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DOCKET NUMBER 50-483
CALLAWAY PLANT
FACILITY OPERATING LICENSE NPF-30
1996 ANNUAL ENVIRONMENTAL OPERATING REPORT

Please find enclosed the 1996 Annual Environmental Operating Report for the Callaway Plant. This report is submitted in accordance with Section 6.9.1.6 of the Technical Specifications and Appendix B to the Callaway Plant Operating License.

Very truly yours,

Alan C. Passwater
Manager, Licensing and Fuels

BFH/plr
Enclosure

COO1/1

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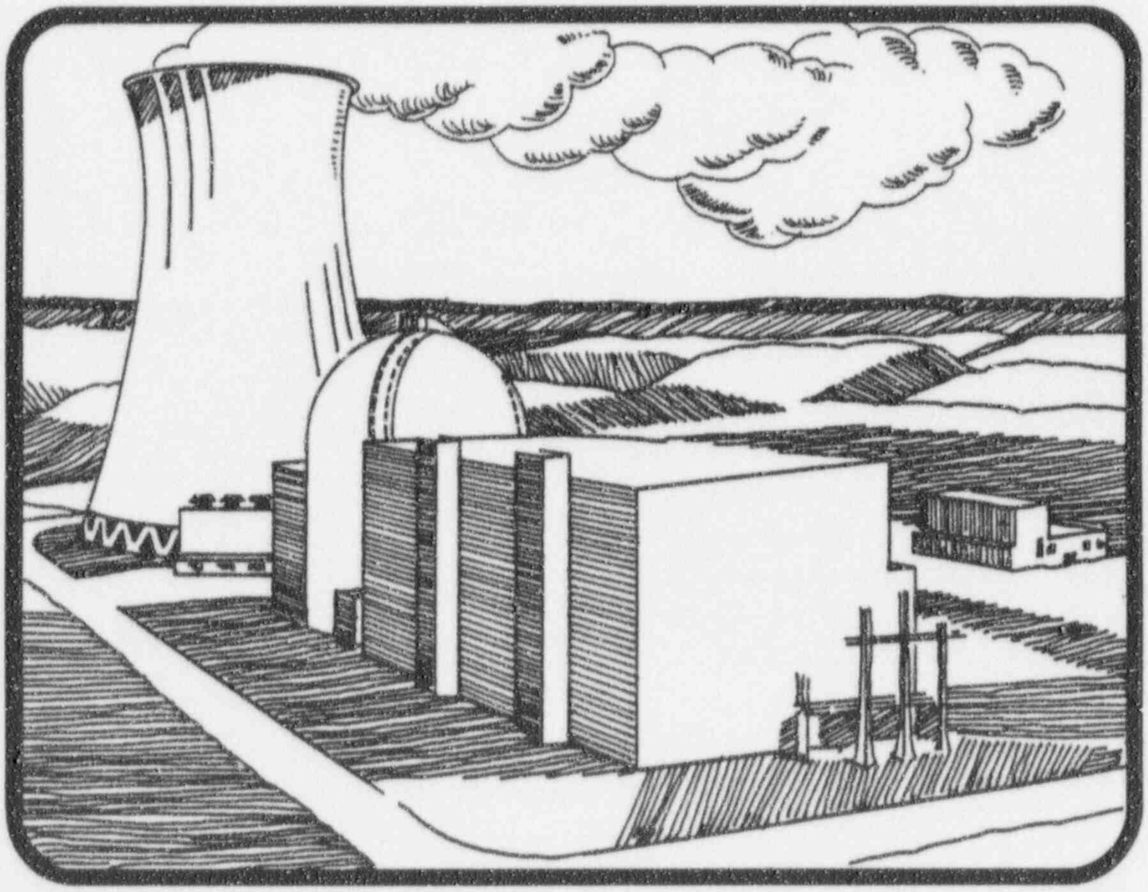
CALLAWAY PLANT

ANNUAL ENVIRONMENTAL OPERATING REPORT

1996



DOCKET NO. 50-483

UNION ELECTRIC

CALLAWAY PLANT

ANNUAL ENVIRONMENTAL OPERATING REPORT

1996

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UNION ELECTRIC

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1.0 INTRODUCTION

The Callaway Plant received an Operating License on June 11, 1984. This report presents analytical data from the environmental monitoring programs with appropriate interpretation for 1996 and environmental evaluations for plant modifications completed during 1996.

The third section of this report summarizes and interprets results of the radiological environmental monitoring program conducted in accordance with Administrative Procedure APA-ZZ-01003, 'OFFSITE DOSE CALCULATION MANUAL", Section 9.11.

Section four describes the conduct and results of the activities associated with the Environmental Protection Plan (EPP) contained in Appendix B to the Callaway Plant Operating License.

This Annual Environmental Operating Report is submitted in accordance with Section 6.9.1.6 of the Technical Specifications and Appendix B to the Callaway Plant Operating License.

2.0 CONCLUSION

The third section of this report contains results of radiological environmental monitoring conducted in the vicinity of the Callaway Plant during 1996. Comparison of results for 1996 to preoperational data and data from previous years of operation showed no significant or adverse effects from operation of Callaway Plant on the environment.

There were no Environmental Protection Plan noncompliances or reportable events identified during 1996.

There were no plant modifications completed during 1996 with an unreviewed environmental question as discussed in section four of this report.

SECTION 3.0

RADIOLOGICAL
ENVIRONMENTAL MONITORING

UNION ELECTRIC COMPANY

ST. LOUIS, MISSOURI

CALLAWAY PLANT

SECTION 3.0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL REPORT

1996

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TABLES

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Abstract

This report presents the Callaway Plant Radiological Environmental Monitoring Program (REMP) data obtained from analysis of environmental samples collected in 1996.

Evaluation of radiation levels in the environs around Union Electric Company's (UEC) Callaway Plant involved sampling at strategic points in various exposure pathways. The following types of samples were collected and analyzed: milk, vegetation, surface water, well water, bottom sediment, shoreline sediment, fish, airborne particulates, airborne radioiodine, direct radiation (TLD), soil and wetlands.

Analytical results are presented and discussed along with other pertinent information. Possible trends and anomalous results, as interpreted by Union Electric Company personnel, are discussed.

1.0 INTRODUCTION

This report presents an analysis of the results of the REMP conducted during 1996 for Union Electric Company, Callaway Plant.

In accordance with federal and state regulations and the desire to maintain the quality of the local environment, UEC began its radiological monitoring program in April, 1982.

The objectives of the REMP are to monitor potential critical pathways of radioeffluent to man and determine the radiological impact on the environment caused by operation of Callaway Plant.

Callaway Plant consists of one 1239 MWe pressurized water reactor, which achieved initial criticality on October 2, 1984. The plant is located on a plateau approximately ten miles southeast of the City of Fulton in Callaway County, Missouri and approximately eighty miles west of the St. Louis metropolitan area. The Missouri River flows by the site in an easterly direction approximately five miles south of the site at its closest point.

2.0 RADIOLOGICAL ENVIRONMENT MONITORING PROGRAM

2.1 Program Design

The purpose of the operational REMP at Callaway Plant is to assess the impact of plant operation on the environment. For this purpose, samples are collected from waterborne, airborne, ingestion and direct radiation pathways. Sampling media are selected which are likely to show effects of plant effluents and which are sensitive to changes in radioactivity levels. The types of sample media collected are: milk, surface water, groundwater, shoreline sediment, bottom sediment, soil, wetlands, fish, vegetation, airborne particulate, airborne radioiodine and direct radiation (TLD).

Samples are collected by Union Electric personnel and shipped to Teledyne Isotopes Midwest Laboratory (TIML) for analysis. TLD's are analyzed by Union Electric personnel. The data obtained are reported monthly and summarized in the annual report.

Environmental sample locations are divided into two types, indicator and control. Indicator samples are those collected from locations which would be expected to manifest plant effects, if any. Control samples are collected at locations which are expected to be unaffected by plant operation.

2.2 Program Description

Sample locations for the REMP are shown in Figures 1, 2 and 3. Table I describes the sample locations, direction and distance from the plant, which are control and which are indicator locations, and the types of samples collected at each location. Sample collection frequencies and required analyses for each sample type are given in Table II. The collections and analyses that comprise the program are described in the following pages.

Identification of sample type codes used in Table I are as follows:

Code	Sample Collected
AI0	Air Iodine
APT	Air Particulate
AQF	Fish
AQS	Sediment
FPL	Leafy Green Vegetables
IDM	TLD
MLK	Milk
SOL	Soil
SWA	Surface Water
WWA	Ground Water

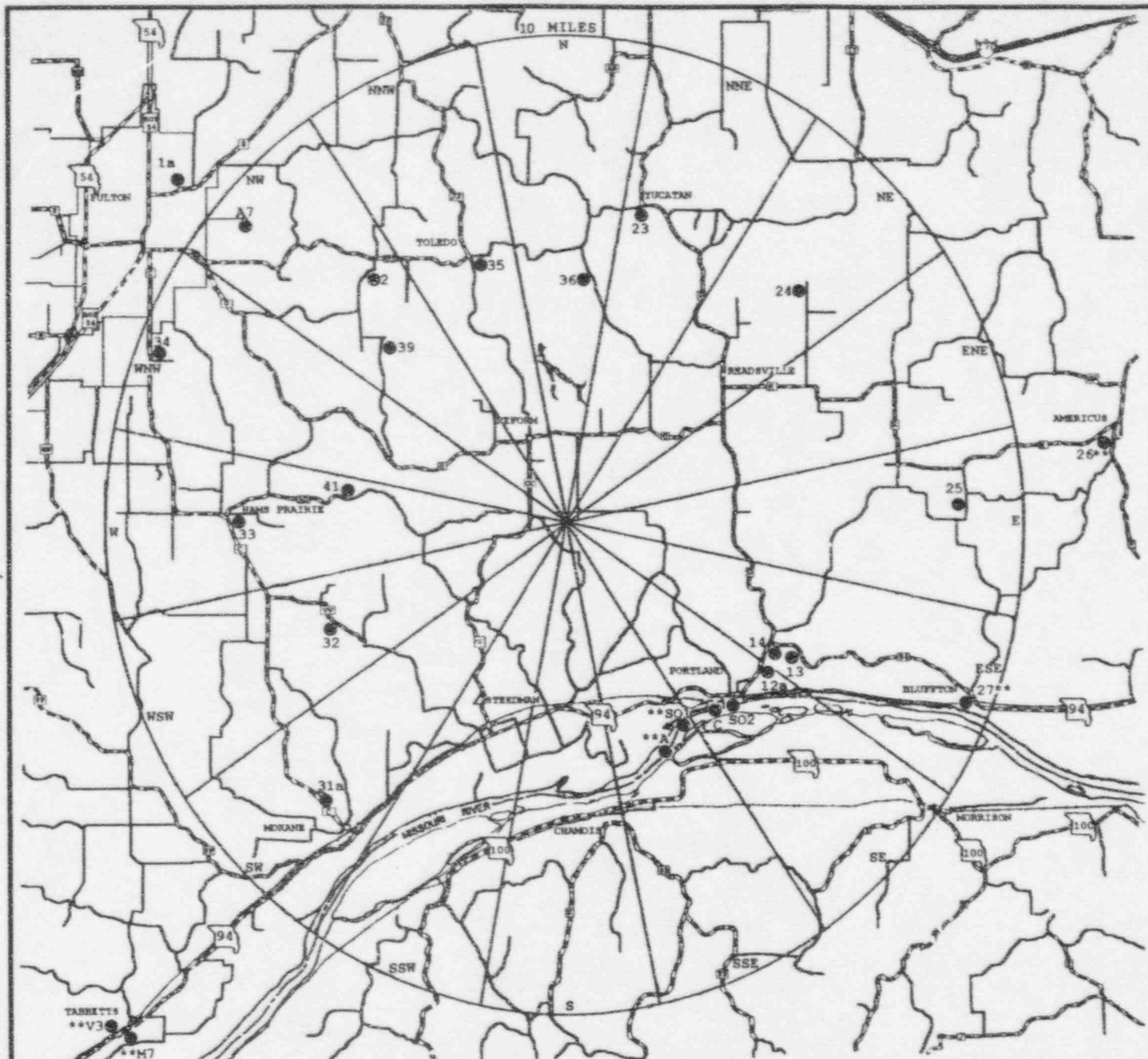
2.2.1 Waterborne Pathway

Surface Water

Monthly composite samples of surface water from the Missouri River are collected from one indicator location (SO2) and from one control location (SO1). The samples are analyzed for tritium and by gamma spectrometry.

Ground Water

Ground water samples are collected quarterly from two on-site wells (F05 and F15) and one off-site well used for drinking water (D01). The on-site ground water samples are collected using a manual grab sampler which is lowered into the well. The off-site ground water sample is collected from a faucet after allowing the line to flush for two minutes. Ground water samples are analyzed for Tritium and gamma emitting nuclides.



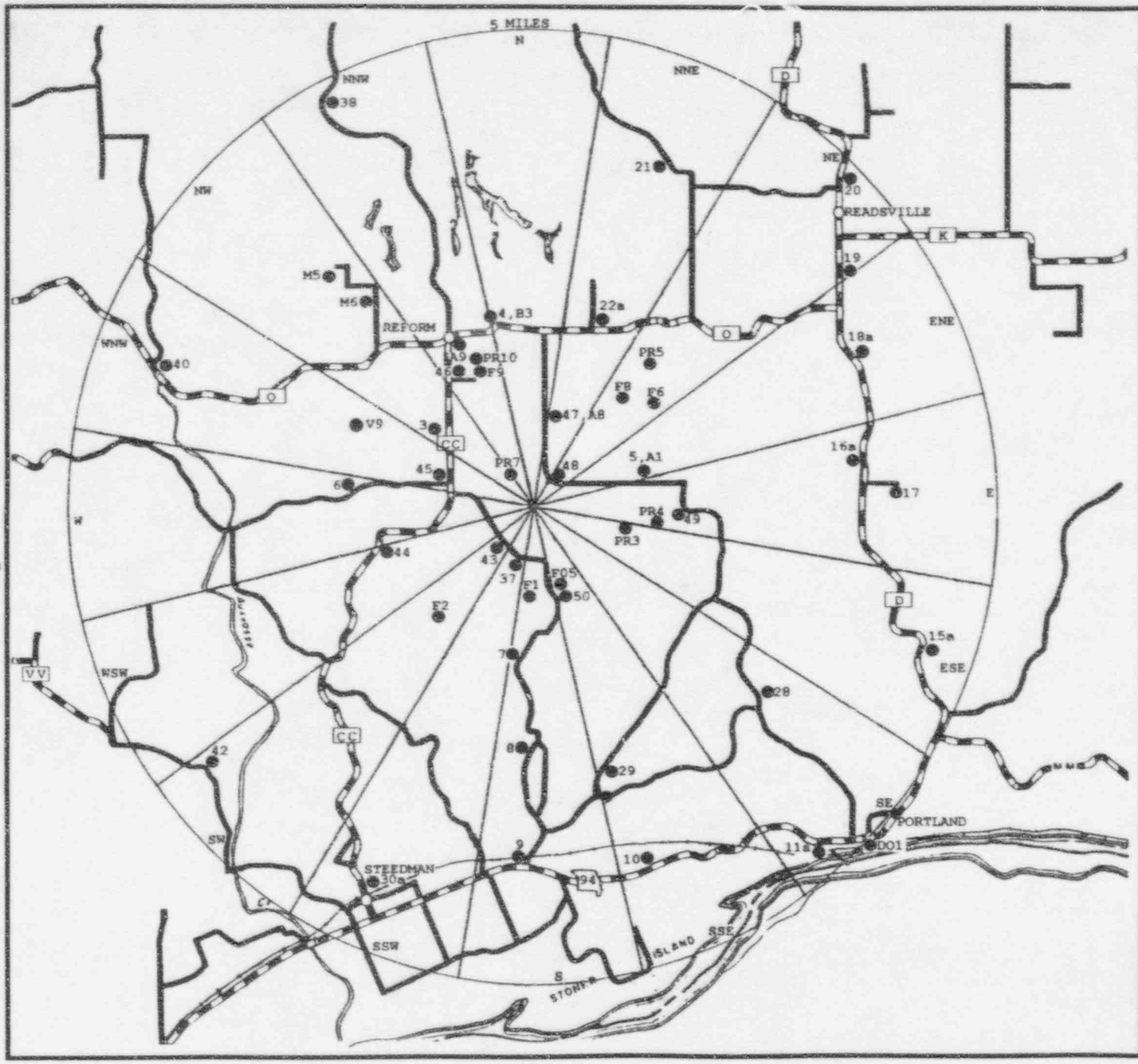
• Collection Locations

** Control Location

UNION ELECTIRC CO.
CALLAWAY PLANT

DISTANT
COLLECTION LOCATIONS

FIGURE 1



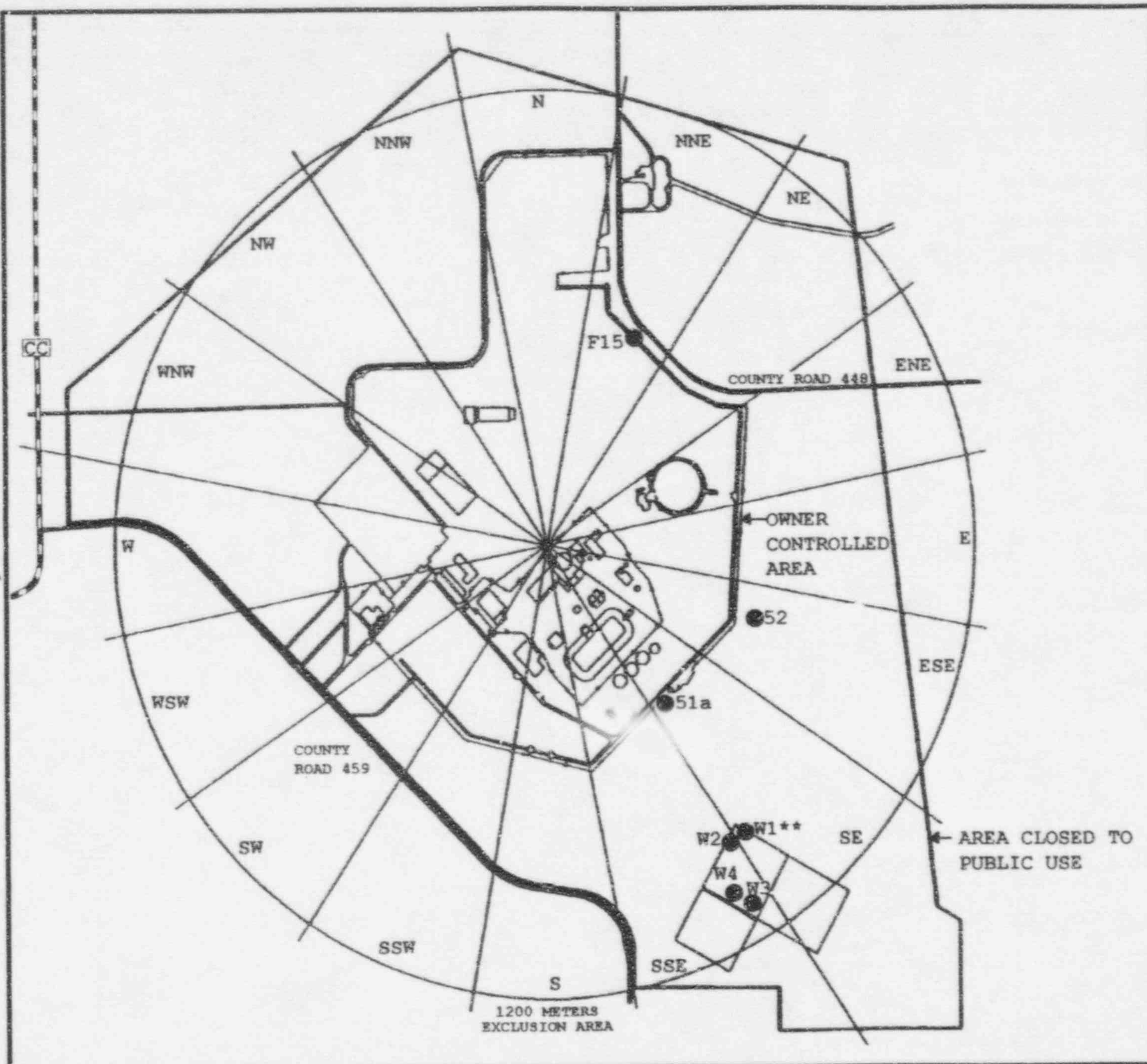
• Collection Locations

** Control Location

UNION ELECTIRC CO.
CALLAWAY PLANT

NEAR SITE
COLLECTION LOCATIONS

FIGURE 2



UNION ELECTIRC CO.
CALLAWAY PLANT

ONSITE
COLLECTION LOCATIONS

FIGURE 3

TABLE I

SAMPLING LOCATIONS

Location Code	Description	Sample Types
1a	10.8 mi NW; City of Fulton on Hwy Z, 0.65 mi East of Business 54, West of Campus Apartments	IDM
2	6.6 mi NW; County Road 111, 0.6 mi South of Hwy UU, Callaway Electric Cooperative Utility Pole No. 17571.	IDM
3	1.3 mi NW; 0.1 mi West of Hwy CC on Gravel Road, 0.8 mi South Hwy 0, Callaway Electric Cooperative Utility Pole No. 18559.	IDM
4,B3	1.9 mi N; 0.3 mi East of the O and CC Junction, Callaway Electric Cooperative Utility Pole No. 18892.	IDM, APT, AIO
5,A1	1.3 mi ENE; Primary Meteorological Tower.	IDM, APT, AIO
6	2.0 mi W; County Road 428, 1.2 mi West of Hwy CC, Callaway Electric Cooperative Utility Pole No. 18609.	IDM
7	1.3 mi S; County Road 459, 2.6 mi North of Hwy 94, Callaway Electric Cooperative Utility Pole No 35097	IDM
8	2.9 mi S; County Road 459, 1.4 mi North of Hwy 94, Callaway Electrical Cooperative Utility Pole No. 06823.	IDM
9	3.7 mi S; NW Side of the County Road 459 and 94 Junction, Callaway Electric Cooperative Utility Pole No. 06754.	IDM
10	4.0 mi SSE; Hwy 94, 1.8 mi East of County Road 459, Callaway Electric Cooperative Utility Pole No. 12182,	IDM
11a	4.9 mi SE; City of Portland, Callaway Electric Cooperative Utility Pole No. 12110.	IDM

TABLE I (Cont'd.)

SAMPLING LOCATIONS

Location Code	Description	Sample Types
12a	5.2 mi SE; East Side of Hwy 94, 0.6 mi South of Hwy D, Callaway Electric Cooperative Utility Pole No. 27536.	IDM
13	5.6 mi ESE; Hwy 94, 0.75 mi East of Hwy D, Kingdom Telephone Pole No. 2X1.	IDM
14	5.0 mi ESE; SE Side of Intersection D and 94, Callaway Electric Cooperative Utility Pole No. 11940.	IDM
15a	4.6 mi ESE; East Side of Hwy D, 3.8 mi South of Hwy 0, Kingdom Telephone Pole No. 2Y1. (Initiated 7/6/95)	IDM
16a	3.7 mi E; West Side of Hwy D, 1.6 mi South of Hwy 0, Kingdom Telephone Pole No. 3x9.	IDM
17	4.0 mi E; County Road 4053, 0.3 mi East of Hwy 94, Kingdom Telephone Company Pole No. 3X12.	IDM
18a	3.9 mi ENE; East side of Hwy D, 0.5 mi South of O, Callaway Electric Cooperative Utility Pole No. 38579.	IDM
19	4.2 mi NE; Hwy D, 0.3 mi North of Hwy 0, Callaway Electric Cooperative Utility Pole No. 12918.	IDM
20	4.8 mi NE; City of Readsville, Callaway Electric Cooperative Utility Pole No. 12830.	IDM
21	4.0 mi NNE; County Road 155, 1.9 mi North of Hwy 0, Callaway Electric Cooperative Utility Pole No. 19100.	IDM
22a	2.0 mi NNE; North Side of Hwy O, 100 feet East of County Road 150, Callaway Electric Cooperative Utility Pole No. 31094.	IDM
23	6.7 mi NNE; City of Yucatan, Callaway Electric Cooperative Utility Pole No. 12670	IDM

TABLE I (Cont'd.)

SAMPLING LOCATIONS

Location Code	Description	Sample Types
24	7.0 mi NE; County Road 191, 2.1 mi North of Hwy K, Callaway Electric Cooperative Utility Pole No. 12498.	IDM
25	8.7 mi E; County Road 289, 0.3 mi South of County Road 287, Callaway Electric Cooperative Utility Pole No. 11295.	IDM
26**	12.1 mi E; Town of Americus, Callaway Electric Cooperative Utility Pole No. 11159.	IDM
27**	9.5 mi ESE; Town of Bluffton, Callaway Electric Cooperative Utility Pole No. 11496.	IDM
28	3.3 mi SE; County Road 469, 2.0 mi North of Hwy 94, Callaway Electric Cooperative Utility Pole No. 06896.	IDM
29	2.7 mi SSW; County Road 448, 1.2 mi North of County Road 459, Callaway Electric Cooperative Utility Pole No. 06851.	IDM
30a	4.4 mi SSE; City of Steedman, N side of Belgian Dr., 150 feet East of Hwy CC, Callaway Electric Cooperative Utility Pole No. 06557.	IDM
31a	7.8 mi SW; City of Mokane, Junction Hwy C and County Road 400, 0.9 mi North of Hwy 94, Callaway Electric Cooperative Utility Pole	IDM
32	5.4 mi WSW; Hwy VV, 0.6 mi West of County Road 447, Callaway Electric Cooperative Utility Pole No. 27031.	IDM
33	7.3 mi W; City of Hams Prairie, SE of Hwy C and AD Junction.	IDM
34	9.7 mi WNW; NE Side of Hwy C and County Road 408 Junction.	IDM
35	5.8 mi NNW; City of Toledo, Callaway Electric Cooperative Utility Pole No. 17684.	IDM

TABLE I (Cont'd.)

SAMPLING LOCATIONS

Location Code	Description	Sample Types
36	5.2 mi N; County Road 155, 0.8 mi South of County Road 132, Callaway Electric Cooperative Utility Pole No. 19137.	IDM
37	0.7 mi SSW; County Road 459, 0.9 mi South of Hwy CC, Callaway Electric Cooperative Utility Pole No. 35077	IDM
38	4.8 mi NNW; County Road 133, 1.5 mi South of Hwy UU, Callaway Electric Cooperative Utility Pole No. 34708.	IDM
39	5.4 mi NW; County Road 112, 0.7 mi East of County Road 111, Callaway Electric Cooperative Utility Pole No. 17516.	IDM
40	4.2 mi WNW; NE Side of County Road 112 and Hwy 0, Callaway Electric Cooperative Utility Pole No. 06326.	IDM
41	4.8 mi W; Hwy AD, 2.8 mi East of Hwy C, Callaway Electric Cooperative Utility Pole No. 18239.	IDM
42	4.4. mi SW; County Road 447, 2.6 mi North of County Road 463, Callaway Electric Cooperative Utility Pole No. 06326.	IDM
43	0.5 mi SW; County Road 459, 0.7 mi South of Hwy CC, Callaway Electric Cooperative Utility Pole No. 35073.	IDM
44	1.7 mi WSW; Hwy CC, 1.0 mi South of County Road 459, Callaway Electric Cooperative Utility Pole No. 18769.	IDM
45	1.0 mi WNW; County Road 428, 0.1 mi West of Hwy CC, Callaway Electric Cooperative Utility Pole No. 18580.	IDM
46	1.5 mi NNW; NE Side of Hwy CC and County Road 466 Intersection, Callaway Electric Cooperative Utility Pole No. 28242.	IDM
47	0.9 mi NNE; County Road 448, 0.9 mi South of Hwy 0, Callaway Electric Cooperative Utility pole No. 28151.	IDM
48	0.4 mi NE; County Road 448, 1.5 mi South of Hwy 0, Plant Security Sign Post.	IDM

TABLE I (Cont'd.)

SAMPLING LOCATIONS

Location Code	Description	Sample Types
49	1.7 mi E; County Road 448, Callaway Electric Cooperative Utility pole No. 06959, Reform Wildlife Management Parking Area.	IDM
50	0.9 mi SSE; County Road 459, 3.3 mi North of Hwy 94, Callaway Electric Cooperative Utility Pole No. 35086.	IDM
51a	0.3 mi SE; Owner Control Fence, SE of the Water Treatment Plant.	IDM
52	0.4 mi ESE; Light Pole Near the East Plant Security Fence.	IDM
A7	9.5 mi NW; C. Bartley Farm.	APT, AIO
A8	0.9 mi NNE; County Road 448, 0.9 miles South of Hwy 0.	APT, AIO
A9	1.7 mi NNW; Community of Reform.	APT, AIO
D01	5.1 mi SE; Holzhouser Grocery Story/Tavern (Portland, MO).	WWA
F05	1.0 mi SSE; Onsite Groundwater Monitoring Well.	WWA
F15	0.5 mi NE; Onsite Groundwater Monitoring Well.	WWA
M5	3.1 mi NW; Schneider Farm (Goats' milk).	MLK
M6	2.7 mi NW; Pierce Farm (Cows' milk).	MLK
M7**	14.8 mi SW; Kissock Farm (Cows' milk)	MLK
V3 **	15.0 mi SW; Beazley Farm.	FPL, SOL
V9	2.0 mi WNW; Meehan Farm.	FPL
A **	4.9 mi SSE; 0.6 River Miles Upstream of Discharge North Bank.	AQS, AQF
C	5.1 mi SE; 1.0 River Miles Downstream of Discharge North Bank.	AQS, AQF

TABLE I (Cont'd.)

SAMPLING LOCATIONS

Location Code	Description	Sample Types
S01**	4.8 mi SE; 105 feet Upstream of Discharge North Bank.	SWA
S02	5.2 mi SE; 1.1 River Miles Downstream of Discharge North Bank.	SWA
F1	0.98 mi S; Callaway Plant Forest Ecology Plot F1.	SOL
F2	1.64 mi SW; Callaway Plant Forest Ecology Plot F2.	SOL
F6	1.72 mi NE; Callaway Plant Forest Ecology Plot F6.	SOL
F8	1.50 mi NE; Callaway Plant Forest Ecology Plot F8.	SOL
F9	1.45 mi NNW; Callaway Plant Forest Ecology Plot F9.	SOL
PR3	1.02 mi ESE; Callaway Plant Prairie Ecology Plot PR3.	SOL
PR4	1.34 mi ESE; Callaway Plant Prairie Ecology Plot PR4.	SOL
PR5	1.89 mi NE; Callaway Plant Prairie Ecology Plot PR5.	SOL
PR7	0.45 mi NNW; Callaway Plant Prairie Ecology Plot PR7.	SOL
PR10	1.55 mi NNW; Callaway Plant Prairie Ecology Plot PR10.	SOL
W1**	0.61 mi SE; Callaway Plant Wetlands, High Ground	SOL
W2	0.60 mi SE; Callaway Plant Wetlands, Inlet Area	SOL
W3	0.72 mi SSE; Callaway Plant Wetlands, Discharge Area	SOL
W4	0.68 mi SSE; Callaway Plant Wetlands, SW Bank	SOL

* All distances are measured from the center line of the reactor
** Control locations

TABLE II

REMP SAMPLE COLLECTION FREQUENCIES AND REQUIRED ANALYSES

Sample Type	Sample Code	Collection Frequency	Required Analysis
Airborne Iodine	AIO	Weekly	I-131 weekly
Air Particulate	APT	Weekly	Gross Beta weekly[1] Sr-89/90 and Gamma Isotopic of quarterly filter composite
Fish	AQF	Semiannually	SR-89/90 and Gamma Isotopic
Sediment	AQS	Semiannually	Gamma Isotopic
Leafy Green Vegetables	FPL	Monthly during the growing season	Gross Alpha, Gross Beta, I-131, and Gamma Isotopic
TLD	IDM	Quarterly and yearly	Gamma Dose
Milk	MLK	Semimonthly when animals are on Pasture; monthly otherwise	I-131, Sr-89/90, Ca, and Gamma Isotopic
Soil	SOL	Annually	Gross Alpha, Gross Beta and Gamma Isotopic
Surface Water	SWA	Monthly composite	H-3 and Gamma Isotopic
Ground Water	WWA	Quarterly Grab	H-3 and Gamma Isotopic

Note: 1) If gross beta activity is greater than the established baseline activity level gamma isotopic analysis is performed on the individual sample.

Bottom Sediment

Bottom sediment samples are collected semi-annually from one indicator location (C) and one control location (A). The samples are taken from water at least 2 meters deep to prevent influence of bank erosion. A Ponar dredge is used to obtain the samples, consisting of the uppermost layer of sediment. Each sample is placed, without preservative, in a plastic bag and sealed. Bottom sediment samples are analyzed for gamma emitting isotopes.

Shoreline Sediment

Shoreline sediment samples are collected semi-annually in the same area as bottom sediment. The samples are collected within two feet of the waters edge and consist of 2 six inch diameter by two inch deep sediment plugs. Each sample is placed in a plastic bag and sealed. Shoreline sediment samples are analyzed for gamma emitting isotopes.

Wetlands Soil

Wetlands Soil Samples are collected annually from 3 indicator locations (W2, W3, and W4) and one control location (W1). Two 6 inch square soil plugs consisting of the uppermost two-inch layer of soil are taken at each location. The samples are placed in plastic bags and sealed. Wetlands soil samples are analyzed for gross alpha, gross beta, and gamma emitting isotopes.

2.2.2 Airborne Pathway

Airborne Particulates

Airborne particulate samples are collected on a 47mm diameter glass fiber filter type A/E (99 percent removal efficiency at 1 micron particulate) at a volumetric rate of one and one-half cubic feet per minute at five locations. The particulate filters are collected weekly and shipped to TIML for analyses. The filters are analyzed for gross beta activity approximately five days after collection to allow for decay of naturally-occurring short-lived radionuclides. Quarterly composites of filters by location are gamma-scanned and analyzed for Strontium-89 and Strontium-90. All five sample locations are considered indicator locations (A1, A7, A8, A9, and B3). One of the indicators (A9) is located at the community with the highest D/Q.

Airborne Iodine

Each airborne particulate air sampler is equipped with a charcoal cartridge in-line after the particulate filter holder. The charcoal cartridge at each location is collected at the same time as the particulate filter and analyzed for Iodine-131 within eight days after collection.

2.2.3 Ingestion Pathway

Milk

Two gallon milk samples are collected semi-monthly during the pasture season (April through September) and monthly during the winter from one goat and one cow milk location near the Plant (M5 and M6) and one cow milk location away from the Plant (M7). Milk samples are shipped in ice to be received by TIML within 48 hours of collection. Analyses for Iodine-131, elemental calcium, Strontium-89, Strontium-90, and gamma emitting nuclides are performed on all milk samples.

Fish

The five most abundant recreational or commercial fish species are collected semi-annually from one indicator location (C) and one control location (A). Fish samples are filleted and are analyzed for Strontium-89, Strontium-90 and gamma emitting isotopes.

Vegetation

Monthly, during the growing season, green leafy vegetation is collected from two indicator locations (V6 and V9) and from one control location (V3). Vegetation samples consist of mustard greens, turnip greens, cabbage, lettuce, and spinach. The vegetation samples are analyzed for gross alpha, gross beta, Iodine-131, and by gamma spectrometry.

Soil

Once a year soil samples are collected from ten indicator locations (F1, F2, PR3, PR4, PR5, F6, PR7, F8, F9, and PR10) and one control location (V3). To ensure only the most recent deposition is sampled, the uppermost two-inch layer of soil is taken at each location. Samples consist of 2 six inch square soil plugs. The litter at the surface and the root mat is considered part of the sample. The samples are placed in plastic bags and sealed. Each soil sample is analyzed for gross alpha, gross beta, and gamma emitting isotopes.

2.2.4 Direct Radiation

Thermoluminescent Dosimetry

Thermoluminescent Dosimetry (TLD) is employed to determine direct radiation levels in and around the Callaway site. Panasonic model UD-814 TLDs sealed in plastic bags are placed in polypropylene mesh cylindrical holders at fifty-two locations and exchanged quarterly and annually. Fifty of the fifty-two locations are indicators (2 through 33 and 35 through 52) and two locations are controls (1, 1a and 34).

2.3 Program Execution

The program was executed as described in the preceding section with the following exceptions;

Surface Water

1. The downstream composite sampler was out of service from 01/01/96 to 01/10/96 to replace a failed sample pump.

2. During the period of 01/27/96 to 02/10/96 the downstream composite sampler was inoperable due to a frozen sample line.

3. The upstream compositor sampler was out of service from 01/27/96 to 03/08/96 for replacement of a broken sample line and sample pump..

4. From 03/19/96 to 03/28/96 the downstream composite sampler was taken out of service for replacement of a pump hose and implementation of sampler modifications to improve availability.

5. Due to a break in the sample line, the downstream composite sampler was inoperable from 05/14/96 to 05/24/96.

6. The downstream composite sampler was removed from service on 05/29/96 through 06/06/96 due to Missouri River conditions.

7. The downstream sampler was taken out of service from 11/15/96 to 11/19/96 due to a plugged sample line.

8. During the period of 12/26/96 to 12/29/96 the downstream composite sampler was inoperable due to frozen sample line.

9. The upstream sampler was taken out of service from 12/06/96 to 12/20/96 so that the intake pump bay receiving the sampler discharge could be dewatered for routine maintenance.

While the composite samplers were inoperable, daily grab samples were taken and composited monthly, except as noted below:

10. Location SO2 daily grab samples were not collected from 01/08/96 to 01/10/96 due to unsafe ice conditions on the river bank at the sample location..

11. Daily grab samples were not collected at location SO1 on 02/01/96 through 02/08/96 due to unsafe weather conditions.

Airborne

1. The air particulate and airborne iodine sample results from location A8 for the collection periods ending 08/15/96 and 09/26/96 were questionable because of sampler power loss during the entire sampling period.

Milk

1. Milk samples were unavailable from location M5 during the months of January, February, March, October, November and December. Goats were not producing milk during these months.

2. Milk samples were unavailable from location M7 for the months of September, October, November and December. Cows were either not producing milk or were nursing calves during these months.

Vegetation

1. Green leafy vegetation was unavailable from location V3 during the month of May due to lack of plant growth.

2. There were no green leafy vegetation samples collected from location V3 for the months of August, September, October, and November due to weather related lack of plant growth or loss.

3. No green leafy vegetation was available from location V9 during the month of September due to dry weather conditions.

Direct Radiation

1. There was no direct radiation data from location 49 for the first quarter because of TLD station vandalism.

2. There was no direct radiation data from location 28 for the second quarter because of TLD station vandalism.

3. Annual TLD's from locations 24 and 28 were missing from the TLD holder during the second quarter TLD changeout. New annual TLDs were installed at these locations.

4. The annual direct radiation data from location 15 is questionable due to the pressence of visible moisture in all TLD elements used for dose determination.

2.4 Analytical Procedures

Analytical procedures and counting methods employed by the contractor laboratory follow those recommended by the U.S. Public Health Service publication, Radioassay Procedures for Environmental Samples, January 1967; and the U.S. Atomic Energy Commission Health and Safety Laboratory, HASL Procedures Manual, (HASL-300), 1972.

A synopsis of the routinely used analytical procedures for sample analyses is presented below.

2.4.1 Airborne

2.4.1.1 Gross Beta

The glass fiber filter type A/E (99 percent removal efficiency at 1 micron particulate), is placed into a stainless steel planchet and counted for gross beta radioactivity using a proportional counter.

2.4.1.2 Gamma Spectrometry

Filters are composited according to location and counted using a germanium detector coupled to a computer based, multi-channel analyzer. The resulting spectrum is analyzed by computer and specific nuclides, if present, identified and quantified.

2.4.1.3 Strontium-89 and Strontium-90

The composited filters, with stable strontium and barium carriers added, are leached in nitric acid to bring deposits into solution. After filtration, filtrate is reduced in volume by evaporation. The residue is purified by adding iron and rare earth carriers and precipitating them as hydroxides. After a second strontium nitrate precipitation from nitric acid, the nitrates are dissolved in acid again with yttrium carrier and stored for ingrowth. The yttrium is precipitated as hydroxide and separated from strontium with the strontium being in the supernate. Each fraction is precipitated separately as an oxalate (yttrium) and carbonate (strontium) and collected on a No. 42 (2.4 cm) Whatman filter. The filters are counted using a low background proportional counter and the Strontium-90 activity is calculated from the oxalate data. The Strontium-89 activity is determined by subtracting the calculated Strontium-90 activity from the measured gross strontium activity calculated from the carbonate.

2.4.1.4 Iodine-131

Each Charcoal cartridge is placed on the germanium detector and counted. A peak of 0.36 MeV is used to calculate the concentration at counting time. The equilibrium concentration at the end of collection is then calculated. Decay correction for the time interval between sample collection and counting is then made.

2.4.2 Direct Radiation

Direct radiation measurements are taken by UEC using Thermoluminescent Dosimeters (TLD's). The UEC program employs the Panasonic Model UD-814 TLD and Model UD-710A automatic dosimeter reader. Each dosimeter consists of three elements of $CaSO_4$:Tm and one element of $Li_2B_4O_7$:Cu. The dosimeters are sealed in a moisture resistant plastic bag and placed inside a polypropylene mesh cylindrical holder in the environment. After exposure in the environment the dosimeters are read and the exposure for the time period is determined from the $CaSO_4$:Tm elements. The $Li_2B_4O_7$:Cu element is not used to determine exposure during routine operations.

2.4.3 Vegetation

2.4.3.1 Iodine-131

A suitable aliquot of wet (as received) sample is placed into a standard calibrated container and counted using a germanium detector coupled to a computer based, multi-channel analyzer. A peak of 0.36 MeV is used to calculate the concentration at counting time. The equilibrium concentration at the end of collection is calculated by decay correcting for the time interval between sample collection and counting.

2.4.3.2 Gross Alpha and Gross Beta

A suitable aliquot of ashed sample is transferred to a two-inch ringed planchet. The planchet is counted for gross alpha and gross beta activity using a proportional counter.

2.4.3.3 Gamma Spectrometry

A suitable aliquot of wet (as received) sample is placed into a standard calibrated container and specific nuclides, if present, identified and quantified using a germanium detector coupled to a computer based, multi-channel analyzer.

2.4.4 Milk

2.4.4.1 Iodine-131

Two liters of milk containing standardized Iodine carrier are stirred with anion exchange resin for one hour. The resin is washed with NaCl and the iodine is eluted with sodium hypochlorite. Iodine in the iodate form is reduced to I_2 and the elemental iodine extracted into CCl_4, back-extracted into water, then precipitated as palladium iodide. The precipitate is counted for I-131 using a proportional counter.

2.4.4.2 Strontium-89 and Strontium-90

One liter of milk containing strontium and barium carriers is passed through a cation-exchange resin column.

Strontium, barium and calcium are eluted from the cation-exchange resin with sodium chloride solution. Following dilution of the eluate, the alkaline earths are precipitated as carbonates. The carbonates are then converted to nitrates, and strontium and barium nitrate are precipitated. The nitrate precipitate is dissolved, and barium is precipitated as chromate, purified as chloride, and counted for Barium-140 (if required). From the supernate, strontium is precipitated as nitrate, dissolved in w..ter and reprecipitated as strontium nitrate. The nitrate is converted to carbonate, which is filtered, weighted to determine strontium carrier recovery, and counted for "total radiostrontium" using a proportional counter.

After counting total radiostrontium the second time after six to eight days, Sr-89 concentrations are calculated. If the Sr-89 concentration shows a positive result, the precipitate is dissolved, yttrium carrier added and the sample is stored for six to eight days to allow for additional yttrium ingrowth. Yttrium is separated from strontium, precipitated as yttrium oxalate and counted to determine Sr-90 concentrations.

The concentration of Sr-89 is calculated as the difference between the activity for "total radiostrontium" and the activity due to Sr-90.

2.4.4.3 Gamma Spectrometry

3.5 liters or 500 ml aliquot of milk is placed in a standard counting container and specific nuclides identified and quantified using a germanium detector coupled to a computer based, multi-channel analyzer.

2.4.4.4 Elemental Calcium

Strontium, barium, and calcium are adsorbed on cation-exchange resin, then eluted with sodium chloride solution. An aliquot of the eluate is diluted to reduce the high sodium ion concentration. From this diluted aliquot, calcium oxalate is precipitated, dissolved in dilute hydrochloric acid, and the oxalate is titrated with standardized potassium permanganate.

2.4.5 Surface and Ground Water

2.4.5.1 Tritium

A 60-70 ml aliquot of water is purified by distillation, a portion of the distillate is transferred to a counting vial and scintillation fluid added. The contents of the vial are thoroughly mixed and counted in a liquid scintillation counter.

2.4.5.2 Gamma Spectrometry

3.5 liters or 500 ml aliquot of water is placed in a standard counting container and specific nuclides identified and quantified using the Method described in Section 2.4.1.2.

2.4.6 Fish

2.4.6.1 Gross Alpha and Gross Beta

A suitable aliquot of ashed fish sample is transferred to a two-inch ringed planchet. The planchet is counted for gross alpha and gross beta activity using a proportional counter.

2.4.6.2 Strontium-89 and Strontium-90

A suitable aliquot of ashed sample transferred to a 250 ml beaker and strontium-yttrium carriers added. The sample is leached in nitric acid and filtered. After filtration, filtrate is reduced in volume by evaporation. The residue is purified by adding iron and rare earth carriers and precipitating them as hydroxides. After a second strontium nitrate precipitation from nitric acid, the nitrates are dissolved in acid again with yttrium carrier and stored for ingrowth of Yttrium-90. The yttrium is precipitated as hydroxide and separated from strontium with the strontium being in the supernate. Each fraction is precipitated separately as an oxalate (yttrium) and carbonate (strontium) and collected on No. 42 (2.4 cm) Whatman filter for counting using a low background proportional counter. The Strontium-90 concentration is determined from the yttrium oxalate counting results and the Strontium-89 concentration is calculated as the difference between the strontium carbonate activity and the activity due to Strontium-90.

2.4.6.3 Gamma Spectrometry

A suitable aliquot of prepared sample is placed in a standard calibrated container and specific nuclides identified and quantified using a germanium detector coupled to a computer based, multi-channel analyzer.

2.4.7 Bottom and Shoreline Sediment

2.4.7.1 Gamma Spectrometry

A suitable aliquot of prepared sample is placed in a standard calibrated container and specific nuclides identified and quantified using a germanium detector coupled to a computer based, multi-channel analyzer.

2.4.8 Soil and Wetlands

2.4.8.1 Gross Alpha and Gross Beta

A suitable aliquot of dried sample is transferred to a two-inch ringed planchet. The planchet is counted for gross alpha and gross beta activity using a proportional counter.

2.4.8.2 Gamma Spectrometry

A suitable aliquot of prepared sample is placed in a standard calibrated container and specific nuclides identified and quantified using a germanium detector coupled to a computer based, multi-channel analyzer.

2.5 Program Modifications

During 1996 three modifications were made to the monitoring program. The first modification was the deletion of vegetation sampling location 6. Sampling at this location was discontinued due to the residence being vacated,

The second modification involved reclassification of air sampling location A7 from a control location to an indicator location. This change was in response to the Notice of violation in Inspection Report 50-483/95016,

The third change was replacement of TLD locations 1a and 34 with TLD locations 26 and 27 as control locations. There was no physical change made to the stations or their locations.

3.0 ISOTOPIC DETECTION LIMITS AND ACTIVITY DETERMINATIONS

A discussion of the calculations used in determining detection limits and activity by the contractor laboratory is found in Appendix C.

Table III gives the required detection limits for radiological environmental sample analysis. For each sample type, the table lists the detection level for each isotope.

TABLE III

DETECTION CAPABILITIES FOR RADIOLOGICAL ENVIRONMENTAL SAMPLE ANALYSIS

ANALYSIS	WATER (pCi/l)	AIRBORNE (pCi/m^3)	FISH (pCi/kg wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg wet)	SOIL AND SEDIMENT (pCi/kg dry)
Gross beta	4					
H-3	300					
Mn-54	15		130			
Fe-59	30		260			
Co-58, -60	15		130			
Zr-Nb-95	15*					
I-131	1	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-La-140	15*			15*		

NOTE: This list does not mean only these nuclides will be detected and reported. Other peaks which are measurable and identifiable together with above nuclides, will also be identified and reported.

* Total activity, parent plus daughter activity.

4.0 QUALITY CONTROL PROGRAM

To insure the validity of the data, the contractor laboratory maintains a quality control (QC) program which employs quality control checks, with documentation, of the analytical phase of its environmental monitoring studies. The program is defined in the Quality Control Program, and procedures are specified in the QC Procedures Manual.

The QC Program includes laboratory procedures designed to prevent cross-contamination and ensure accuracy and precision of analyses. The quality control checks include blind samples, duplicate samples, and spiked samples as necessary to verify laboratory analysis activities are being maintained at a high level of accuracy.

The Quality Control Program is in compliance with USNRC Regulatory Guide 4.15 and includes appropriate control charts with specified acceptance levels for instrument source checks, background, efficiency, etc. for counting equipment.

The laboratory participates in the USEPA Interlaboratory Comparison Program (crosscheck program) by analyzing radioactive samples distributed for that purpose. The results of the crosscheck program are presented in Appendix B.

5.0 DATA INTERPRETATIONS

In interpreting the data, effects due to the Callaway Plant must be distinguished from those due to other sources.

One interpretation method used in assessment of those effects is the indicator-control concept used in the design of the monitoring program. Most sample types are collected at both indicator locations (areas potentially affected by plant operations) and control locations (areas not affected by plant discharge). A possible plant effect would be indicated if the radiation level at an indicator location was significantly larger than at the control location. The difference would have to be greater than what could be accounted for by typical fluctuations in radiation levels arising from other sources.

An additional interpretation method involves analysis for specific radionuclides present in environmental samples collected around the plant site. For certain isotopes it can be determined if the activity is the result of weapons testing or plant operations because of the different characteristic proportions in which these isotopes appear in the fission product mix produced by a nuclear reactor and that produced by a nuclear detonation.

Other means of distinguishing sources of environmental radiation that are also employed in interpretation of the data. Current radiation levels can be compared with preoperational levels. Results can be related to those obtained in other parts of the country. Finally, results can be related to events known to have caused elevated levels of radiation in the environment.

6.0 **RESULTS AND DISCUSSION**

Analytical results for the reporting period January to December 1996 are presented in summary form in Appendix D. For each type of analysis of each sampled medium, this table shows the annual mean and range for all indicator locations and for all control locations. Results for the location with the highest annual mean are also given.

Discussion of the results is divided into four pathways; waterborne, airborne, ingestion, and direct radiation. The individual samples and analyses within each category provides an adequate means of estimating radiation dose to individuals from principal pathways. Data for individual samples are presented in tabular form in Appendix E.

6.1 Waterborne Pathway

The water pathway of exposure from Callaway Plant was evaluated by analyzing surface water, well water, bottom sediment, shoreline sediment and wetlands.

Surface Water

Analysis of Tritium in surface water showed detectable activity in seven of the samples collected at location SO2 with results ranging from 165 to 227 pCi/l. The mean Tritium concentration at location SO2 was 198 pCi/liter. The LLDs for other samples ranged from 146 to 187 pCi/l.

No gamma emitting nuclides were detected in any surface water samples.

While the presence of detectable activity at the indicator location with none at the control location could indicate an influence from Callaway Plant, the levels measured were barely above detectable and were within the range of preoperational background data collected.

Ground Water

In ground water samples, tritium results for all thirteen samples were below the detection limit which ranged from 149 to 197 pCi/l.

No gamma emitting nuclides were detected in any ground water sample.

There was no indication of plant operational effects on ground water.

Bottom Sediment

Analysis of bottom sediment collected in April and October showed no plant related gamma emitting nuclides in any of the samples.

Shoreline Sediment

Shoreline Sediment samples were collected in April and October, 1996 and analyzed for gamma emitting isotopes. The shoreline sediment sample collected in April at Location A showed Cesium-137 activity of 92 pCi/kg. There were no other gamma emitting nuclides detected in shoreline sediment samples. Similar levels of Cesium-137 activity due to fallout from atmospheric nuclear testing were observed in 1984, 1985, and 1987 thru 1995.

Wetlands

Analysis for alpha emitters showed detectable activity in all samples, with results ranging from 9280 to 13710 pCi/kg. The average sample concentration at the indicator location was 11435 pCi/kg and at the control location was 9280 pCi/kg.

The average gross beta activity in all wetlands samples ranged from 16615 to 21476 pCi/kg. The average activity at the control location was 17498 pCi/kg and at the indicator location was 18744 pCi/kg.

Potassium-40 and Cesium-137 were the only gamma emitting isotopes detected. Potassium-40 was detected in all samples with results ranging from 9606 to 16590 pCi/kg. The average concentration for indicator locations was 12347 pCi/kg and for the control location was 14555 pCi/kg.

The control sample and one indicator sample showed positive Cesium-137 activity of 63.4 pCi/kg and 209 pCi/kg, respectively.

Gross alpha and gross beta activity can be attributed to naturally occurring isotopes (e.g. Potassium-40). Similar levels of Cesium-137 activity were observed in previously accumulated data for the wetlands. Cesium-137 activity is expected to be present since the base material for the wetlands is concentrated Missouri River Sediment. The presence of Cesium-137 in river sediment has been identified as a long term residual effect of previous atmospheric nuclear tests.

6.2 Airborne Pathway

Airborne pathways of exposure from Callaway Plant were evaluated by analyzing samples of air particulate and air iodine cartridges.

Airborne Particulate

Gross beta activity in airborne particulate ranged from 0.009 to 0.060 pCi/m3 in all samples. The average gross beta activity at all locations was 0.024 pCi/m3. The highest annual average (0.026 pCi/m3) was measured at location A1, 1.3 miles ENE of the plant.

Gamma spectral analysis of quarterly composites of air particulate filters showed Beryllium-7 in all twenty samples. The average Beryllium-7 activity for all sample locations was 0.1 pCi/m3. The presence of Beryllium-7 can be attributed to cosmic ray activity. No gamma emitting isotopes of plant origin were detected in the quarterly composities.

Strontium-89 and Strontium-90 analyses performed on quarterly composites indicated no activity above detection limits.

Levels and distribution of activity in air particulate samples are similar to previously accumulated data and indicate no influence from plant operation.

Airborne Iodine

Airborne Iodine-131 results were below the detection limit of 0.07 pCi/m3 in all samples. Thus, there was no indication of any plant operational effect on this sample media.

6.3 Ingestion Pathway

Potential ingestion pathways of exposure for Callaway Plant were evaluated by analyzing samples of milk, fish, vegetation, and soil.

Milk

A total of forty-three analyses for Iodine-131 in milk were performed during 1996. All samples were below the LLD which ranged from 0.1 to 0.5 pCi/l.

Naturally occurring Potassium-40 was the only gamma emitting isotope found in milk samples. Concentrations ranged from 1050 to 2050 pCi/l. The average concentration for indicator locations was 1484 pCi/l and for control locations was 1332 pCi/l.

Strontium-89 results were below the LLD for all samples. The LLDs ranged from 0.7 to 1.6 pCi/l. Strontium-90 was detected in all milk samples averaging 4.0 pCi/l for indicator locations and 1.6 pCi/l for control locations. The range of detectable results was 0.6 to 7.7 pCi/l.

Calcium was analyzed in all milk samples with levels ranging from 0.81 to 1.10 gm/l.

In summary, the milk data for 1996 show no radiological effects from plant operation. The presence of Strontium-90 in milk samples exhibits a long range residual effect of previous atmospheric nuclear tests.

Fish

The types of fish species collected during 1996 were: River Carpsucker, Channel Catfish, Blue Sucker, Bigmouth Buffalo, Freshwater Drum and Carp.

All fish samples indicated positive Potassium-40 activity with levels ranging from 2093 pCi/kg-wet to 3377 pCi/kg-wet. The mean Potassium-40 activity was 2863 pCi/kg-wet for the indicator location and 2767 pCi/kg-wet for the control location. One fish sample collected in October 1996, showed positive Cobalt-58 activity of 361 pCi/kg-wet. Aside from Co-58, no other gamma emitting isotopes of plant origin were detected in the fish samples.

No Strontium-89 or Strontium-90 activity was detected in fish samples collected during 1995.

Levels and fluctuations of activity detected in fish indicates no significant impact from plant operations.

Vegetation

Vegetation samples collected during 1996 consisted of mustard greens, turnip greens, lettuce, cabbage, and spinach. The number of vegetation samples collected in 1996 were lower than in past years. This sample reduction was due to the loss of an indicator location at the start of the growing season and unusually dry conditions in late summer.

Gross alpha activity was observed in thirteen of the eighteen vegetation samples with results ranging from 59 to 441 pCi/kg-wet. The average activity for indicator locations was 199 pCi/kg-wet and for the control location was 135 pCi/kg-wet.

Gross beta activity was detected in all vegetation samples with results ranging from 2001 to 7813 pCi/kg-wet. The average gross beta activity for indicator locations was 4690 pCi/kg-wet and for the control location was 3377 pCi/kg-wet.

Iodine-131 activity was below the detection limit in all samples.

Naturally occurring Potassium-40 was found in all vegetation samples. Concentrations ranged from 2295 to 8387 pCi/kg-wet and averaged 4840 and 4103 pCi/kg-wet at indicator and control locations respectively. All other gamma emitting isotopes were below their detection limit.

Levels of activity detected in vegetation samples were consistent with previously accumulated data and no plant operational effects were indicated.

Soil

Gross alpha results ranged from 10848 to 26097 pCi/kg for all eleven samples. The mean activity for indicator locations was 15582 pCi/kg and for the control location was 13219 pCi/kg. Gross beta activity was detected in all eleven samples ranging from 21439 to 29800 pCi/kg. The average gross beta activity was 25111 and 29800 pCi/kg at indicator and control locations respectively.

Gamma spectral analysis of the soil samples showed Cesium-137 and Potassium-40 in all samples. Cesium-137 results ranged from 268 to 1351 pCi/kg. The average concentration was 832 pCi/kg at the indicator locations and 268 pCi/kg at the control location. Potassium-40 results ranged from 4849 to 17097 pCi/kg. The average concentration for indicator locations was 11001 pCi/kg and for the control location was 17097 pCi/kg.

The gross alpha and gross beta activity can be attributed to naturally occurring isotopes (e.g. Potassium-40). Cesium-137 activity present can be attributed to worldwide fallout from atmospheric nuclear testing. The level of activity and distribution pattern is similar to previously accumulated data and indicates no influence from the plant.

6.4 Direct Radiation

All TLD results presented in this report have been normalized to a 90-day quarter (standard quarter) to eliminate apparent differences in data caused by variations in length of exposure period.

The range of quarterly TLD results for indicator locations was 12.9 to 20.5 mRem/standard quarter and 11.8 to 19.2 mRem/standard quarter for control locations. Quarterly TLD analyses yielded an average exposure level of 17.5 mRem/standard quarter at all indicator locations and an average exposure level of 15.3 mRem/standard quarter at all control locations.

The annual TLD results ranged from 12.4 to 19.6 mRem/standard quarter. The average exposure level at the indicator and control locations were17.5 mRem/standard quarter and 15.9 mRem/standard quarter, respectively.

There was no significant difference between indicator and control locations for the TLD's during 1996. The exposure levels were consistent with previously accumulated data and no plant operational effects were indicated.

APPENDIX A

1996 LAND USE CENSUS

UNION ELECTRIC COMPANY

CALLAWAY PLANT

1996 LAND USE CENSUS

Prepared by ______________________

Approved by ______________________

1.0 INTRODUCTION

In accordance with Technical Specification 6.8.4.f and APA-ZZ-01003, Offsite Dose Calculation Manual (ODCM), a Land Use Census is performed annually during the growing season within a 5 mile radius of Callaway Plant. The Land Use Census is conducted to identify the location of the nearest resident, the nearest milking animal, and the nearest garden of greater than 50 m^2 producing broad leaf vegetation in each of the 16 meteorological sectors. The results of this census are used to identify changes in the use of the area at and beyond the SITE BOUNDARY that would require modification to the existing monitoring programs presented in the ODCM.

The 1996 Land Use Census was conducted during August and September by the Union Electric Real Estate Department. Information was collected by contacting families identified in the 1995 Land Use Census and field surveys conducted within a 5 mile radius of the plant site noting the location of the above mentioned items.

2.0 RESULTS

Results of the Land Use Census are presented in Tables 1 through 3 and discussed below. The tables include radial direction and distance from the Callaway Plant for each location. The radial direction is one of the 16 different compass points. Mileage was estimated from map position for each location.

Changes identified in this year's Land Use Census did require modifications to the monitoring programs used to evaluated dose to the public from principle pathways of exposure.

2.1 Nearest Resident

Table 1 presents the location of the nearest resident to Callaway Plant in each of the 16 meteorological sectors. There were three changes noted in the 1996 census. The most significant change was to the location of the nearest resident yielding the highest calculated dose commitment. The previously identified nearest resident has moved and the house is schedule to be demolished. The new nearest resident is located 1.9 miles NNW of the plant.

2.2 Milking Animals

Table 2 presents the location of the nearest milking animals identified within a 5 mile radius of Callaway Plant. All milking animals, whose milk is not used for human consumption and/or not yielding milk, are shown on Table 2. There were no location changes observed during this years census. One change was noted this year in the number and types of milking animals observed in SW sector. The changes identified are normal for a rural area where milking animals are bought and sold on a routine basis. None of the changes noted resulted in modification to the current milk monitoring program.

2.3 Vegetable Gardens

Locations of the nearest vegetable garden greater than 50 m^2 producing broad leaf vegetation are presented in Table 3. Five changes in the location of the nearest garden were observed during this year's census. None of the changes identified resulted in changes to the current vegetable sampling locations.

TABLE 1

NEAREST RESIDENCE WITHIN FIVE MILES OF THE CALLAWAY PLANT

1996

Meteorological Sector	Radial Mileage
N	2.0
NNE	1.6
NE	2.2
ENE	3.8
E	3.2
ESE	2.3
SE	2.4
SSE	2.6
S	2.6
SSW	2.5
SW	2.6
WSW	1.2
W	1.4
WNN	2.0
NW	2.1
NNW	1.9

TABLE 2

NEAREST MILKING ANIMALS WITHIN FIVE MILES OF
THE CALLAWAY PLANT

1996

Meteorological Sector	Radial Mileage	Number of Cows	Number of Goats
SSE	2.6	1	2*
SW	2.6	15	1
NW	2.7	2	NONE
NW	3.1	NONE	4

* Milk producing animals whose milk is not used for human consumption and/or milk producing animals not yielding milk.

TABLE 3

NEAREST GARDEN WITHIN FIVE MILES OF THE CALLAWAY PLANT

1996

Meteorological Sector	Radial Mileage
N	2.0*
NNE	2.4
NE	2.2
ENE	3.8
E	3.6
ESE	2.3
SE	2.4
SSE	2.6
S	3.5
SSW	2.5
SW	2.6
WSW	1.2*
W	3.5
WNN	2.0
NW	3.1
NNW	1.9*

* In this sector there were no gardens noted within five miles producing "broad leaf vegetation." The distance noted is the distance to the nearest residence.

APPENDIX B

EPA CROSS-CHECK RESULTS

1996

TABLE B1

EPA INTERCOMPARISON STUDY RESULTS
1996

SAMPLE TYPE	STUDY DATE	ANALYSIS	TIML RESULTS ± 2σ[a]	EPA RESULTS[b] 1s, N=1	CONTROL LIMITS	UNITS
WATER	JAN 1996	GR. ALPHA	19.5 ± 1.5	12.1 ± 5.0	3.4 - 20.8	pCi/l
		GR. BETA	7.9 ± 0.7	7.0 ± 5.0	0.0 - 15.7	pCi/l
WATER	FEB 1996	I-131	70.7 ± 1.5	67.0 ± 7.0	54.9 - 79.1	pCi/l
WATER	MAR 1996	H-3	22777 ± 185.0	22002 ± 2200	18185 - 25819	pCi/l
WATER	APR 1996	GR. ALPHA	63.8 ± 2.4	74.8 ± 18.7	42.4 - 107.2	pCi/l
		RA-226	2.9 ± 0.1	3.0 ± 0.5	2.1 - 3.9	pCi/l
		RA-228	4.6 ± 0.2	5.0 ± 1.3	2.7 - 7.3	pCi/l
		URANIUM	57.9 ± 0.5	58.4 ± 5.8	48.3 - 68.5	pCi/l
WATER	APR 1996	CO-60	32.7 ± 0.6	31.0 ± 5.0	22.3 - 39.7	pCi/l
		CS-134	43.0 ± 1.0	46.0 ± 5.0	37.3 - 54.7	pCi/l
		CS-137	52.3 ± 2.1	50.0 ± 5.0	41.3 - 58.7	pCi/l
		GR. BETA	154.9 ± 6.8	166.9 ± 25.0	123.5 - 210.3	pCi/l
		SR-89	42.0 ± 3.6	43.0 ± 5.0	34.3 - 51.7	pCi/l
		SR-90	15.3 ± 2.9	16.0 ± 5.0	7.3 - 24.7	pCi/l
WATER	JUN 1996	BA-133	745.0 ± 19.5	745.0 ± 75.0	614.9 - 875.1	pCi/l
		CO-60	97.0 ± 3.6	99.0 ± 5.0	90.3 - 107.7	pCi/l
		CS-134	72.3 ± 1.2	79.0 ± 5.0	70.3 - 87.7	pCi/l
		CS-137	201.3 ± 2.3	197.0 ± 10.0	179.7 - 214.3	pCi/l
		ZN-65	298.0 ± 6.2	300.0 ± 30.0	248.0 - 352.0	pCi/l
WATER	JUN 1996	RA-226	4.8 ± 0.1	4.9 ± 0.7	3.7 - 6.1	pCi/l
		RA-228	8.7 ± 0.5	9.0 ± 2.3	5.0 - 13.0	pCi/l
		URANIUM	20.4 ± 0.8	20.2 ± 3.0	15.0 - 25.4	pCi/l
WATER	JUL 1996	SR-89	24.0 ± 2.0	25.0 ± 5.0	16.3 - 33.7	pCi/l
		SR-90	11.3 ± 1.2	12.0 ± 5.0	3.3 - 20.7	pCi/l
WATER	JUL 1996	GR. ALPHA	20.1 ± 2.0	24.4 ± 6.1	13.8 - 35.0	pCi/l
		GR. BETA	40.4 ± 3.2	44.8 ± 5.0	36.1 - 53.5	pCi/l
WATER	SEP 1996	RA-226	13.6 ± 0.4	14.0 ± 2.1	10.4 - 17.6	pCi/l
		RA-228	5.4 ± 0.4	4.7 ± 1.2	2.6 - 6.8	pCi/l
		URANIUM	10.0 ± 0.2	10.1 ± 3.0	4.9 - 15.3	pCi/l

TABLE B1 (Cont.)

EPA INTERCOMPARISON STUDY RESULTS
1996

SAMPLE TYPE	STUDY DATE	ANALYSIS	TIML RESULTS ± 2σ[a]	EPA RESULTS[b] 1s, N=1	CONTROL LIMITS	UNITS
WATER	OCT 1996	I-131	26.7 ± 2.3	27.0 ± 6.0	16.6 - 37.4	pCi/l
WATER	OCT 1996	GR. ALPHA	10.2 ± 2.1	10.3 ± 5.0	1.6 - 19.0	pCi/l
		GR. BETA	32.0 ± 1.6	34.6 ± 5.0	25.9 - 43.3	pCi/l

a Unless otherwise indicated, the TIML results are given as the mean ± 2 standard deviations for three determinations.

b EPA results are presented as the known value and expected laboratory precision (1s, 1 determination) and control limits as defined by EPA.

c See Addendum to appendix B for explanation of the reason why the sample results were outside the control limits specified by EPA.

APPENDIX C

ISOTOPIC DETECTION LIMITS

AND

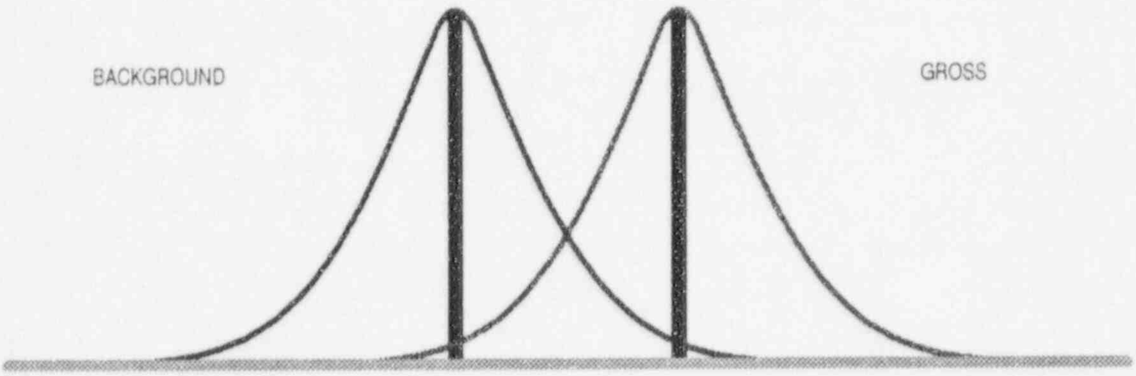
ACTIVITY DETERMINATIONS

Isotopic Detection Limits and Activity Determination

Making a reasonable estimate of the limits of detection for a counting procedure or a radiochemical method is usually complicated by the presence of significant background.

It must be considered that the background is not a fixed value but a series of replicates normally distributed. The desired net activity is thus the difference between the gross sample activity and background activity distributions.

The interpretation of this difference becomes a problem if the two distributions intersect as indicated in the diagram.



If a sufficient number of replicate analyses are run, it is to be expected that results would fall in a normal Gaussian distribution. In routine analysis such replication is not carried out. Standard statistics allow an estimate of the probability of any particular deviation from the mean value. It is common practice to report the mean ± one or two standard deviations as the final result.

Analytical detection limits are governed by a number of factors including:

1. Sample Size

2. Counting Efficiency

   The fundamental quality in the measurement of a radioactive substance is the number of disintegrations per unit time. As with most physical measurements in analytical chemistry, it is seldom possible to make an absolute measurement of the disintegrations rate, but rather, it is necessary to compare the sample with one or more standards. The standards determine the counter efficiency which may then be used to convert sample counts per minute (cpm) to disintegrations per minute (dpm).

3. Background Count Rate

Any counter will show a certain counting rate without a sample in position. This background counting rate comes from several sources: 1) natural environmental radiation from the surroundings, 2) cosmic radiation, and 3) the natural radioactivity in the counter material itself. The background counting rate will depend on the amount of these types of radiation and sensitivity of the counter to radiation.

4. Background and Sample Count Time

The amount of time devoted to counting background depends on the level of the activity being measured. In general, with low level samples, this time should be about equal to that devoted to counting a sample.

5. Time Interval Between Sample Collection and Counting

Decay measurements are useful in identifying certain short-lived isotopes. This disintegration constant is one of the basic characteristics of a specific radionuclide and is readily determined, if the half-life is sufficiently short.

6. Chemical Recovery of the Analytical Procedure

Most radiochemical analyses are carried out in such a way that losses occur during the separations. These losses occur due to a large number of contaminants that may be present and interfere during chemical separations. Thus it is necessary to include a technique for estimating these losses in the development of the analytical procedure.

The following method was used to determine lower limit of detection (LLD) as per NRC Regulatory Guide 4.1, Rev. 1, "Program for Monitoring Radioactivity in the Environs of Nuclear Power Plants", and the NRC Branch Technical Position, November 1979, "An acceptable radiological Environmental Monitoring Program". The LLD is defined, for purposes of this guide, as the smallest concentration of radioactivity material in a sample that will yield a net count (above system background) that will be detected with 95% probability with only 5% probability of falsely concluding that a blank observation represents a "real" signal.

For a particular measurement system (which may include radiochemical separation):

$$LLD = \frac{4.66 * s_b}{E * V * 2.22 * Y * \exp(-\lambda \Delta t)}$$

Where:

LLD = " A priori lower limit of detection as defined above (pCi per unit mass or volume).

s_b = Standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute).

E = Counting efficiency (counts per disintegration).

V = Sample size (units of mass or volume).

2.22 = Number of disintegrations per minute per picocurie.

Y = Fractional radiochemical yield (when applicable).

λ = Radioactive decay constant for the particular radioisotope.

Δt = Elapsed time between sample collection (or end of the sample collection period) and time of counting.

The value of s_b used in the calculation of the LLD for a particular measurement system is based on the actual observed variance of the background count rate, or, the counting rate of the blank sample, (as appropriate), rather than an unverified theoretically predicated variance.

In calculating the LLD for a radionuclide determined by gamma-ray spectrometry, the background includes the typical contributions of other nuclides normally present in the samples.

Single Measurements

Each single measurement is reported as follows:

$$x \pm s$$

where: x = Value of the measurement;

$s = 2\sigma$ counting uncertainty (corresponding to the 95% confidence level).

In cases where the activity is found to be below the lower limit of detection L it is reported as

$$< L$$

where L = the lower limit of detection based on 4.66σ uncertainty for a background sample.

Duplicate Analysis

1. Individual results: $x_1 \pm s_1$
$x_2 \pm s_2$

Reported result: $x \pm s$

where $x = (\frac{1}{2})(x_1 + x_2)$

$$s = (\tfrac{1}{2})\sqrt{(s_1^2 + s_2^2)}$$

2. Individual results: $< L_1$
$< L_2$

Reported results: $< L$

where L = lower of L_1 and L_2

3. Individual results: $x \pm s$
$< L$

Reported results: $x \pm s$ if $x \geq L$;
$< L$ otherwise

Computation of Average and Standard Deviations

Average and standard deviations listed in the tables are computed from all individual measurements over the period averaged; for example, an annual standard deviation would not be the average of quarterly standard deviations. The average x and standard deviation(s) of a set of n numbers $x_1, x_2, \ldots x_n$ are defined as follows:

$$\bar{x} = \frac{1}{n}\Sigma x$$

$$s = \sqrt{\frac{\Sigma(\bar{x} - x_i)^2}{n-1}}$$

If all values in the averaging group are less than the lower limit of detection, the highest LLD is reported.

If all but one of the values are less than the lower limit of detection, the single value x and associated two sigma error is reported.

In rounding off, the following rules are followed:

1. If the figure following those to be retained is less than 5, the figure is dropped, and the retained figures are unchanged. As an example, 11.443 is rounded off to 11.44.

2. If the figure following those to be retained is greater than 5, the figure is dropped and the last retained figure is raised by 1. As an example, 11.446 is rounded off to 11.45.

3. If the figure following those to be retained is 5, and if there are not figures other than zeros beyond the five, the figure 5 is dropped, and the last-place figure retained is increased by one if it is an odd number or unchanged if an even number. As an example, 11.435 is rounded off to 11.44, while 11.425 is rounded off to 11.42.

APPENDIX D

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY 1996

APPENDIX D

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility: Callaway Plant — Docket No.: 50-483

Location of Facility: Callaway County, Missouri (county, state) — Reporting Period: 1996

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE & DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (f)[2] RANGE	CONTROL LOCATION MEAN (f)[2] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
A. Waterborne Pathway							
Surface Water (pCi/l)	H-3 (24)	146	198 (7/12) (165 - 227)	5.2 mi. SE; 1.1 mi downstream of discharge	198 (7/12) (165 - 227)	-- (0/12)	0
	Gamma (24)	--	-- (0/24)	NA	NA	-- (0/12)	0
Ground Water (pCi/l)	H-3 (12)	149	-- (0/8)	NA	NA	-- (0/4)	0
	Gamma (13)	--	-- (0/8)	NA	NA	-- (0/4)	0
Bottom Sediment (pCi/kg)	Gamma (4)	--	-- (0/8)	NA	NA	-- (0/4)	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility: Callaway Plant **Docket No.:** 50-483

Location of Facility: Callaway County, Missouri (county, state) **Reporting Period:** 1996

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE & DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (f)[2] RANGE	CONTROL LOCATION MEAN (f)[2] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
A. Waterborne Pathway (Cont.)							
Shoreline Sediment (pCi/kg)	Gamma (4) Cs-137	15	-- (0/2)	4.9 mi SSE; 0.6 mi upstream of discharge	92 (1/2) ---	92 (1/2) ---	0
Wetlands (pCi/kg)	Gross Alpha (4)		11435 (3/3) (9661 - 13710)	0.72 mi SSE; Wetlands discharge area	13710 (1/1) --	9280 (1/1) --	0
	Gross Beta (4)		18744 (3/3) (16615 - 21476)	0.60 mi SE; Wetlands, inlet area	21476 (1/1) --	17498 (1/1) --	0
	Gamma (4) K-40		12347 (3/3) (9606 - 16530)	0.60 mi SE; Wetlands, inlet area	16590 (1/1) --	14555 (1/1) --	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility: Callaway Plant Docket No.: 50-483

Location of Facility: Callaway County, Missouri (county, state) Reporting Period: 1996

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE & DIRECTION	MEAN (f)[2] RANGE	CONTROL LOCATION MEAN (f)[2] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
A. Waterborne Pathway (Cont.)							
Wetlands (Cont.) (pCi/kg)	Cs-137	18	209 (1/3) (100 - 292)	0.60 mi SE; Wetlands, inlet area	209 (1/1) --	63 (1/1) --	0
B. Airborne Pathway							
Airborne Particulate (pCi/m^3)	Gross Beta (260)	--	0.024 (260/260) (0.009 - 0.060)	1.3 mi ENE Callaway Primary Meteorological Tower	0.026 (52/52) (0.014 - 0.060)	NA --	0
	Gamma (20) Be-7	--	0.100 (20/20) (0.067 - 0.200)	1.3 mi ENE Callaway Primary Meteorological Tower	0.128 (4/4) (0.081 - 0.200)	NA --	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE & DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (f)[2] RANGE	CONTROL LOCATION MEAN (f)[2] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
B. Airborne Pathway (Cont.)							
Airborne Particulate (Cont.) (pCi/m³)	Sr-89 (20)	0.0003	-- (0/16)	NA	NA	-- (0/4)	0
	Sr-90 (20)	0.0001	-- (0/16)	NA	NA	-- (0/4)	0
Airborne Iodine (pCi/m³)	I-131 (260)	0.070	-- (0/208)	NA	NA	-- (0/52)	0
C. Ingestion Pathway							
Milk (pCi/l)	I-131 (43)	0.1	-- (0/33)	NA	NA	-- (0/15)	0
	Gamma (43)						
	K-40	---	1484 (30/30) (1050 - 2050)	3.1 mi NW Goats milk Schneiders farm	1889 (12/12) (1670 - 2050)	1332 (13/13) (1210 - 1450)	0
	Sr-89 (43)	0.6	-- (0/33)	NA	NA	-- (0/15)	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE & DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (f)[2] RANGE	CONTROL LOCATION MEAN (f)[2] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
C. Ingestion Pathway (Cont.)							
Milk (Cont.) (pCi/l)	Sr-90 (43)	---	4.0 (30/30) (1.7 - 7.7)	3.1 mi NW Goats milk Schneiders farm	5.2 (12/12) (2.5 - 7.0)	1.6 (13/13) (0.6 - 2.6)	0
(grams/liter)	Ca (43)	---	0.92 (30/30) (0.81 - 1.10)	14.8 mi SW; Cows milk Kissock farm	0.96 (13/13) (0.82 - 1.10)	0.96 (13/13) (0.82 - 1.10)	0
Fish (pCi/kg - wet)	Gamma (20) K-40	---	2863 (10/10) (2537 - 3242)	5.1 mi. SE; 1.0 mi downstream of discharge	2863 (10/10) (2537 - 3242)	2767 (10/10) (2093 - 3377)	0
	Co-58	6.3	361 (1/1) --	5.1 mi. SE; 1.0 mi downstream of discharge	361 (1/1) --	-- --	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility: Callaway Plant — Docket No.: 50-483

Location of Facility: Callaway County, Missouri (county, state) — Reporting Period: 1996

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE & DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (f)[2] RANGE	CONTROL LOCATION MEAN (f)[2] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
C. Ingestion Pathway (Cont.)							
Fish (Cont.) (pCi/kg - wet)	Sr-89 (20)	5.8	-- (0/10)	NA	NA	-- (0/10)	0
	Sr-90 (20)	1.4	-- (0/10)	4.9 mi SSE; 0.6 mi upstream of discharge	4 (1/1) --	4 (1/1) --	0
Vegetation (pCi/kg - wet)	Gross Alpha (18)	27	199 (10/15) (89 - 441)	2.0 mi WNW; Meehans farm	199 (10/15) (89 - 441)	135 (3/3) (59 - 183)	0
	Gross Beta (20)	---	4690 (15/15) (2173 - 7813)	2.0 mi WNW; Meehans farm	4690 (15/15) (2173 - 7813)	3377 (3/3) (2001 - 4265)	0
	I-131 (20)	8.7	-- (0/16)	NA	NA	-- (0/4)	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility: Callaway Plant **Docket No.:** 50-483

Location of Facility: Callaway County, Missouri (county, state) **Reporting Period:** 1996

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE & DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (f)[2] RANGE	CONTROL LOCATION MEAN (f)[2] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
C. Ingestion Pathway (Cont.)							
Vegetation (Cont.) (pCi/kg - wet)	Gamma (20) K-40		4840 (16/16) (2295 - 8387)	2.0 mi WNW; Meehan farm	4840 (16/16) (2295 - 8387)	4103 (3/3) (2327 - 5449)	0
Soil (pCi/kg)	Gross Alpha (11)		15582 (10/10) (10848 - 26097)	1.50 mi NE; Forest ecology plot F8	26097 (1/1) --	13219 (1/1) --	0
	Gross Beta (11)		25111 (10/10) (21439 - 29440)	15.0 mi SW Beazley farm	29800 (1/1) --	29800 (1/1) --	0
	Gamma (11) K-40		11001 (10/10) (4849 - 13232)	15.0 mi SW; Beazley fram	17097 (1/1) --	17097 (1/1) --	0

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MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] RANGE	LOCATION WITH HIGHEST ANNUAL MEAN NAME DISTANCE & DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN MEAN (f)[2] RANGE	CONTROL LOCATION MEAN (f)[2] RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS
C. Ingestion Pathway (Cont.)							
Soil (Cont.) (pCi/kg)	Cs-137		832 (10/10) (410 - 1351)	0.98 mi S; Forest ecology plot F1	1351 (1/1) --	268 (1/1) --	0
D. Direct Radiation							
Quarterly TLDs (mRem/Standard Quarter)	Gamma Dose (206)	10	17.5 (198/198) (12.9 - 20.5)	2.9 mi S; County Rd. 459, 1.4 mi N of HWY 94	19.1 (4/4) (17.8 - 20.0)	15.3 (8/8) (11.8 - 19.2)	0
Annual TLDs (mRem/Standard Quarter)	Gamma Dose (52)	10	17.5 (50/50) (12.7 - 19.6)	2.9 mi S; County Rd. 459, 1.4 mi N of HWY 94	19.6 (1/1) --	15.9 (2/2) (12.4 - 19.3)	0

RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM ANNUAL SUMMARY

Name of Facility: Callaway Plant **Docket No.:** 50-483

Location of Facility: Callaway County, Missouri (county, state) **Reporting Period:** 1996

MEDIUM OR PATHWAY SAMPLED (UNIT OF MEASUREMENT)	TYPE AND TOTAL NUMBER OF ANALYSES PERFORMED	LOWER LIMIT OF DETECTION[1] (LLD)	ALL INDICATOR LOCATIONS MEAN (f)[2] / RANGE	LOCATION WITH HIGHEST ANNUAL MEAN: NAME / DISTANCE & DIRECTION	LOCATION WITH HIGHEST ANNUAL MEAN: MEAN (f)[2] / RANGE	CONTROL LOCATION MEAN (f)[2] / RANGE	NUMBER OF NONROUTINE REPORTED MEASUREMENTS

Notes:

(1) The LLDs quoted are the lowest actual LLD obtained in the various media during the reporting period. The required LLDs for radiological environmental sample analysis is found in Table III. Where all nuclides were LLD for a specific media, no LLD was listed.

(2) Mean and range are based upon detectable measurements only. Fraction of detectable measurements is indicated in parentheses.

APPENDIX E

INDIVIDUAL SAMPLE RESULTS

DATA TABLES

1996

APPENDIX E

LIST OF TABLES

Definition of terms used in the data tables are as follows:

Wet Weight	A reporting unit used with organic tissue samples such as vegetation and animal samples in which the amount of sample is taken to be the weight as received from the field with no moisture removed.
Dry Weight	A reporting unit used for soil and sediment in which the amount of sample is taken to be the weight of the sample after removal of moisture by drying in an oven.
pCi/m3	A reporting unit used with air particulate and radioiodine data which refers to the radioactivity content expressed in picocuries per cubic meter of air passed through the filter and/or the charcoal trap. Note the volume is not corrected to standard conditions.
Gamma Emitters or Gamma Isotopic	Samples were analyzed by high resolution (GeLi) gamma spectrometry. The resulting spectrum is analyzed by a computer program which scans from about 50 to 2000 keV and lists the energy peaks of any nuclides present in concentrations exceeding the sensitivity limits set for that particular sample.
Error Terms	Figures following " ±" are error terms based on counting uncertainties at the 95 percent confidence level. Values preceded by the "<" symbol were below the stated concentration at the 99 percent confidence level.
Sensitivity	In general, all analyses meet the sensitivity requirements of the program as given in Table III. For the few samples that do not (because of inadequate sample quantities, analytical interference, etc.) the sensitivity actually obtained in the analysis is given.

TABLE E1

AIRBORNE IODINE-131 and GROSS BETA in AIR PARTICULATE FILTERS (pCi/m^3)
1996

COLLECTION DATE	CA-APT-A1 Vol. (M^3)	CA-APT-A1 GROSS BETA	CA-APT-A1 I-131	CA-APT-A7 Vol. (M^3)	CA-APT-A7 GROSS BETA	CA-APT-A7 I-131	CA-APT-A8 Vol. (M^3)	CA-APT-A8 GROSS BETA	CA-APT-A8 I-131	CA-APT-A9 Vol. (M^3)	CA-APT-A9 GROSS BETA	CA-APT-A9 I-131	CA-APT-B3 Vol. (M^3)	CA-APT-B3 GROSS BETA	CA-APT-B3 I-131
01/04/96	428	0.030 ± 0.003	<0.070	431	0.031 ± 0.003	<0.070	426	0.030 ± 0.003	<0.070	431	0.031 ± 0.003	<0.070	428	0.026 ± 0.003	<0.070
01/11/96	433	0.030 ± 0.003	<0.070	428	0.029 ± 0.003	<0.070	433	0.031 ± 0.003	<0.070	428	0.029 ± 0.003	<0.070	428	0.028 ± 0.003	<0.070
01/19/96	489	0.026 ± 0.002	<0.070	423	0.027 ± 0.003	<0.070	489	0.026 ± 0.002	<0.070	492	0.031 ± 0.003	<0.070	492	0.030 ± 0.003	<0.070
01/25/96	370	0.028 ± 0.003	<0.070	433	0.029 ± 0.003	<0.070	372	0.026 ± 0.003	<0.070	367	0.027 ± 0.003	<0.070	370	0.027 ± 0.003	<0.070
02/01/96	421	0.027 ± 0.003	<0.070	431	0.026 ± 0.003	<0.070	421	0.027 ± 0.003	<0.070	418	0.026 ± 0.003	<0.070	421	0.025 ± 0.003	<0.070
02/08/96	433	0.043 ± 0.003	<0.070	423	0.042 ± 0.003	<0.070	431	0.041 ± 0.003	<0.070	436	0.037 ± 0.003	<0.070	431	0.040 ± 0.003	<0.070
02/15/96	426	0.014 ± 0.002	<0.070	426	0.012 ± 0.002	<0.070	426	0.015 ± 0.002	<0.070	426	0.015 ± 0.002	<0.070	428	0.013 ± 0.002	<0.070
02/22/96	431	0.028 ± 0.003	<0.070	433	0.022 ± 0.003	<0.070	433	0.031 ± 0.003	<0.070	431	0.026 ± 0.003	<0.070	431	0.025 ± 0.003	<0.070
02/29/96	428	0.025 ± 0.003	<0.070	428	0.020 ± 0.003	<0.070	428	0.023 ± 0.003	<0.070	433	0.024 ± 0.003	<0.070	426	0.021 ± 0.003	<0.070
03/07/96	428	0.029 ± 0.003	<0.070	428	0.017 ± 0.002	<0.070	428	0.020 ± 0.003	<0.070	433	0.019 ± 0.003	<0.070	426	0.018 ± 0.003	<0.070
03/14/96	428	0.028 ± 0.003	<0.070	426	0.026 ± 0.003	<0.070	428	0.025 ± 0.003	<0.070	428	0.026 ± 0.003	<0.070	431	0.024 ± 0.003	<0.070
03/21/96	431	0.024 ± 0.003	<0.070	433	0.014 ± 0.002	<0.070	431	0.020 ± 0.003	<0.070	431	0.018 ± 0.003	<0.070	428	0.020 ± 0.003	<0.070
03/28/96	423	0.021 ± 0.003	<0.070	421	0.022 ± 0.003	<0.070	423	0.021 ± 0.003	<0.070	426	0.020 ± 0.003	<0.070	426	0.020 ± 0.003	<0.070
04/04/96	431	0.029 ± 0.003	<0.070	433	0.022 ± 0.003	<0.070	431	0.025 ± 0.003	<0.070	431	0.025 ± 0.003	<0.070	431	0.026 ± 0.003	<0.070
04/11/96	428	0.024 ± 0.003	<0.070	426	0.019 ± 0.003	<0.070	428	0.021 ± 0.003	<0.070	426	0.020 ± 0.003	<0.070	426	0.018 ± 0.003	<0.070
04/18/96	418	0.019 ± 0.003	<0.070	423	0.018 ± 0.003	<0.070	421	0.016 ± 0.002	<0.070	421	0.022 ± 0.003	<0.070	423	0.018 ± 0.003	<0.070
04/25/96	431	0.015 ± 0.002	<0.070	433	0.014 ± 0.002	<0.070	431	0.017 ± 0.003	<0.070	433	0.016 ± 0.002	<0.070	431	0.015 ± 0.002	<0.070
05/02/96	431	0.014 ± 0.002	<0.070	428	0.012 ± 0.002	<0.070	431	0.011 ± 0.002	<0.070	431	0.011 ± 0.002	<0.070	431	0.011 ± 0.002	<0.070
05/09/96	426	0.019 ± 0.002	<0.070	423	0.015 ± 0.002	<0.070	426	0.019 ± 0.002	<0.070	426	0.016 ± 0.002	<0.070	426	0.016 ± 0.002	<0.070
05/16/96	431	0.019 ± 0.002	<0.070	431	0.014 ± 0.002	<0.070	431	0.017 ± 0.002	<0.070	428	0.015 ± 0.002	<0.070	428	0.014 ± 0.002	<0.070
05/23/96	428	0.021 ± 0.003	<0.070	431	0.021 ± 0.003	<0.070	431	0.020 ± 0.003	<0.070	431	0.017 ± 0.002	<0.070	431	0.017 ± 0.002	<0.070
05/30/96	428	0.019 ± 0.002	<0.070	426	0.015 ± 0.002	<0.070	426	0.018 ± 0.002	<0.070	426	0.015 ± 0.002	<0.070	426	0.013 ± 0.002	<0.070
06/06/96	426	0.017 ± 0.002	<0.070	426	0.017 ± 0.002	<0.070	426	0.017 ± 0.002	<0.070	428	0.015 ± 0.002	<0.070	426	0.013 ± 0.002	<0.070
06/13/96	428	0.015 ± 0.002	<0.070	431	0.015 ± 0.002	<0.070	431	0.016 ± 0.002	<0.070	428	0.012 ± 0.002	<0.070	431	0.009 ± 0.002	<0.070
06/20/96	428	0.027 ± 0.003	<0.070	426	0.027 ± 0.003	<0.070	426	0.027 ± 0.003	<0.070	428	0.024 ± 0.003	<0.070	428	0.019 ± 0.002	<0.070
06/27/96	431	0.022 ± 0.003	<0.070	431	0.022 ± 0.003	<0.070	433	0.023 ± 0.003	<0.070	431	0.020 ± 0.003	<0.070	431	0.016 ± 0.002	<0.070
07/03/96	364	0.028 ± 0.003	<0.070	367	0.026 ± 0.003	<0.070	362	0.030 ± 0.003	<0.070	364	0.024 ± 0.003	<0.070	362	0.025 ± 0.003	<0.070

Notes:

TABLE E1 (Cont.)

AIRBORNE IODINE-131 and GROSS BETA in AIR PARTICULATE FILTERS (pCi/m^3)
1996

COLLECTION DATE	CA-APT-A1 Vol. (M^3)	CA-APT-A1 GROSS BETA	CA-APT-A1 I-131	CA-APT-A7 Vol. (M^3)	CA-APT-A7 GROSS BETA	CA-APT-A7 I-131	CA-APT-A8 Vol. (M^3)	CA-APT-A8 GROSS BETA	CA-APT-A8 I-131	CA-APT-A9 Vol. (M^3)	CA-APT-A9 GROSS BETA	CA-APT-A9 I-131	CA-APT-B3 Vol. (M^3)	CA-APT-B3 GROSS BETA	CA-APT-B3 I-131
07/11/96	487	0.020 ± 0.002	<0.070	487	0.017 ± 0.002	<0.070	489	0.020 ± 0.002	<0.070	487	0.023 ± 0.002	<0.070	487	0.022 ± 0.002	<0.070
07/18/96	487	0.023 ± 0.002	<0.070	487	0.021 ± 0.002	<0.070	489	0.023 ± 0.002	<0.070	487	0.019 ± 0.002	<0.070	487	0.022 ± 0.002	<0.070
07/25/96	426	0.015 ± 0.002	<0.070	423	0.012 ± 0.002	<0.070	426	0.014 ± 0.002	<0.070	423	0.013 ± 0.002	<0.070	423	0.014 ± 0.002	<0.070
08/01/96	428	0.025 ± 0.003	<0.070	428	0.023 ± 0.002	<0.070	428	0.021 ± 0.002	<0.070	428	0.021 ± 0.002	<0.070	428	0.021 ± 0.002	<0.070
08/08/96	428	0.026 ± 0.003	<0.070	426	0.024 ± 0.003	<0.070	428	0.026 ± 0.003	<0.070	431	0.022 ± 0.002	<0.070	431	0.024 ± 0.003	<0.070
08/15/96	428	0.026 ± 0.003	<0.070	428	0.025 ± 0.003	<0.070	370	0.024 ± 0.003	<0.070	428	0.028 ± 0.003	<0.070	428	0.027 ± 0.003	<0.070
08/22/96	428	0.028 ± 0.003	<0.070	431	0.029 ± 0.003	<0.070	423	0.031 ± 0.003	<0.070	423	0.027 ± 0.003	<0.070	426	0.029 ± 0.003	<0.070
08/29/96	431	0.034 ± 0.003	<0.070	431	0.032 ± 0.003	<0.070	433	0.032 ± 0.003	<0.070	451	0.031 ± 0.003	<0.070	433	0.033 ± 0.003	<0.070
09/05/96	431	0.060 ± 0.004	<0.070	426	0.047 ± 0.003	<0.070	428	0.053 ± 0.003	<0.070	408	0.056 ± 0.003	<0.070	426	0.053 ± 0.003	<0.070
09/12/96	426	0.037 ± 0.003	<0.070	428	0.030 ± 0.003	<0.070	428	0.032 ± 0.003	<0.070	431	0.031 ± 0.003	<0.070	428	0.030 ± 0.003	<0.070
09/19/96	426	0.021 ± 0.002	<0.070	426	0.019 ± 0.002	<0.070	426	0.016 ± 0.002	<0.070	426	0.015 ± 0.002	<0.070	426	0.018 ± 0.002	<0.070
09/26/96	428	0.030 ± 0.003	<0.070	428	0.024 ± 0.002	<0.070	245	0.025 ± 0.004	<0.070	428	0.022 ± 0.002	<0.070	428	0.029 ± 0.003	<0.070
10/03/96	431	0.028 ± 0.003	<0.070	428	0.025 ± 0.003	<0.070	418	0.024 ± 0.003	<0.070	431	0.022 ± 0.002	<0.070	431	0.027 ± 0.003	<0.070
10/10/96	431	0.030 ± 0.003	<0.070	431	0.022 ± 0.002	<0.070	431	0.027 ± 0.003	<0.070	428	0.023 ± 0.002	<0.070	428	0.031 ± 0.003	<0.070
10/17/96	436	0.033 ± 0.003	<0.070	436	0.028 ± 0.003	<0.070	436	0.028 ± 0.003	<0.070	438	0.027 ± 0.003	<0.070	438	0.033 ± 0.003	<0.070
10/24/96	418	0.027 ± 0.003	<0.070	418	0.024 ± 0.002	<0.070	418	0.024 ± 0.002	<0.070	415	0.022 ± 0.002	<0.070	415	0.029 ± 0.033	<0.070
10/31/96	433	0.020 ± 0.003	<0.070	433	0.021 ± 0.003	<0.070	431	0.016 ± 0.003	<0.070	431	0.017 ± 0.003	<0.070	433	0.018 ± 0.003	<0.070
11/07/96	431	0.028 ± 0.003	<0.070	431	0.021 ± 0.002	<0.070	433	0.021 ± 0.002	<0.070	433	0.023 ± 0.003	<0.070	431	0.028 ± 0.003	<0.070
11/14/96	301	0.023 ± 0.003	<0.070	423	0.018 ± 0.003	<0.070	423	0.014 ± 0.002	<0.070	423	0.017 ± 0.002	<0.070	423	0.018 ± 0.003	<0.070
11/21/96	428	0.051 ± 0.003	<0.070	431	0.054 ± 0.003	<0.070	431	0.035 ± 0.003	<0.070	433	0.050 ± 0.003	<0.070	428	0.055 ± 0.003	<0.070
11/29/96	492	0.020 ± 0.003	<0.070	484	0.021 ± 0.003	<0.070	489	0.019 ± 0.003	<0.070	487	0.021 ± 0.003	<0.070	489	0.021 ± 0.003	<0.070
12/04/96	306	0.027 ± 0.004	<0.070	308	0.032 ± 0.004	<0.070	308	0.028 ± 0.004	<0.070	308	0.028 ± 0.004	<0.070	306	0.031 ± 0.004	<0.070
12/12/96	489	0.025 ± 0.002	<0.070	489	0.024 ± 0.002	<0.070	487	0.023 ± 0.002	<0.070	489	0.025 ± 0.003	<0.070	489	0.025 ± 0.002	<0.070
12/19/96	428	0.031 ± 0.003	<0.070	426	0.029 ± 0.003	<0.070	426	0.030 ± 0.003	<0.070	426	0.031 ± 0.003	<0.070	428	0.028 ± 0.003	<0.070
12/26/96	431	0.024 ± 0.003	<0.070	433	0.021 ± 0.003	<0.070	431	0.024 ± 0.003	<0.070	431	0.027 ± 0.003	<0.070	431	0.026 ± 0.003	<0.070

Notes:

TABLE E2

AIRBORNE PARTICULATE - QUARTERLY COMPOSITES (pCi/m^3)
1996

JANUARY - MARCH 1996	CA-APT-A1	CA-APT-A7	CA-APT-A8	CA-APT-A9	CA-APT-B3
Volume (Cubic Feet):	5995	5990	5995	6001	5994
Analysis					
Sr-89	<0.0003	<0.0004	<0.0004	<0.0007	<0.0003
Sr-90	<0.0001	<0.0002	<0.0002	<0.0003	<0.0001
Be-7	0.1100 ± 0.0110	0.0910 ± 0.0100	0.1100 ± 0.0110	0.1000 ± 0.0070	0.0910 ± 0.0090
Co-58	<0.0003	<0.0004	<0.0006	<0.0002	<0.0004
Co-60	<0.0007	<0.0005	<0.0005	<0.0004	<0.0004
Zr-95	<0.0007	<0.0010	<0.0015	<0.0005	<0.0008
Cs-134	<0.0005	<0.0002	<0.0003	<0.0003	<0.0002
Cs-137	<0.0006	<0.0004	<0.0007	<0.0004	<0.0003
Ba-La-140	<0.0009	<0.0011	<0.0007	<0.0006	<0.0006
Ce-144	<0.0024	<0.0032	<0.0029	<0.0010	<0.0017

APRIL - JUNE 1996	CA-APT-A1	CA-APT-A7	CA-APT-A8	CA-APT-A9	CA-APT-B3
Volume (Cubic Feet):	5929	5935	5934	5932	5931
Analysis					
Sr-89	<0.0007	<0.0007	<0.0007	<0.0009	<0.0005
Sr-90	<0.0003	<0.0003	<0.0003	<0.0004	<0.0003
Be-7	0.1200 ± 0.0110	0.1000 ± 0.0120	0.1000 ± 0.0090	0.1000 ± 0.0090	0.0870 ± 0.0090
Co-58	<0.0003	<0.0005	<0.0004	<0.0003	<0.0001
Co-60	<0.0003	<0.0007	<0.0004	<0.0003	<0.0003
Zr-95	<0.0006	<0.0013	<0.0007	<0.0009	<0.0010
Cs-134	<0.0004	<0.0005	<0.0003	<0.0002	<0.0002
Cs-137	<0.0005	<0.0005	<0.0004	<0.0004	<0.0004
Ba-La-140	<0.0010	<0.0009	<0.0009	<0.0007	<0.0006
Ce-144	<0.0017	<0.0024	<0.0016	<0.0022	<0.0014

Notes:

TABLE E2 (Cont.)

AIRBORNE PARTICULATE - QUARTERLY COMPOSITES (pCi/m^3)
1996

JULY - SEPTEMBER 1996	CA-APT-A1	CA-APT-A7	CA-APT-A8	CA-APT-A9	CA-APT-B3
Volume (Cubic Feet):	5685	5677	5431	5682	5682
Analysis					
Sr-89	<0.0006	<0.0006	<0.0013	<0.0006	<0.0005
Sr-90	<0.0003	<0.0003	<0.0005	<0.0003	<0.0003
Be-7	0.2000 ± 0.0170	0.1000 ± 0.0090	0.1100 ± 0.0100	0.1000 ± 0.0140	0.1100 ± 0.0130
Co-58	<0.0011	<0.0002	<0.0005	<0.0006	<0.0005
Co-60	<0.0006	<0.0002	<0.0004	<0.0003	<0.0005
Zr-95	<0.0028	<0.0015	<0.0005	<0.0013	<0.0011
Cs-134	<0.0010	<0.0005	<0.0003	<0.0004	<0.0006
Cs-137	<0.0005	<0.0004	<0.0002	<0.0008	<0.0003
Ba-La-140	<0.0009	<0.0016	<0.0007	<0.0010	<0.0016
Ce-144	<0.0035	<0.0009	<0.0026	<0.0041	<0.0037

OCTOBER - DECEMBER 1996	CA-APT-A1	CA-APT-A7	CA-APT-A8	CA-APT-A9	CA-APT-B3
Volume (Cubic Feet):	5445	5566	5570	9658	5565
Analysis					
Sr-89	<0.0004	<0.0003	<0.0004	<0.0004	<0.0004
Sr-90	<0.0004	<0.0003	<0.0003	<0.0003	<0.0004
Be-7	0.0810 ± 0.0090	0.0670 ± 0.0090	0.0770 ± 0.0110	0.0730 ± 0.0100	0.0720 ± 0.0080
Co-58	<0.0006	<0.0004	<0.0006	<0.0006	<0.0002
Co-60	<0.0003	<0.0002	<0.0002	<0.0006	<0.0003
Zr-95	<0.0012	<0.0007	<0.0011	<0.0016	<0.0006
Cs-134	<0.0005	<0.0005	<0.0006	<0.0006	<0.0005
Cs-137	<0.0003	<0.0004	<0.0005	<0.0007	<0.0003
Ba-La-140	<0.0006	<0.0006	<0.0005	<0.0005	<0.0005
Ce-144	<0.0016	<0.0030	<0.0034	<0.0022	<0.0022

Notes:

TABLE E3

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (01/09/96)	CA-MLK-M6 (01/09/96)	CA-MLK-M7 (01/09/96)
I-131	ND	<0.4	<0.3
Sr-89	ND	<0.8	<1.0
Sr-90	ND	4.0 ± 0.6	2.6 ± 0.6
K-40	ND	1390.0 ± 160.0	1300.0 ± 160.0
Zn-65	ND	<13.0	<13.9
Cs-134	ND	<6.2	<7.5
Cs-137	ND	<8.0	<7.6
Ba-La-140	ND	<2.5	<2.3
Ca (g/l)	ND	0.83	0.85

Analysis	CA-MLK-M5B (02/13/96)	CA-MLK-M6 (02/13/96)	CA-MLK-M7 (02/13/96)
I-131	ND	<0.3	<0.3
Sr-89	ND	<1.6	<1.3
Sr-90	ND	4.0 ± 1.0	1.2 ± 0.5
K-40	ND	1300.0 ± 150.0	1360.0 ± 120.0
Zn-65	ND	<6.4	<6.9
Cs-134	ND	<6.4	<3.3
Cs-137	ND	<7.9	<3.9
Ba-La-140	ND	<5.4	<1.3
Ca (g/l)	ND	1.10	0.82

Notes:
ND = No Data. See section 2.3 for explanation.

TABLE E3 (Cont.)

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (03/12/96)	CA-MLK-M6 (03/12/96)	CA-MLK-M7 (03/12/96)
I-131	ND	<0.4	<0.4
Sr-89	ND	<1.1	<0.9
Sr-90	ND	1.8 ± 0.5	1.3 ± 0.4
K-40	ND	1260.0 ± 130.0	1450.0 ± 160.0
Zn-65	ND	<20.3	<7.2
Cs-134	ND	<4.1	<6.3
Cs-137	ND	<6.5	<5.2
Ba-La-140	ND	<4.2	<2.4
Ca (g/l)	ND	0.93	0.86

Analysis	CA-MLK-M5B (04/09/96)	CA-MLK-M6 (04/09/96)	CA-MLK-M7 (04/09/96)
I-131	<0.3	<0.3	<0.3
Sr-89	<1.2	<0.9	<0.9
Sr-90	7.7 ± 0.9	3.7 ± 0.6	1.3 ± 0.4
K-40	1770.0 ± 160.0	1250.0 ± 120.0	1380.0 ± 150.0
Zn-65	<11.0	<6.9	<10.2
Cs-134	<3.5	<4.6	<8.3
Cs-137	<5.0	<3.9	<5.9
Ba-La-140	<2.0	<1.4	<1.9
Ca (g/l)	0.94	1.01	0.90

Notes:
ND = No Data. See section 2.3 for explanation.

TABLE E3 (Cont.)

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (04/23/96)	CA-MLK-M6 (04/23/96)	CA-MLK-M7 (04/23/96)
I-131	<0.2	<0.5	<0.4
Sr-89	<0.8	<0.8	<0.8
Sr-90	5.7 ± 0.8	3.2 ± 0.5	2.0 ± 0.5
K-40	1760.0 ± 120.0	1130.0 ± 100.0	1440.0 ± 80.0
Zn-65	<8.0	<7.1	<5.9
Cs-134	<4.2	<3.9	<3.3
Cs-137	<4.2	<4.3	<3.6
Ba-La-140	<3.7	<3.3	<2.9
Ca (g/l)	0.81	0.93	1.03

Analysis	CA-MLK-M5B (05/13/96)	CA-MLK-M6 (05/14/96)	CA-MLK-M7 (05/14/96)
I-131	<0.4	<0.4	<0.4
Sr-89	<1.1	<1.1	<1.0
Sr-90	6.5 ± 0.7	3.4 ± 0.5	2.6 ± 0.5
K-40	1860.0 ± 190.0	1220.0 ± 170.0	1340.0 ± 120.0
Zn-65	<7.6	<8.5	<5.6
Cs-134	<7.1	<8.0	<4.0
Cs-137	<6.8	<8.5	<2.4
Ba-La-140	<2.8	<3.0	<2.3
Ca (g/l)	0.98	0.95	0.93

Notes:

TABLE E3 (Cont.)

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (05/28/96)	CA-MLK-M6 (05/28/96)	CA-MLK-M7 (05/28/96)
I-131	<0.5	<0.5	<0.3
Sr-89	<1.0	<0.9	<0.9
Sr-90	5.1 ± 0.7	6.0 ± 0.7	1.2 ± 0.4
K-40	1890.0 ± 210.0	1300.0 ± 120.0	1370.0 ± 140.0
Zn-65	<9.4	<4.3	<11.3
Cs-134	<7.6	<4.4	<7.2
Cs-137	<8.5	<5.8	<3.8
Ba-La-140	<5.3	<3.3	<2.7
Ca (g/l)	[illegible]	1.07	0.91

Analysis	CA-MLK-M5B (06/11/96)	CA-MLK-M6 (06/11/96)	CA-MLK-M7 (06/11/96)
I-131	<0.1	<0.1	<0.3
Sr-89	<0.7	<0.8	<0.9
Sr-90	5.6 ± 0.7	3.8 ± 0.6	1.7 ± 0.5
K-40	2020.0 ± 190.0	1240.0 ± 150.0	1350.0 ± 130.0
Zn-65	<10.6	<12.0	<8.7
Cs-134	<6.2	<5.5	<2.7
Cs-137	<6.0	<8.0	<5.7
Ba-La-140	<2.3	<4.0	<6.2
Ca (g/l)	1.03	1.02	0.99

Notes:

TABLE E3 (Cont.)

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (06/25/96)	CA-MLK-M6 (06/25/96)	CA-MLK-M7 (06/25/96)
I-131	<0.2	<0.3	<0.4
Sr-89	<0.8	<0.8	<0.7
Sr-90	6.2 ± 0.7	3.3 ± 0.6	1.7 ± 0.5
K-40	1670.0 ± 180.0	1280.0 ± 150.0	1230.0 ± 130.0
Zn-65	<18.3	<9.1	<9.8
Cs-134	<4.8	<6.9	<3.2
Cs-137	<5.7	<7.0	<5.4
Ba-La-140	<2.4	<2.5	<1.8
Ca (g/l)	0.87	1.00	1.02

Analysis	CA-MLK-M5B (07/09/96)	CA-MLK-M6 (07/09/96)	CA-MLK-M7 (07/09/96)
I-131	<0.2	<0.2	<0.4
Sr-89	<0.9	<0.6	<0.9
Sr-90	3.1 ± 0.4	1.7 ± 0.3	0.9 ± 0.2
K-40	1850.0 ± 190.0	1240.0 ± 110.0	1210.0 ± 170.0
Zn-65	<7.4	<11.5	<5.3
Cs-134	<6.0	<4.3	<5.5
Cs-137	<6.0	<8.2	<3.8
Ba-La-140	<2.6	<2.8	<2.3
Ca (g/l)	0.84	0.89	1.06

Notes:

TABLE E3 (Cont.)

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (07/22/96)	CA-MLK-M7 (07/22/96)	CA-MLK-M6 (07/23/96)
I-131	<0.4	<0.4	<0.4
Sr-89	<1.4	<0.6	<1.3
Sr-90	3.9 ± 0.6	0.6 ± 0.2	3.1 ± 0.5
K-40	2050.0 ± 190.0	1250.0 ± 140.0	1230.0 ± 140.0
Zn-65	<15.3	<16.0	<11.7
Cs-134	<8.2	<3.8	<5.4
Cs-137	<4.5	<6.3	<6.3
Ba-La-140	<2.2	<3.7	<2.1
Ca (g/l)	0.82	1.06	0.90

Analysis	CA-MLK-M5B (08/13/96)	CA-MLK-M6 (08/13/96)	CA-MLK-M7 (08/13/96)
I-131	<0.3	<0.2	<0.5
Sr-89	<1.3	<1.1	<1.1
Sr-90	5.6 ± 0.7	2.9 ± 0.5	1.8 ± 0.4
K-40	1960.0 ± 190.0	1210.0 ± 150.0	1420.0 ± 170.0
Zn-65	<13.6	<10.6	<13.1
Cs-134	<6.8	<6.0	<6.7
Cs-137	<7.3	<4.3	<9.9
Ba-La-140	<4.8	<2.4	<2.7
Ca (g/l)	0.85	1.02	1.10

Notes:

TABLE E3 (Cont.)

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (08/26/96)	CA-MLK-M6 (08/27/96)	CA-MLK-M7 (08/27/96)
I-131	<0.2	<0.3	<0.5
Sr-89	<0.9	<0.9	<0.9
Sr-90	5.8 ± 0.7	2.3 ± 0.5	1.4 ± 0.4
K-40	1890.0 ± 180.0	1110.0 ± 150.0	1210.0 ± 150.0
Zn-65	<14.6	<6.3	<11.4
Cs-134	<7.4	<3.4	<4.3
Cs-137	<8.9	<6.2	<4.8
Ba-La-140	<2.4	<4.2	<2.4
Ca (g/l)	0.82	0.83	1.00

Analysis	CA-MLK-M5B (09/09/96)	CA-MLK-M6 (09/09/96)	CA-MLK-M7 (09/09/96)
I-131	<0.3	<0.4	ND
Sr-89	<1.5	<1.5	ND
Sr-90	2.5 ± 0.6	3.8 ± 0.6	ND
K-40	2050.0 ± 140.0	1160.0 ± 140.0	ND
Zn-65	<11.5	<9.8	ND
Cs-134	<6.1	<6.0	ND
Cs-137	<4.6	<6.4	ND
Ba-La-140	<2.3	<2.9	ND
Ca (g/l)	0.85	0.88	ND

Notes:
ND = No Data. See section 2.3 for explanation.

TABLE E3 (Cont.)

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (09/24/96)	CA-MLK-M6 (09/24/96)	CA-MLK-M7 (09/24/96)
I-131	<0.5	<0.3	ND
Sr-89	<1.1	<1.0	ND
Sr-90	4.2 ± 0.6	3.2 ± 0.5	ND
K-40	1900.0 ± 150.0	1050.0 ± 110.0	ND
Zn-65	<11.6	<7.0	ND
Cs-134	<5.0	<4.3	ND
Cs-137	<4.7	<3.5	ND
Ba-La-140	<1.5	<1.8	ND
Ca (g/l)	0.83	0.93	ND

Analysis	CA-MLK-M5B (10/08/96)	CA-MLK-M6 (10/08/96)	CA-MLK-M7 (10/08/96)
I-131	ND	<0.2	ND
Sr-89	ND	<1.0	ND
Sr-90	ND	2.9 ± 0.5	ND
K-40	ND	1100.0 ± 80.0	ND
Zn-65	ND	<4.9	ND
Cs-134	ND	<1.7	ND
Cs-137	ND	<3.6	ND
Ba-La-140	ND	<1.3	ND
Ca (g/l)	ND	0.97	ND

Notes:
ND = No Data. See section 2.3 for explanation.

TABLE E3 (Cont.)

MILK (pCi/kg dry)
1996

Analysis	CA-MLK-M5B (11/12/96)	CA-MLK-M6 (11/12/96)	CA-MLK-M7 (11/12/96)
I-131	ND	<0.5	ND
Sr-89	ND	<0.7	ND
Sr-90	ND	3.3 ± 0.5	ND
K-40	ND	1170.0 ± 140.0	ND
Zn-65	ND	<14.8	ND
Cs-134	ND	<1.8	ND
Cs-137	ND	<4.5	ND
Ba-La-140	ND	<4.6	ND
Ca (g/l)	ND	0.91	ND

Analysis	CA-MLK-M5B (12/10/96)	CA-MLK-M6 (12/10/96)	CA-MLK-M7 (12/10/96)
I-131	ND	<0.5	ND
Sr-89	ND	<0.7	ND
Sr-90	ND	2.5 ± 0.5	ND
K-40	ND	1210.0 ± 150.0	ND
Zn-65	ND	<12.1	ND
Cs-134	ND	<7.1	ND
Cs-137	ND	<7.4	ND
Ba-La-140	ND	<5.8	ND
Ca (g/l)	ND	0.91	ND

Notes:
ND = No Data. See section 2.3 for explanation.

TABLE E4

VEGETATION (pCi/kg wet)
1996

Analysis	CA-FPL-V3 (05/27/96)	CA-FPL-V9 SPINACH (05/27/96)	CA-FPL-V9 LETTUCE (05/27/96)
Gross Alpha	ND	311.4 ± 154.9	441.1 ± 123.5
Gross Beta	ND	6129.3 ± 312.5	4136.3 ± 172.5
I-131	ND	<12.6	<7.6
K-40	ND	6018.0 ± 480.0	4338.0 ± 224.0
Mn-54	ND	<15.2	<8.6
Co-58	ND	<6.9	<3.6
Co-60	ND	<8.7	<13.4
Cs-134	ND	<17.0	<5.1
Cs-137	ND	<18.9	<8.3

Analysis	CA-FPL-V3 LETTUCE (06/25/96)	CA-FPL-V9 LETTUCE (06/24/96)	CA-FPL-V9 CABBAGE (06/24/96)
Gross Alpha	183.3 ± 64.2	235.4 ± 73.2	216.2 ± 78.5
Gross Beta	4265.1 ± 139.6	5348.3 ± 160.1	4216.0 ± 143.4
I-131	<15.8	<16.3	<19.7
K-40	5449.0 ± 386.0	5838.0 ± 444.0	4158.0 ± 371.0
Mn-54	<10.4	<12.0	<11.6
Co-58	<11.2	<7.1	<8.5
Co-60	<20.5	<28.4	<20.6
Cs-134	<15.1	<15.8	<16.0
Cs-137	<13.4	<10.6	<17.9

Notes:
ND = No Data. See section 2.3 for explanation.

TABLE E4 (Cont.)

VEGETATION (pCi/kg wet)
1996

Analysis	CA-FPL-V9 MUSTARD GREENS (06/24/96)	CA-FPL-V3 CABBAGE (07/23/96)	CA-FPL-V3 TURNIPS GREENS (07/23/96)
Gross Alpha	186.9 ± 81.3	59.2 ± 32.9	161.2 ± 62.0
Gross Beta	5261.6 ± 177.0	2001.1 ± 85.3	3863.3 ± 127.9
I-131	<11.9	<6.5	<15.0
K-40	5586.0 ± 371.0	2327.0 ± 263.0	4534.0 ± 465.0
Mn-54	<5.6	<4.8	<20.8
Co-58	<6.2	<9.9	<14.9
Co-60	<16.9	<12.7	<23.0
Cs-134	<13.1	<5.9	<16.7
Cs-137	<13.5	<5.5	<20.4

Analysis	CA-FPL-V9 MUSTARD GREENS (07/08/96)	CA-FPL-V9 LETTUCE (07/08/96)	CA-FPL-V9 CABBAGE (07/08/96)
Gross Alpha	<87.7	<112.7	<131.8
Gross Beta	5271.4 ± 186.3	7812.7 ± 246.5	5528.4 ± 208.9
I-131	<29.4	<23.6	<12.9
K-40	5725.0 ± 560.0	8387.0 ± 534.0	4145.0 ± 340.0
Mn-54	<19.0	<14.1	<9.7
Co-58	<17.8	<13.3	<8.4
Co-60	<29.6	<7.8	<8.4
Cs-134	<25.8	<17.3	<11.8
Cs-137	<17.3	<18.3	<9.3

Notes:

TABLE E4 (Cont.)

VEGETATION (pCi/kg wet)
1996

Analysis	CA-FPL-V9 CABBAGE (07/22/96)	CA-FPL-V9 LETTUCE (07/22/96)	CA-FPL-V9 MUSTARD GREENS (07/22/96)
Gross Alpha	<26.6	89.1 ± 57.5	119.3 ± 79.3
Gross Beta	2173.2 ± 64.0	4931.7 ± 170.4	3233.0 ± 179.1
I-131	<12.6	<10.8	<12.9
K-40	2295.0 ± 328.0	5113.0 ± 252.0	4324.0 ± 302.0
Mn-54	<11.4	<9.1	<11.0
Co-58	<9.5	<6.5	<8.4
Co-60	<16.8	<14.2	<5.5
Cs-134	<14.1	<9.5	<10.2
Cs-137	<11.8	<6.5	<9.8

Analysis	CA-FPL-V3 (08/13/96)	CA-FPL-V9 CABBAGE (08/13/96)	CA-FPL-V3 (09/30/96)
Gross Alpha	ND	162.1 ± 60.1	ND
Gross Beta	ND	3719.0 ± 121.8	ND
I-131	ND	<7.1	ND
K-40	ND	4108.0 ± 185.0	ND
Mn-54	ND	<7.4	ND
Co-58	ND	<6.3	ND
Co-60	ND	<5.1	ND
Cs-134	ND	<7.4	ND
Cs-137	ND	<7.9	ND

Notes:
ND = No Data. See section 2.3 for explanation.

TABLE E4 (Cont.)

VEGETATION (pCi/kg wet)
1996

Analysis	CA-FPL-V9 (09/30/96)	CA-FPL-V3 (10/08/96)	CA-FPL-V9 MUSTARD GREENS (10/08/96)
Gross Alpha	ND	ND	129.8 ± 81.2
Gross Beta	ND	ND	4943.1 ± 212.1
I-131	ND	ND	<16.4
K-40	ND	ND	4564.0 ± 273.0
Mn-54	ND	ND	<12.0
Co-58	ND	ND	<6.3
Co-60	ND	ND	<8.0
Cs-134	ND	ND	<5.9
Cs-137	ND	ND	<10.5

Analysis	CA-FPL-V3 (11/12/96)	CA-FPL-V9 CABBAGE (11/12/96)	CA-FPL-V9 MUSTARD GREENS (11/12/96)
Gross Alpha	ND	95.2 ± 56.2	<106.3
Gross Beta	ND	2660.3 ± 130.0	4983.1 ± 211.0
I-131	ND	<17.5	<26.1
K-40	ND	2352.0 ± 304.0	5642.0 ± 534.0
Mn-54	ND	<13.4	<20.0
Co-58	ND	<5.9	<19.4
Co-60	ND	<8.6	<28.8
Cs-134	ND	<9.5	<21.7
Cs-137	ND	<5.7	<23.0

Notes:
ND = No Data. See section 2.3 for explanation.

TABLE E5

SOIL (pCi/kg dry)
1996

Analysis	CA-SOL-F1 (12/05/96)	CA-SOL-F2 (12/05/96)	CA-SOL-F6 (12/05/96)
Gross Alpha	11090.0 ± 4008.0	18636.0 ± 4938.0	13741.0 ± 4411.0
Gross Beta	24082.0 ± 3009.0	24124.0 ± 3209.0	29440.0 ± 3388.0
K-40	11890.0 ± 643.0	12810.0 ± 669.0	11629.0 ± 627.0
Mn-54	<20.0	<21.5	<17.9
Co-58	<32.9	<32.8	<35.4
Co-60	<15.1	<16.8	<16.5
Cs-134	<25.0	<30.3	<31.9
Cs-137	1350.9 ± 56.5	943.2 ± 48.7	1258.8 ± 57.2

Analysis	CA-SOL-F8 (12/05/96)	CA-SOL-F9 (12/05/96)	CA-SOL-PR10 (12/05/96)
Gross Alpha	26097.0 ± 5589.0	16000.0 ± 4815.0	14210.0 ± 4042.0
Gross Beta	27371.0 ± 3164.0	25748.0 ± 3182.0	26005.0 ± 3026.0
K-40	10822.0 ± 648.0	12181.0 ± 628.0	10398.0 ± 581.0
Mn-54	<20.8	<21.8	<24.0
Co-58	<16.6	<27.6	<33.0
Co-60	<18.0	<15.7	<18.4
Cs-134	<29.7	<32.6	<26.5
Cs-137	1333.4 ± 58.9	740.3 ± 48.9	599.3 ± 40.6

Notes:

TABLE E5 (Cont.)

SOIL (pCi/kg dry)
1996

Analysis	CA-SOL-PR3 (12/05/96)	CA-SOL-PR4 (12/05/96)	CA-SOL-PR5 (12/05/96)
Gross Alpha	15309.0 ± 4693.0	15940.0 ± 4565.0	10848.0 ± 4170.0
Gross Beta	24328.0 ± 3172.0	22251.0 ± 2959.0	26317.0 ± 3272.0
K-40	4849.0 ± 412.0	11254.0 ± 629.0	13232.0 ± 628.0
Mn-54	<27.8	<19.0	<20.7
Co-58	<19.2	<8.5	<31.5
Co-60	<18.8	<15.1	<15.4
Cs-134	<28.0	<31.6	<33.4
Cs-137	409.8 ± 35.4	519.5 ± 42.6	703.9 ± 42.6

Analysis	CA-SOL-PR7 (12/05/96)	CA-SOL-V3 (12/05/96)
Gross Alpha	13945.0 ± 2932.0	13219.0 ± 4163.0
Gross Beta	21439.0 ± 2128.0	29800.0 ± 3473.0
K-40	10946.0 ± 452.0	17097.0 ± 718.0
Mn-54	<18.7	<20.2
Co-58	<23.7	<10.7
Co-60	<17.6	<16.7
Cs-134	<23.3	<31.8
Cs-137	459.2 ± 28.1	267.8 ± 36.9

Notes:

TABLE E6

WETLANDS (pCi/kg dry)
1996

Analysis	CA-SOL-W1 (12/05/96)	CA-SOL-W2 (12/05/96)
Gross Alpha	9280.0 ± 3686.0	9661.0 ± 3506.0
Gross Beta	17498.0 ± 3011.0	21476.0 ± 2931.0
K-40	14555.0 ± 607.0	16590.0 ± 686.0
Mn-54	<20.8	<20.2
Co-58	<18.6	<25.9
Co-60	<16.7	<19.0
Cs-134	<29.4	<35.0
Cs-137	63.4 ± 25.7	209.1 ± 36.7

Analysis	CA-SOL-W3 (12/05/96)	CA-SOL-W4 (12/05/96)
Gross Alpha	13710.0 ± 4589.0	10934.0 ± 3831.0
Gross Beta	16615.0 ± 2812.0	18141.0 ± 2741.0
K-40	10846.0 ± 492.0	9606.0 ± 552.0
Mn-54	<15.3	<22.4
Co-58	<10.7	<27.6
Co-60	<18.3	<18.6
Cs-134	<15.2	<32.3
Cs-137	<18.4	<19.1

Notes:

TABLE E7

SURFACE WATER (pCi/l)
1996

Analysis	CA-SWA-S01 (01/09/96)	CA-SWA-S02 (01/09/96)
H-3	<157.0	<157.0
Mn-54	<3.6	<2.1
Fe-59	<6.6	<11.7
Co-58	<4.8	<2.9
Co-60	<4.3	<2.2
Zr-Nb-95	<5.7	<6.4
Cs-134	<4.2	<5.0
Cs-137	<4.1	<5.2
Ba-La-140	<12.7	<6.5

Analysis	CA-SWA-S01 (02/13/96)	CA-SWA-S02 (02/13/96)
H-3	<146.0	<148.0
Mn-54	<3.7	<3.5
Fe-59	<8.3	<9.0
Co-58	<2.1	<2.1
Co-60	<3.0	<3.2
Zr-Nb-95	<3.3	<3.6
Cs-134	<3.5	<6.3
Cs-137	<4.6	<2.8
Ba-La-140	<1.9	<3.5

Notes:

TABLE E7 (Cont.)

SURFACE WATER (pCi/l)
1996

Analysis	CA-SWA-S01 (03/12/96)	CA-SWA-S02 (03/12/96)
H-3	<187.0	195.0 ± 101.0
Mn-54	<1.9	<4.5
Fe-59	<2.5	<4.3
Co-58	<2.4	<3.1
Co-60	<2.0	<4.9
Zr-Nb-95	<3.0	<1.9
Cs-134	<1.8	<4.1
Cs-137	<3.4	<2.5
Ba-La-140	<1.8	<3.1

Analysis	CA-SWA-S01 (04/11/96)	CA-SWA-S02 (04/11/96)
H-3	<152.0	168.0 ± 83.0
Mn-54	<5.6	<3.5
Fe-59	<7.9	<3.2
Co-58	<5.7	<5.2
Co-60	<3.8	<5.2
Zr-Nb-95	<3.0	<2.3
Cs-134	<4.8	<2.8
Cs-137	<5.9	<7.1
Ba-La-140	<3.7	<3.0

Notes:

TABLE E7 (Cont.)

SURFACE WATER (pCi/l)
1996

Analysis	CA-SWA-S01 (05/14/96)	CA-SWA-S02 (05/14/96)
H-3	<160.0	217.0 ± 89.0
Mn-54	<4.9	<3.4
Fe-59	<7.7	<4.3
Co-58	<2.3	<3.6
Co-60	<2.4	<1.8
Zr-Nb-95	<5.0	<4.8
Cs-134	<4.7	<3.5
Cs-137	<2.6	<2.8
Ba-La-140	<4.8	<5.0

Analysis	CA-SWA-S01 (06/11/96)	CA-SWA-S02 (06/11/96)
H-3	<152.0	203.0 ± 85.0
Mn-54	<2.6	<4.8
Fe-59	<3.1	<7.5
Co-58	<3.8	<5.5
Co-60	<4.4	<5.5
Zr-Nb-95	<4.4	<6.2
Cs-134	<2.5	<7.1
Cs-137	<2.9	<5.9
Ba-La-140	<3.3	<10.1

Notes:

TABLE E7 (Cont.)

SURFACE WATER (pCi/l)
1996

Analysis	CA-SWA-SO1 (07/09/96)	CA-SWA-SO2 (07/09/96)
H-3	<156.0	<156.0
Mn-54	<2.8	<2.8
Fe-59	<3.5	<7.3
Co-58	<2.6	<3.9
Co-60	<2.7	<3.0
Zr-Nb-95	<2.6	<4.2
Cs-134	<2.9	<3.0
Cs-137	<2.6	<2.5
Ba-La-140	<3.6	<2.5

Analysis	CA-SWA-SO1 (08/13/96)	CA-SWA-SO2 (08/13/96)
H-3	<150.0	227.0 ± 84.0
Mn-54	<3.1	<4.5
Fe-59	<10.4	<10.6
Co-58	<2.4	<4.1
Co-60	<1.3	<2.0
Zr-Nb-95	<2.3	<3.0
Cs-134	<3.1	<2.6
Cs-137	<3.3	<5.3
Ba-La-140	<2.8	<4.2

Notes:

TABLE E7 (Cont.)

SURFACE WATER (pCi/l)
1996

Analysis	CA-SWA-S01 (09/10/96)	CA-SWA-S02 (09/10/96)
H-3	<162.0	<162.0
Mn-54	<1.4	<3.9
Fe-59	<5.9	<4.3
Co-58	<4.4	<6.6
Co-60	<2.3	<3.5
Zr-Nb-95	<3.8	<4.0
Cs-134	<5.0	<2.2
Cs-137	<5.6	<2.3
Ba-La-140	<6.6	<6.0

Analysis	CA-SWA-S01 (10/08/96)	CA-SWA-S02 (10/08/96)
H-3	<157.0	165.0 ± 85.0
Mn-54	<4.5	<6.2
Fe-59	<13.6	<7.9
Co-58	<3.2	<6.9
Co-60	<5.5	<4.5
Zr-Nb-95	<4.3	<9.9
Cs-134	<5.8	<2.9
Cs-137	<5.2	<5.7
Ba-La-140	<10.4	<6.5

Notes:

TABLE E7 (Cont.)

SURFACE WATER (pCi/l)
1996

Analysis	CA-SWA-S01 (11/12/96)	CA-SWA-S02 (11/12/96)
H-3	<154.0	210.0 ± 86.0
Mn-54	<2.7	<2.4
Fe-59	<6.6	<4.4
Co-58	<3.9	<3.3
Co-60	<3.0	<2.0
Zr-Nb-95	<2.8	<4.3
Cs-134	<3.3	<2.8
Cs-137	<2.4	<3.1
Ba-La-140	<6.6	<5.6

Analysis	CA-SWA-S01 (12/10/96)	CA-SWA-S02 (12/10/96)
H-3	<158.0	<158.0
Mn-54	<2.8	<6.2
Fe-59	<6.8	<10.2
Co-58	<5.5	<6.7
Co-60	<4.2	<2.4
Zr-Nb-95	<8.1	<6.8
Cs-134	<7.0	<4.3
Cs-137	<7.3	<6.3
Ba-La-140	<6.0	<5.6

Notes:

TABLE E8

GROUND WATER (pCi/l)
1996

Analysis	CA-WWA-D01 (01/29/96)	CA-WWA-F15 (01/27/96)	CA-WWA-F05 (01/27/96)
H-3	<197.0	<197.0	<197.0
Mn-54	<2.2	<4.2	<3.3
Fe-59	<8.3	<7.5	<7.1
Co-58	<2.2	<3.5	<3.8
Co-60	<3.2	<5.7	<2.3
Zr-Nb-95	<4.1	<6.9	<3.9
Cs-134	<4.1	<6.1	<2.0
Cs-137	<4.5	<4.6	<3.5
Ba-La-140	<4.4	<6.8	<5.4

Analysis	CA-WWA-D01 (04/23/96)	CA-WWA-F15 (04/26/96)	CA-WWA-F05 (04/30/96)
H-3	<150.0	<149.0	<149.0
Mn-54	<4.0	<2.4	<3.2
Fe-59	<5.2	<1.9	<3.3
Co-58	<5.6	<3.4	<2.9
Co-60	<5.2	<1.2	<1.5
Zr-Nb-95	<4.3	<1.8	<4.1
Cs-134	<3.1	<2.8	<2.7
Cs-137	<3.5	<2.1	<3.4
Ba-La-140	<5.7	<2.9	<6.7

Notes:

TABLE E8 (Cont.)

GROUND WATER (pCi/l)
1996

Analysis	CA-WWA-D01 (07/29/96)	CA-WWA-F15 (07/26/96)	CA-WWA-F05 (07/26/96)
H-3	<169.0	<169.0	<169.0
Mn-54	<3.7	<3.5	<3.0
Fe-59	<6.1	<12.3	<4.4
Co-58	<3.7	<4.0	<2.5
Co-60	<0.9	<2.9	<2.9
Zr-Nb-95	<4.2	<4.4	<3.6
Cs-134	<3.8	<3.2	<4.3
Cs-137	<4.9	<6.6	<3.4
Ba-La-140	<3.7	<13.5	<3.4

Analysis	CA-WWA-D01 (10/08/96)	CA-WWA-F15 (10/04/96)	CA-WWA-F05 (10/04/96)
H-3	<155.0	<157.0	<156.0
Mn-54	<3.5	<3.7	<3.7
Fe-59	<5.2	<4.7	<9.7
Co-58	<6.5	<3.6	<4.1
Co-60	<4.1	<1.5	<3.9
Zr-Nb-95	<3.7	<5.3	<5.3
Cs-134	<5.1	<2.4	<3.2
Cs-137	<4.6	<2.9	<4.2
Ba-La-140	<7.2	<10.5	<14.8

Notes:

TABLE E9

BOTTOM SEDIMENT (pCi/kg dry)
1996

Analysis	CA-AQS-A (04/18/96)	CA-AQS-C (04/18/96)
Mn-54	<49.9	<45.0
Fe-59	<85.8	<48.8
Co-58	<46.8	<48.8
Co-60	<25.2	<28.7
Zr-Nb-95	<48.5	<37.7
Cs-134	<44.4	<41.1
Cs-137	<40.3	<29.4
Ba-La-140	<114.0	<62.1

Analysis	CA-AQS-A (10/22/96)	CA-AQS-C (10/22/96)
Mn-54	<13.8	<31.6
Fe-59	<21.0	<59.2
Co-58	<17.9	<37.7
Co-60	<8.2	<19.7
Zr-Nb-95	<20.4	<40.2
Cs-134	<12.9	<28.9
Cs-137	<9.8	<26.2
Ba-La-140	<48.5	<71.5

Notes:

TABLE E10

SHORELINE SEDIMENT (pCi/kg dry)
1996

Analysis	CA-AQS-A (04/18/96)	CA-AQS-C (04/18/96)
Mn-54	<44.7	<41.1
Fe-59	<100.0	<84.0
Co-58	<28.1	<25.9
Co-60	<30.7	<27.4
Zr-Nb-95	<77.2	<43.3
Cs-134	<48.4	<45.9
Cs-137	92.2 ± 29.5	<25.9
Ba-La-140	<163.0	<67.7

Analysis	CA-AQS-A (10/22/96)	CA-AQS-C (10/22/96)
Mn-54	<20.3	<33.6
Fe-59	<45.0	<47.6
Co-58	<23.2	<34.1
Co-60	<20.0	<27.2
Zr-Nb-95	<37.9	<44.5
Cs-134	<22.0	<30.7
Cs-137	<14.5	<23.1
Ba-La-140	<96.0	<149.0

Notes:

TABLE E11

FISH, CA-AQF-A (pCi/kg WET)
1996

Analysis	CHANNEL CATFISH (04/18/96)	FRESHWATER DRUM (04/18/96)	CARP (04/18/96)	RIVER CARPSUCKER (04/18/96)	BIGMOUTH BUFFALO (04/18/96)
Sr-89	<8.0	<15.0	<6.2	<9.0	<10.2
Sr-90	<4.7	<5.7	<3.3	<4.7	4.0 ± 2.6
K-40	2544.0 ± 254.0	2573.0 ± 362.0	2744.0 ± 279.0	2631.0 ± 403.0	3023.0 ± 387.0
Mn-54	<3.5	<12.8	<7.9	<7.4	<8.5
Fe-59	<29.0	<17.0	<21.7	<45.5	<30.3
Co-58	<6.3	<15.2	<13.0	<14.6	<13.5
Co-60	<14.0	<19.2	<11.0	<13.7	<18.6
Cs-134	<10.9	<15.4	<7.6	<9.1	<10.3
Cs-137	<8.5	<14.8	<9.4	<21.4	<14.1

Analysis	CHANNEL CATFISH (10/22/96)	CARP (10/22/96)	RIVER CARPSUCKER (10/22/96)	FRESHWATER DRUM (10/22/96)	BLUE SUCKER (10/22/96)
Sr-89	<9.9	<5.8	<12.5	<13.3	<12.1
Sr-90	<3.7	<2.5	<4.9	<4.7	<4.1
K-40	3066.0 ± 333.0	2600.0 ± 326.0	2093.0 ± 350.0	3019.0 ± 364.0	3377.0 ± 418.0
Mn-54	<11.5	<12.8	<8.8	<6.7	<15.9
Fe-59	<30.5	<65.7	<60.7	<13.7	<45.7
Co-58	<14.2	<15.7	<17.6	<12.8	<14.7
Co-60	<12.8	<12.9	<10.0	<18.4	<11.7
Cs-134	<13.1	<9.3	<12.5	<13.4	<9.8
Cs-137	<13.4	<13.1	<14.1	<8.8	<10.6

Notes:

TABLE E11 (Cont.)

FISH, CA-AQF-C (pCi/kg WET)
1996

Analysis	CHANNEL CATFISH (04/18/96)	FRESHWATER DRUM (04/18/96)	CARP (04/18/96)	RIVER CARPSUCKER (04/18/96)	BIGMOUTH BUFFALO (04/18/96)
Sr-89	<8.8	<11.5	<11.8	<10.4	<6.9
Sr-90	<2.9	<4.8	<4.6	<4.6	<2.1
K-40	2537.0 ± 342.0	3167.0 ± 387.0	3242.0 ± 430.0	2798.0 ± 322.0	3074.0 ± 357.0
Mn-54	<19.1	<17.1	<19.1	<9.3	<7.9
Fe-59	<50.4	<56.9	<27.7	<32.5	<26.9
Co-58	<28.3	<23.5	<25.5	<16.9	<13.5
Co-60	<20.0	<16.0	<24.6	<12.6	<6.9
Cs-134	<14.3	<7.7	<16.9	<12.0	<14.2
Cs-137	<14.1	<22.1	<20.6	<12.8	<11.4

Analysis	CHANNEL CATFISH (10/22/96)	CARP (10/22/96)	RIVER CARPSUCKER (10/22/96)	FRESHWATER DRUM (10/22/96)	BLUE SUCKER (10/22/96)
Sr-89	<8.5	<10.5	<16.3	<11.1	<12.0
Sr-90	<3.0	<4.7	<6.7	<4.2	<4.9
K-40	2562.0 ± 353.0	2717.0 ± 373.0	2867.0 ± 356.0	2907.0 ± 245.0	2759.0 ± 314.0
Mn-54	<8.5	<18.0	<15.6	<10.2	<4.8
Fe-59	<63.5	<39.5	<30.0	<32.0	<45.2
Co-58	<10.3	<24.9	361.0 ± 46.0	<14.9	<13.6
Co-60	<8.7	<21.4	<20.3	<10.7	<12.8
Cs-134	<11.9	<7.9	<19.0	<9.4	<7.0
Cs-137	<6.5	<12.6	<18.0	<9.7	<8.9

Notes:

TABLE E12

THERMOLUMINESCENT DOSIMETRY
1996

LOCATION CODE	FIRST QUARTER FIELD TIME (DAYS)	FIRST QUARTER TOTAL EXPOSURE (MREM ± 2σ)	FIRST QUARTER NET EXPOSURE (MREM/STD QTR ± 2σ)	SECOND QUARTER FIELD TIME (DAYS)	SECOND QUARTER TOTAL EXPOSURE (MREM ± 2σ)	SECOND QUARTER NET EXPOSURE (MREM/STD QTR ± 2σ)	THIRD QUARTER FIELD TIME (DAYS)	THIRD QUARTER TOTAL EXPOSURE (MREM ± 2σ)	THIRD QUARTER NET EXPOSURE (MREM/STD QTR ± 2σ)	FOURTH QUARTER FIELD TIME (DAYS)	FOURTH QUARTER TOTAL EXPOSURE (MREM ± 2σ)	FOURTH QUARTER NET EXPOSURE (MREM/STD QTR ± 2σ)	ANNUAL FIELD TIME (DAYS)	ANNUAL TOTAL EXPOSURE (MREM ± 2σ)	ANNUAL NET EXPOSURE (MREM/STD QTR ± 2σ)
CA-IDM-01a	90.8	17.3 ± 0.8	17.1 ± 0.8	91.1	18.0 ± 0.5	17.8 ± 0.5	90.0	18.4 ± 0.4	18.4 ± 0.4	94.2	17.6 ± 1.0	16.8 ± 0.9	366.0	73.4 ± 0.2	18.0 ± 0.0
CA-IDM-02	89.9	17.6 ± 0.7	17.7 ± 0.7	91.1	18.1 ± 0.8	17.9 ± 0.8	90.2	18.2 ± 0.4	18.2 ± 0.3	94.0	17.9 ± 1.2	17.1 ± 1.1	365.1	66.6 ± 1.8	16.4 ± 0.4
CA-IDM-03	90.0	18.0 ± 0.6	18.0 ± 0.6	91.0	18.4 ± 1.0	18.2 ± 1.0	91.1	19.6 ± 0.7	19.4 ± 0.7	93.9	17.0 ± 0.7	16.3 ± 0.7	366.0	76.0 ± 2.4	18.7 ± 0.6
CA-IDM-04	90.0	15.2 ± 0.7	15.2 ± 0.7	91.0	16.0 ± 0.5	15.9 ± 0.5	91.1	16.0 ± 0.7	15.8 ± 0.7	93.9	16.8 ± 0.4	16.1 ± 0.4	366.0	67.1 ± 8.3	16.5 ± 2.0
CA-IDM-05	90.0	14.9 ± 0.6	14.9 ± 0.6	91.0	15.0 ± 0.6	14.9 ± 0.6	91.1	16.4 ± 0.5	16.2 ± 0.5	93.9	13.6 ± 0.7	13.0 ± 0.7	366.0	61.1 ± 1.5	15.0 ± 0.4
CA-IDM-06	90.0	17.3 ± 0.6	17.3 ± 0.6	91.0	17.7 ± 0.6	17.5 ± 0.6	91.1	18.9 ± 0.6	18.6 ± 0.6	93.9	16.9 ± 0.4	16.2 ± 0.3	366.0	73.8 ± 5.0	18.2 ± 1.2
CA-IDM-07	90.0	17.5 ± 0.4	17.5 ± 0.4	91.0	19.0 ± 1.8	18.8 ± 1.7	91.0	18.9 ± 1.9	18.6 ± 1.8	94.0	16.7 ± 0.5	16.0 ± 0.5	366.0	71.6 ± 4.4	17.6 ± 1.1
CA-IDM-08	90.0	18.9 ± 0.3	18.9 ± 0.3	91.0	20.2 ± 0.3	20.0 ± 0.2	91.1	20.1 ± 0.5	19.8 ± 0.4	94.0	18.6 ± 1.6	17.8 ± 1.5	366.0	79.8 ± 1.4	19.6 ± 0.4
CA-IDM-09	90.0	16.1 ± 0.7	16.1 ± 0.7	91.0	17.0 ± 0.4	16.8 ± 0.4	91.1	17.1 ± 0.4	16.9 ± 0.4	93.9	17.0 ± 0.7	16.3 ± 0.7	366.0	71.4 ± 6.2	17.6 ± 1.5
CA-IDM-10	90.0	18.2 ± 0.4	18.2 ± 0.4	91.0	18.9 ± 0.3	18.7 ± 0.2	91.1	18.6 ± 0.5	18.4 ± 0.5	93.9	15.8 ± 0.5	15.1 ± 0.5	366.0	73.1 ± 4.1	18.0 ± 1.0
CA-IDM-11a	90.0	18.2 ± 0.5	18.2 ± 0.5	91.0	18.1 ± 0.4	17.9 ± 0.4	91.1	19.4 ± 0.6	19.2 ± 0.6	93.9	18.1 ± 1.4	17.4 ± 1.3	366.0	73.1 ± 0.6	18.0 ± 0.1
CA-IDM-12a	90.0	17.4 ± 0.5	17.4 ± 0.5	91.0	18.5 ± 0.8	18.3 ± 0.8	91.1	18.1 ± 0.4	17.8 ± 0.3	94.0	17.9 ± 1.2	17.1 ± 1.2	366.0	70.1 ± 3.4	17.2 ± 0.8
CA-IDM-13	90.0	18.3 ± 0.7	18.3 ± 0.7	91.0	19.8 ± 0.5	19.6 ± 0.5	91.1	20.1 ± 0.7	19.9 ± 0.7	93.9	18.4 ± 0.7	17.7 ± 0.7	366.0	78.7 ± 3.0	19.4 ± 0.7
CA-IDM-14	90.0	18.8 ± 0.5	18.8 ± 0.5	91.0	18.4 ± 0.7	18.2 ± 0.7	91.1	20.1 ± 0.8	19.9 ± 0.8	93.9	17.3 ± 0.6	16.6 ± 0.6	366.0	73.6 ± 3.6	18.1 ± 0.9
CA-IDM-15a	90.0	18.5 ± 0.8	18.5 ± 0.8	91.0	19.5 ± 1.2	19.3 ± 1.2	91.1	20.1 ± 0.8	19.9 ± 0.7	93.9	18.3 ± 2.0	17.5 ± 1.9	366.0	79.5 ± 3.6	19.5 ± 0.9
CA-IDM-16a	89.9	18.5 ± 0.7	18.6 ± 0.7	90.1	19.0 ± 0.8	19.0 ± 0.8	91.1	19.5 ± 0.6	19.2 ± 0.6	93.9	19.0 ± 0.9	18.2 ± 0.8	365.0	71.1 ± 4.0	17.5 ± 1.0
CA-IDM-17	90.0	18.1 ± 0.4	18.1 ± 0.4	91.0	16.8 ± 0.3	16.6 ± 0.3	91.1	19.2 ± 0.8	19.0 ± 0.8	93.9	18.2 ± 0.8	17.5 ± 0.7	366.0	70.6 ± 1.1	17.4 ± 0.3
CA-IDM-18a	90.0	18.1 ± 0.6	18.1 ± 0.6	91.0	18.0 ± 0.4	17.8 ± 0.4	91.1	19.4 ± 0.5	19.1 ± 0.5	93.9	16.5 ± 0.6	15.8 ± 0.6	366.0	74.1 ± 3.9	18.2 ± 0.9
CA-IDM-19	90.0	18.4 ± 0.6	18.4 ± 0.6	91.0	18.6 ± 0.7	18.4 ± 0.6	91.1	19.3 ± 0.4	19.1 ± 0.4	94.0	17.5 ± 0.6	16.8 ± 0.6	366.0	72.7 ± 4.4	17.9 ± 1.1
CA-IDM-20	90.0	18.1 ± 0.8	18.1 ± 0.8	91.0	19.1 ± 0.9	18.9 ± 0.9	91.1	19.6 ± 0.6	19.4 ± 0.6	93.9	17.8 ± 1.6	17.1 ± 1.6	366.0	75.1 ± 2.6	18.5 ± 0.6
CA-IDM-21	90.0	19.7 ± 0.9	19.7 ± 0.9	91.0	18.6 ± 0.6	18.4 ± 0.6	91.1	18.8 ± 1.1	18.6 ± 1.1	93.9	16.7 ± 1.1	16.0 ± 1.1	366.0	74.4 ± 3.4	18.3 ± 0.8
CA-IDM-22a	90.0	17.9 ± 1.0	17.9 ± 1.0	91.0	17.4 ± 0.8	17.2 ± 0.8	91.1	18.6 ± 0.5	18.4 ± 0.5	93.9	16.4 ± 0.5	15.7 ± 0.5	366.0	70.1 ± 1.8	17.2 ± 0.4
CA-IDM-23	90.0	18.4 ± 0.7	18.4 ± 0.7	91.0	19.2 ± 0.9	19.0 ± 0.9	91.1	18.6 ± 0.7	18.4 ± 0.7	93.9	17.8 ± 0.6	17.1 ± 0.6	366.0	70.1 ± 5.6	17.2 ± 1.4
CA-IDM-24	90.0	19.3 ± 0.8	19.3 ± 0.8	91.0	18.4 ± 1.0	18.2 ± 1.0	91.1	19.0 ± 0.8	18.8 ± 0.8	93.9	17.8 ± 0.5	17.1 ± 0.5	183.8	36.8 ± 2.1	18.0 ± 1.0
CA-IDM-25	90.0	18.0 ± 0.5	18.0 ± 0.5	91.0	18.6 ± 1.0	18.4 ± 1.0	91.1	18.9 ± 0.9	18.7 ± 0.8	93.9	16.5 ± 1.1	15.8 ± 1.1	366.0	77.7 ± 11.1	19.1 ± 2.7
CA-IDM-26	90.0	12.4 ± 0.4	12.4 ± 0.4	91.0	13.0 ± 0.5	12.9 ± 0.5	91.1	13.1 ± 0.2	12.9 ± 0.2	93.9	12.3 ± 0.7	11.8 ± 0.7	366.0	50.2 ± 1.7	12.4 ± 0.4

Notes:

TABLE E12 (Cont.)

THERMOLUMINESCENT DOSIMETRY
1996

	FIRST QUARTER			SECOND QUARTER			THIRD QUARTER			FOURTH QUARTER			ANNUAL		
LOCATION CODE	FIELD TIME (DAYS)	TOTAL EXPOSURE (MREM ± 2σ)	NET EXPOSURE (MREM/STD QTR ± 2σ)	FIELD TIME (DAYS)	TOTAL EXPOSURE (MREM ± 2σ)	NET EXPOSURE (MREM/STD QTR ± 2σ)	FIELD TIME (DAYS)	TOTAL EXPOSURE (MREM ± 2σ)	NET EXPOSURE (MREM/STD QTR ± 2σ)	FIELD TIME (DAYS)	TOTAL EXPOSURE (MREM ± 2σ)	NET EXPOSURE (MREM/STD QTR ± 2σ)	FIELD TIME (DAYS)	TOTAL EXPOSURE (MREM ± 2σ)	NET EXPOSURE (MREM/STD QTR ± 2σ)
CA-IDM-27	90.0	19.0 ± 0.9	19.0 ± 0.9	91.0	19.0 ± 0.8	18.8 ± 0.8	91.1	19.5 ± 0.7	19.2 ± 0.7	93.9	16.2 ± 0.6	15.5 ± 0.6	366.0	78.6 ± 2.5	19.3 ± 0.6
CA-IDM-28	90.0	18.7 ± 0.6	18.7 ± 0.6	91.0	ND	ND	91.1	19.3 ± 0.5	19.1 ± 0.5	94.0	16.8 ± 2.2	16.1 ± 2.1	183.9	38.2 ± 1.8	18.7 ± 0.9
CA-IDM-29	90.0	16.8 ± 0.3	16.8 ± 0.3	91.0	17.3 ± 1.0	17.1 ± 0.9	91.1	17.9 ± 0.5	17.7 ± 0.5	93.9	16.9 ± 1.3	16.2 ± 1.2	366.0	64.8 ± 2.8	15.9 ± 0.7
CA-IDM-30a	90.0	17.4 ± 0.6	17.4 ± 0.6	91.9	18.4 ± 0.8	18.0 ± 0.8	90.2	18.2 ± 1.2	18.1 ± 1.2	94.0	16.8 ± 0.5	16.1 ± 0.5	366.0	69.9 ± 3.2	17.2 ± 0.8
CA-IDM-31a	90.0	19.3 ± 0.7	19.3 ± 0.7	91.8	19.4 ± 0.7	19.0 ± 0.6	90.2	19.3 ± 0.4	19.3 ± 0.4	94.0	19.8 ± 1.1	19.0 ± 1.1	366.0	77.1 ± 1.8	19.0 ± 0.4
CA-IDM-32	90.0	18.2 ± 1.5	18.2 ± 1.5	91.9	18.1 ± 0.6	17.7 ± 0.6	90.2	19.5 ± 0.7	19.5 ± 0.7	94.0	15.3 ± 0.8	14.7 ± 0.8	366.0	70.5 ± 3.7	17.3 ± 0.9
CA-IDM-33	90.0	16.8 ± 0.4	16.8 ± 0.4	91.9	18.1 ± 0.6	17.7 ± 0.6	90.2	18.4 ± 0.5	18.4 ± 0.5	94.0	16.9 ± 0.7	16.2 ± 0.7	366.0	70.6 ± 4.5	17.4 ± 1.1
CA-IDM-34	90.0	17.2 ± 0.5	17.2 ± 0.5	91.9	16.9 ± 0.5	16.6 ± 0.5	90.2	17.2 ± 0.3	17.2 ± 0.3	94.0	17.0 ± 0.8	16.3 ± 0.8	366.0	65.2 ± 3.0	16.0 ± 0.7
CA-IDM-35	90.8	16.3 ± 0.5	16.2 ± 0.5	91.1	16.9 ± 0.4	16.7 ± 0.4	90.1	17.4 ± 0.7	17.3 ± 0.7	94.0	14.8 ± 0.4	14.1 ± 0.4	366.0	66.4 ± 1.6	16.3 ± 0.4
CA-IDM-36	90.0	18.0 ± 0.6	18.0 ± 0.6	91.0	18.3 ± 0.5	18.1 ± 0.5	91.1	18.4 ± 0.4	18.2 ± 0.4	93.9	16.6 ± 1.8	15.9 ± 1.7	366.0	66.9 ± 2.9	16.4 ± 0.7
CA-IDM-37	90.0	18.7 ± 0.8	18.7 ± 0.8	91.0	17.7 ± 0.7	17.5 ± 0.7	91.0	18.2 ± 0.4	18.0 ± 0.4	94.0	14.2 ± 0.9	13.6 ± 0.9	366.0	71.8 ± 4.7	17.7 ± 1.2
CA-IDM-38	90.8	13.1 ± 0.5	13.0 ± 0.5	91.1	13.8 ± 0.6	13.6 ± 0.6	90.1	13.6 ± 0.6	13.6 ± 0.6	94.0	13.4 ± 0.6	12.9 ± 0.6	366.0	51.4 ± 1.7	12.7 ± 0.4
CA-IDM-39	89.9	17.4 ± 0.3	17.4 ± 0.3	91.1	18.6 ± 0.6	18.4 ± 0.6	90.1	18.5 ± 0.3	18.5 ± 0.3	94.0	19.5 ± 0.6	18.6 ± 0.6	365.1	73.8 ± 5.9	18.2 ± 1.5
CA-IDM-40	89.9	19.0 ± 0.5	19.0 ± 0.5	91.1	20.8 ± 0.9	20.5 ± 0.9	90.1	19.4 ± 0.7	19.3 ± 0.7	94.0	18.4 ± 0.6	17.6 ± 0.5	365.1	75.9 ± 6.0	18.7 ± 1.5
CA-IDM-41	90.0	18.2 ± 0.5	18.2 ± 0.5	91.9	17.8 ± 0.4	17.5 ± 0.4	90.2	18.1 ± 0.6	18.1 ± 0.6	94.0	17.9 ± 1.3	17.2 ± 1.2	366.0	71.3 ± 0.6	17.5 ± 0.2
CA-IDM-42	90.0	15.0 ± 0.5	15.0 ± 0.5	91.9	16.0 ± 0.4	15.6 ± 0.4	90.2	15.6 ± 0.7	15.6 ± 0.7	94.0	14.6 ± 0.5	14.0 ± 0.5	366.0	61.1 ± 1.3	15.0 ± 0.3
CA-IDM-43	90.0	17.7 ± 0.5	17.7 ± 0.5	91.0	18.4 ± 1.0	18.2 ± 1.0	91.0	19.0 ± 0.8	18.7 ± 0.7	94.0	17.8 ± 1.0	17.0 ± 1.0	366.0	69.6 ± 0.2	17.1 ± 0.1
CA-IDM-44	90.0	19.0 ± 0.7	19.0 ± 0.7	91.9	18.1 ± 0.4	17.7 ± 0.4	90.2	18.8 ± 0.7	18.7 ± 0.7	94.0	16.9 ± 0.5	16.2 ± 0.5	366.0	72.3 ± 5.4	17.8 ± 1.3
CA-IDM-45	90.0	17.1 ± 0.4	17.1 ± 0.4	91.0	17.7 ± 0.4	17.6 ± 0.3	91.1	16.9 ± 0.4	16.7 ± 0.4	93.9	16.3 ± 0.6	15.6 ± 0.5	366.0	69.2 ± 2.0	17.0 ± 0.5
CA-IDM-46	90.0	18.1 ± 0.8	18.1 ± 0.8	91.0	19.0 ± 0.6	18.8 ± 0.6	91.1	18.8 ± 0.7	18.6 ± 0.7	93.9	17.1 ± 0.3	16.4 ± 0.3	366.0	72.6 ± 5.7	17.9 ± 1.4
CA-IDM-47	90.0	17.2 ± 0.5	17.2 ± 0.5	91.0	17.0 ± 0.4	16.8 ± 0.4	91.1	18.1 ± 0.5	17.[illegible] ± 0.4	93.9	14.9 ± 0.6	14.2 ± 0.6	366.0	70.8 ± 4.6	17.4 ± 1.1
CA-IDM-48	90.0	17.2 ± 0.4	17.2 ± 0.4	91.0	18.9 ± 0.5	18.7 ± 0.5	91.1	18.8 ± 0.5	18.[illegible] ± 0.5	93.9	18.6 ± 2.8	17.8 ± 2.7	366.0	71.6 ± 4.4	17.6 ± 1.1
CA-IDM-49	90.0	ND	ND	91.0	17.4 ± 0.5	17.2 ± 0.5	91.1	17.6 ± 0.7	17.4 ± 0.7	93.9	13.9 ± 0.4	13.3 ± 0.4	366.0	70.9 ± 0.7	17.4 ± 0.2
CA-IDM-50	90.0	18.0 ± 0.6	18.0 ± 0.6	91.0	18.4 ± 0.6	18.2 ± 0.6	91.0	18.8 ± 0.3	18.6 ± 0.3	94.0	17.7 ± 0.7	17.0 ± 0.7	366.0	72.2 ± 3.0	17.8 ± 0.7
CA-IDM-51a	90.0	18.3 ± 0.6	18.3 ± 0.6	91.0	18.9 ± 0.7	18.7 ± 0.7	91.1	19.2 ± 0.7	18.9 ± 0.7	93.9	17.8 ± 0.7	17.1 ± 0.7	366.0	72.6 ± 2.6	17.9 ± 0.6
CA-IDM-52	90.0	17.5 ± 0.4	17.5 ± 0.4	91.0	17.7 ± 0.5	17.5 ± 0.5	91.1	19.1 ± 0.5	18.9 ± 0.5	93.9	17.4 ± 0.5	16.7 ± 0.5	366.0	71.8 ± 3.3	17.7 ± 0.8

Notes: 1. ND = No Data. See section 2.3 for explination.

SECTION 4.0

NONRADIOLOGICAL ENVIRONMENTAL MONITORING

UNION ELECTRIC COMPANY

ST. LOUIS, MISSOURI

CALLAWAY PLANT

SECTION 4.0

NONRADIOLOGICAL ENVIRONMENTAL

MONITORING PROGRAM

ANNUAL REPORT

1996

CONTENTS

1.0 **INTRODUCTION**

Union Electric Company (UEC), in accordance with federal regulations and the desire to maintain the quality of the local environment around the Callaway Plant, has implemented an Environmental Protection Plan (EPP) contained in Appendix B of the Callaway Plant Operating License.

The objective of the EPP is to provide for protection of nonradiological environmental values during operation of the Callaway Plant.

This report describes the conduct of the EPP for the Callaway Plant during 1996.

2.0 **UNUSUAL OR IMPORTANT EVENTS**

No unusual or important events reportable under EPP Section 4.1 were identified during 1996.

3.0 **EPP NONCOMPLIANCES**

During 1996 there were no noncompliances with the EPP.

4.0 **NONROUTINE REPORTS**

There were no nonroutine reports submitted in accordance with EPP, Section 5.4.2 in 1996.

5.0 **PLANT DESIGN AND OPERATION ENVIRONMENTAL EVALUATIONS**

This section lists all changes in plant design, operation, tests or experiments completed during 1996 which could have involved a potentially significant unreviewed environmental question in accordance with section 3.1 of Appendix B.

During 1996 there were seven plant design and operation changes that could have involved a potentially significant unreviewed environmental question. The interpretations and conclusions regarding these plant design and operation changes along with a description of the changes are presented below.

5.1 Callaway Modification Package 94-3006

5.1.1 Description of Change

This change involved the installation of a permanent pumping system for draining groundwater and precipitation from the unit #2 excavation. This change involved the installation of a submersible pump on an existing concrete pad and routing the pump discharge to the existing piping used during Plant construction to discharge water from the excavation. The water is discharge into the ditch near the main access facility that drains to storm water outfall 012.

5.1.2 Evaluation of Change

The construction of the access ramp and installation of the sump pump did not result in a significant increase in any adverse environmental impact, since all measurable non-radiological effects were confined to the areas previously disturbed during site preparation and plant construction. The discharge of water from the unit #2 excavation to storm water outfall 012 is included in the existing NPDES permit. Therefore, this change did not constitute an unreviewed environmental question per Section 3.1 of Appendix B to the Callaway Plant Operating License.

5.2 Request for Resolution 15739B

5.2.1 Description of Change

This change involved the addition of NALCO 1250 Plus (Carbohydrazide) to the steam generators for wet lay-up during refueling. Carbohydrazide was used in place of hydrazine as an oxygen scavenger to reduce feedwater iron transport during startup.

5.2.2 Evaluation of Change

Carbohydrazide, at a concentration of 100 ppm, was added to each steam generator during wet lay-up. Following wet lay-up, two of the steam generators were drained to the discharge monitor tanks for discharge. This resulted in the release of 66,000 gallons of water containing low concentrations of carbohydrazide through Outfall 001 to the Missouri River. Carbohydrazide is less toxic than hydrazine which was used in the past and therefore does not create an increased environmental impact above that which already exists.

Although the use of carbohydrazide was not described in the Callaway NPDES Permit, the Missouri Department of Natural Resources was notified of our intent to use NALCO 1250 Plus and had no objections. Therefore, this change did not constitute an unreviewed environmental question per Section 3.1 of Appendix B to the Callaway Plant Operating License.

5.3 Request for Resolution 16063B

5.3.1 Description of Change

This change allows the processing of the spent chemical cleaning solutions from the steam generator chemical cleaning by an evaporation unit. The spent solutions were dewatered using the evaporator unit. Condensate from the evaporator was returned to radwaste for analysis and disposition. The evaporator bottoms were incorporated into a shippable media and shipped offsite for further processing.

5.3.2 Evaluation of Change

The evaporation process was located plant east of the radwaste building inside a berm. The evaporator used was a closed evaporator that does not emit pollutants to the atmosphere. The condensate from the evaporator was routed to radwaste where it was analyzed and dispositioned. The evaporator concentrates were solidified inside the radwaste building using a non-reactive organic heel.

The Missouri Department of Natural Resources was notified of our intent to process this waste using an evaporator and had no objections as long as the total iron and copper in the evaporator condensate were maintained at less than 1 ppm. Therefore, this change did not constitute an unreviewed environmental question per Section 3.1 of Appendix B to the Callaway Plant Operating License.

5.4 Plant Procedure CTP-KC-06001, Rev. 0

5.4.1 Description of Change

This procedure was prepared to allow for chemical treatment of the Fire Protection System for mitigation of microbiologically induced corrosion(MIC). This procedure provides instructions for a one time initial shock treatment, annual treatments and weekly maintenance treatments of the fire protection system.

5.4.2 Evaluation of Change

The three types of treatments will involve the use of five different Buckman products, BULAB 6067, a gluteraldhyde, BULAB 8006 and 8031, biopenetrants, BULAB 7034, a copolymer, and BULAB 6002, a biostat. The chemicals are added to the fire protection sump which provides makeup to the fire water storage tanks. During the initial treatment and annual treatments, a portion of the water will be flushed from the system to stormwater outfalls 010, 011, and 012 to distribute the chemicals within the system. It was determined that flushing a portion of the chemicals added to the fire protection system to the stormwater ponds would not create an aquatic toxicity condition.

The discharge of water from the fire protection system to storm water outfalls 010, 011, and 012 is mentioned in the existing NPDES permit. Therefore, this change did not constitute an unreviewed environmental question per Section 3.1 of Appendix B to the Callaway Plant Operating License.

5.5 Plant Procedure CTP-ZZ-06000, Rev. 1

5.5.1 Description of Change

This procedure revision allows the addition of BULAB 6002 at the water treatment plant to help control biological growth in the clarifiers. This treatment will be used in addition to sodium hypochlorite that is currently being used to treat algae growth in the clarifiers.

5.5.2 Evaluation of Change

Ten gallons of BULAB 6002 is added to the stilling basin or rapid mixer section at the water treatment plant on a weekly basis or as needed to control algae growth. This results in small quantities of product being released through outfall 016 and outfall 002. Before addition, the cooling tower makeup bypass valve is closed and remains closed for a period of time to allow the chemicals to react. It is expected that most of the BULAB 6002 will be consumed in the clarifiers and in the cooling tower. The residual chemical concentration was estimated to average less than 1 ppm in both outfalls. This concentration would not be expected to cause acute toxicity conditions in the Missouri River.

The Missouri Department of Natural Resources was notified of our intent to use BULAB 6002 for algae control and had no objections. Therefore, this change did not constitute an unreviewed environmental question per Section 3.1 of Appendix B to the Callaway Plant Operating License.

5.6 Suggestion Occurrence Solution 96-0188

5.6.1 Description of Change

An environmental impact review was completed for the potential release of tritium from the discharge monitoring tank (DMT) dike to Logan Creek by way of stormwater outfall 011. The DMT dike collects rainwater that is routinely sampled and analyzed for pH, visual oil and gamma emitters prior to pumping the dike contents to stormwater. On February 9, 1996, tritium analysis was performed along with the normal analysis and tritium was identified. The tritium in the dike was determined to be from water spraying out of the tank vent when the DMT is placed in recirculation with low tank level. This evaluation was for potential release of tritium from the DMT dike prior to February 9, 1996.

5.6.2 Evaluation of Change

Past practice of pumping the DMT dike contents to stormwater potentially could have resulted in the release of low levels of tritium to Logan Creek by way of stormwater outfall 011. The evaluation determined that any tritium released would have been within the NRC regulatory limits and plant administrative limits specified in the Offsite Dose Calculation Manual (APA-ZZ-01003). The potential dose received by an individual due to these releases is insignificant when compared to the dose limits for liquid releases. Therefore, this change did not constitute an unreviewed environmental question per Section 3.1 of Appendix B to the Callaway Plant Operating License.

5.7 Final Safety Analysis Report Change Notice 94-061

5.7.1 Description of Change

In an effort to simplify radioactive waste processing, reduce Low-Level Radioactive Waste (LLRW) burial volume and reduce worker radiation exposure, UE elected to switch from evaporation to demineralization and filtration of liquid discharges in August of 1996. Final Safety Analysis Change Notice 94-061 allows the use of this process instead of evaporation to treat some of the waste generated in the plant.

5.7.2 Evaluation of Change

While some radionuclides in the discharge have increased, all discharges continue to be at a small fraction of regulatory limits. It has been demonstrated that ion-selective resin can be used to limit offsite doses to a small fraction of the regulatory limits. Therefore, this change did not constitute an unreviewed environmental question per Section 3.1 of Appendix B to the Callaway Plant Operating License.