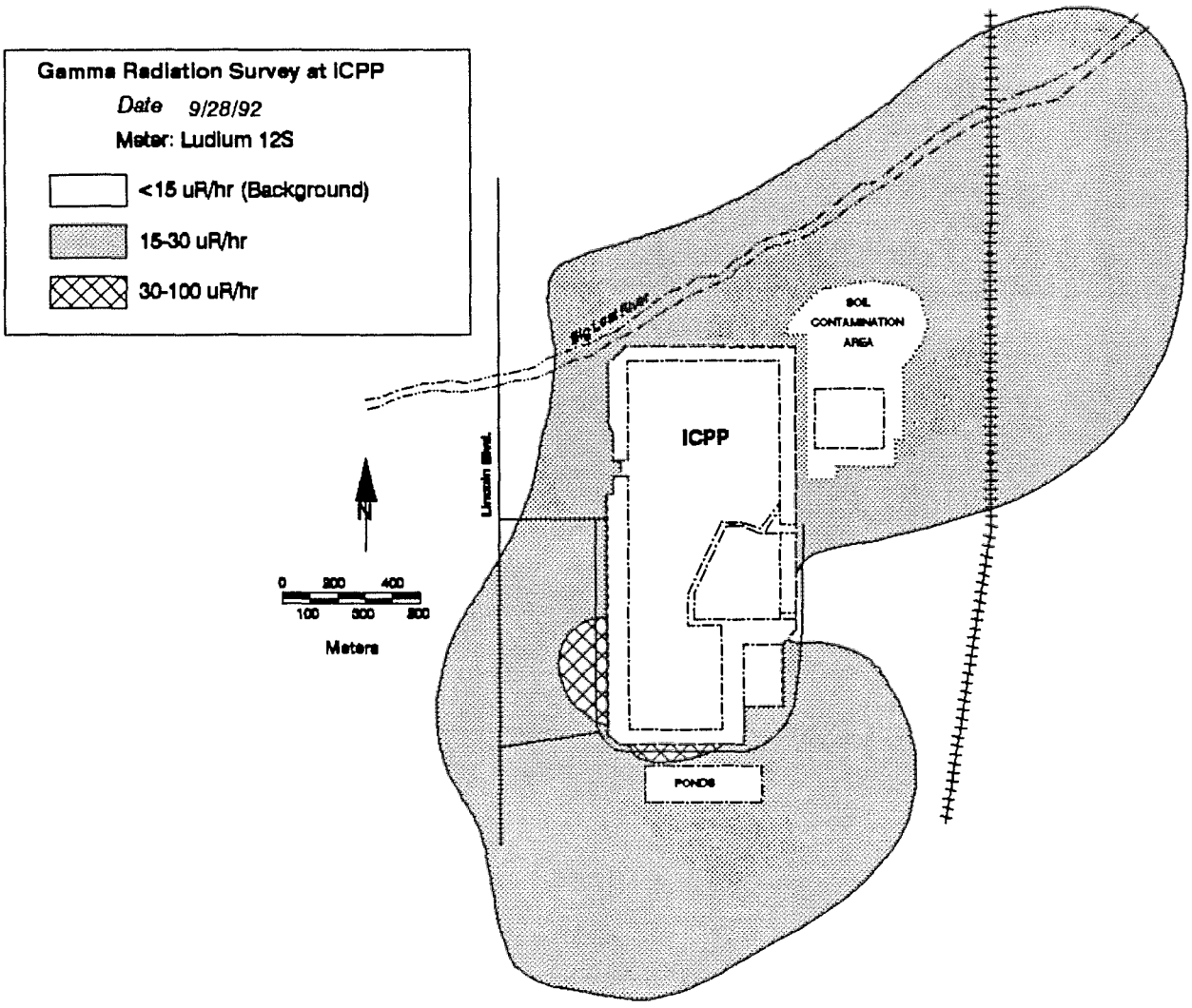

Figure F-4. Gamma Radiation Intensities at ICPP-1992

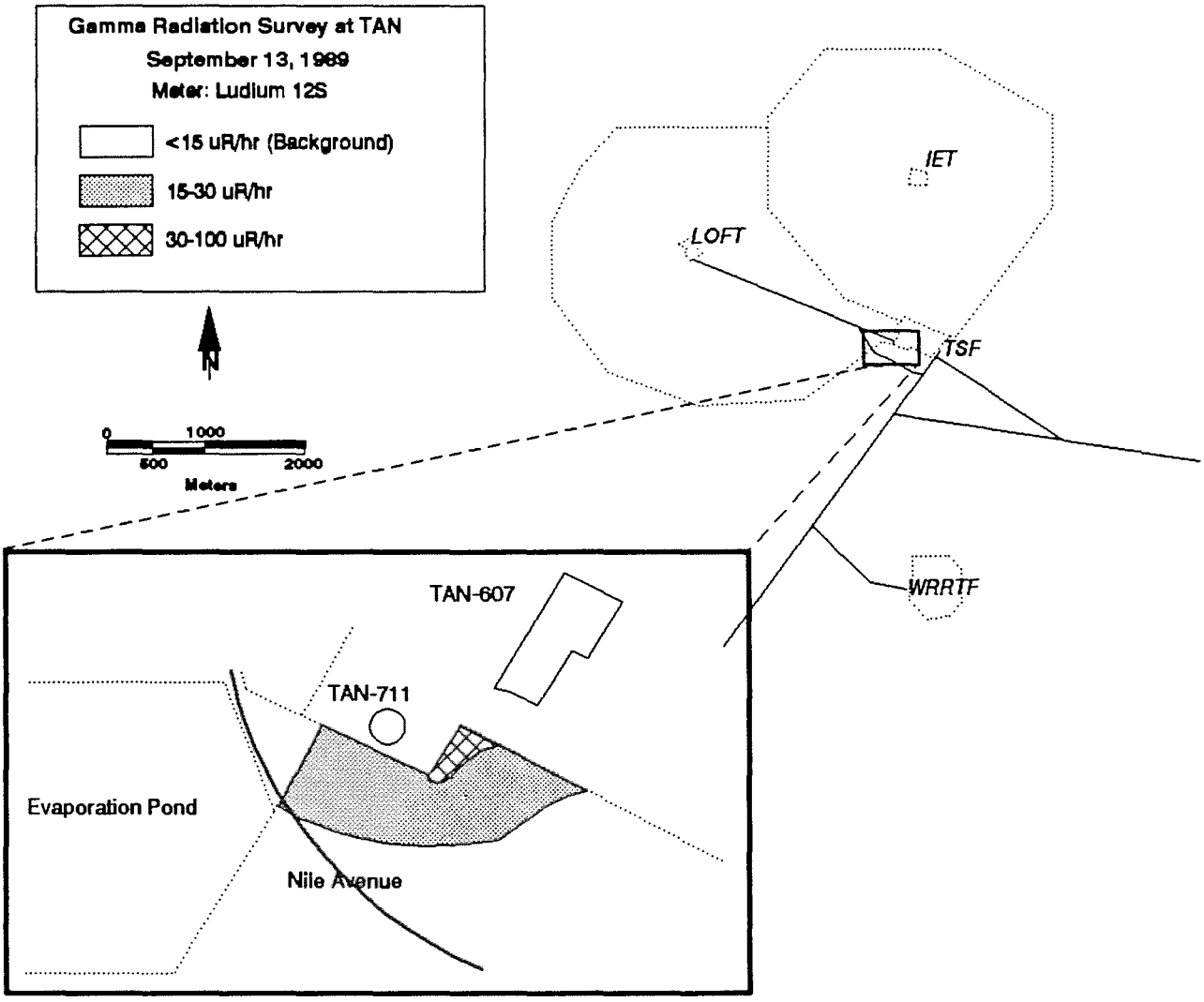

Figure F-5. Gamma Radiation Intensities at TAN-1989

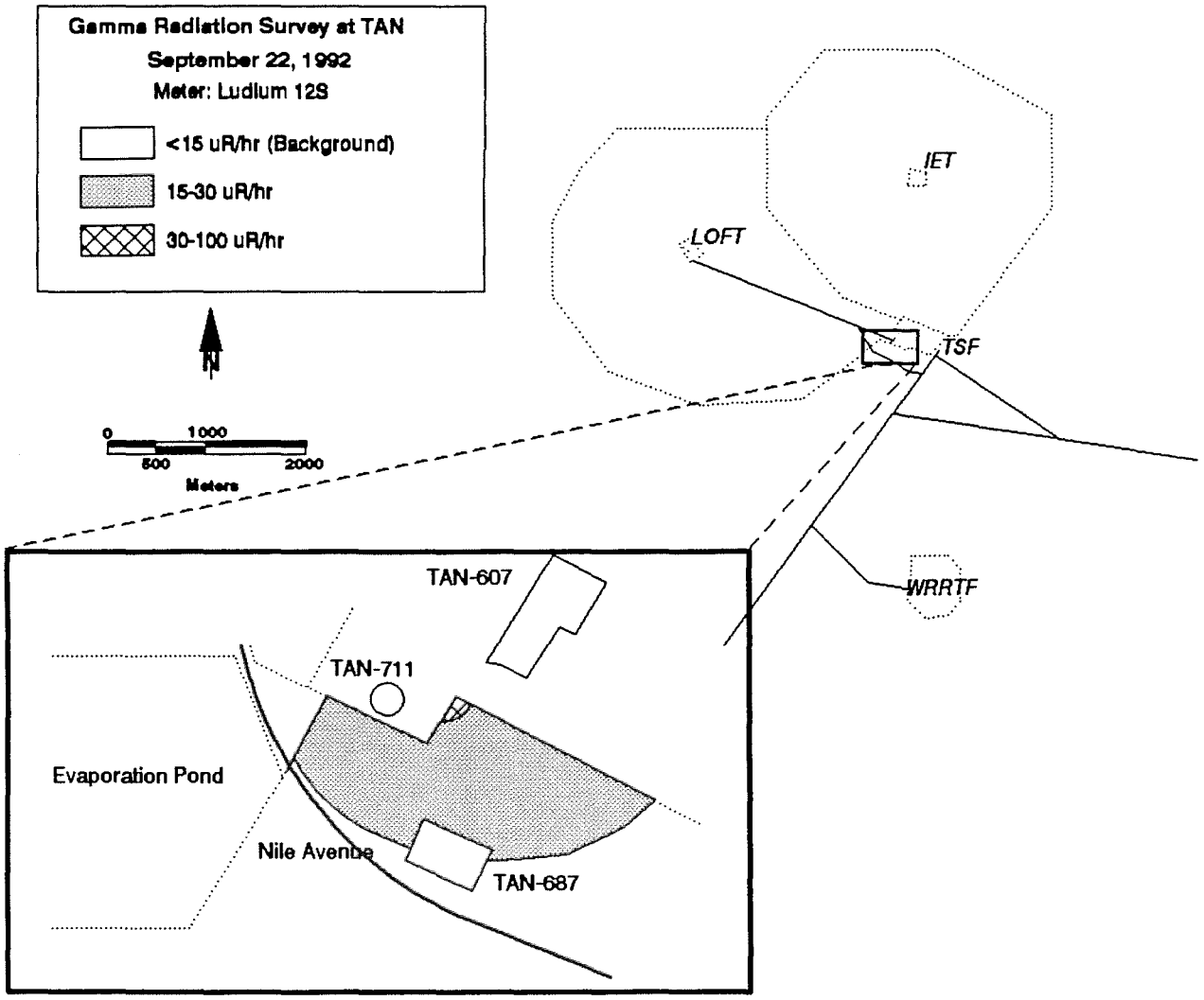

Figure F-6. Gamma Radiation Intensities at TAN-1992