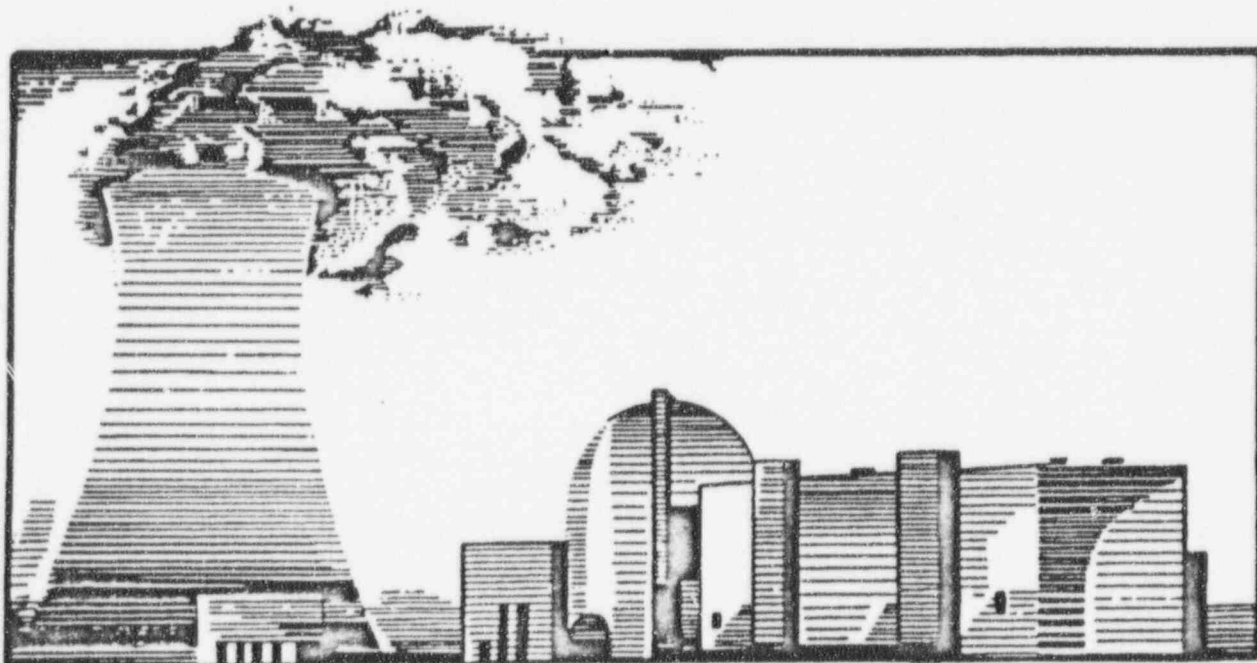




CALLAWAY PLANT

ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

JANUARY — DECEMBER 1995



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ANNUAL RADIOACTIVE EFFLUENT

RELEASE REPORT

CALLAWAY NUCLEAR PLANT

UNION ELECTRIC COMPANY

LICENSE NPF - 30

JANUARY - DECEMBER 1995

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1.0 INTRODUCTION

This Annual Radioactive Effluent Release Report is submitted in accordance with Section 6.9.1.7 of the Callaway Plant Technical Specifications.

The report presents a summary of radioactivity released in liquid and gaseous effluents, and solid waste shipped from the Callaway Plant during the period from January 1, 1995 to December 31, 1995. The information is presented in the format outlined in Appendix B of Regulatory Guide 1.21, Revision 1, June 1974.

All liquid and gaseous effluents discharged during this reporting period were in compliance with federal regulations and the limits of Union Electric Administrative Procedure APA-ZZ-01003, Offsite Dose Calculation Manual (ODCM).

2.0 SUPPLEMENTAL INFORMATION

2.1 Regulatory Limits

Specified as follows are the Radiological Effluent Control (REC) limits applicable to the release of radioactive material in liquid and gaseous effluents.

2.1.1 Fission and Activation Gases (Noble Gases)

The dose rate due to radioactive noble gases released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to less than or equal to 500 mrem/yr to the total body and less than or equal to 3000 mrem/yr to the skin.

The air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the site boundary shall be limited to the following:

- a. During any calendar quarter: Less than or equal to 5 mrad for gamma radiation and less than or equal to 10 mrad for beta radiation and,
- b. During any calendar year: Less than or equal to 10 mrad for gamma radiation and less than or equal to 20 mrad for beta radiation.

2.1.2 Radioiodine, Tritium, and Particulates

The dose rate due to Iodine-131 and 133, tritium and all radionuclides in particulate form with half-lives greater than eight (8) days released in gaseous effluents from the site to areas at and beyond the site boundary shall be limited to less than or equal to 1500 mrem/yr to any organ.

The dose to a member of the public from Iodine-131 and 133, tritium, and all radionuclides in particulate form with half-lives greater than eight (8) days in gaseous effluents released to areas at and beyond the site boundary shall be limited to the following:

- a. During any calendar quarter: Less than or equal to 7.5 mrem to any organ and,
- b. During any calendar year: Less than or equal to 15 mrem to any organ.

2.1.3 Liquid Effluents

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to the concentrations specified in Appendix B, Table II, Column 2 to 10CFR20.001 to 20.601 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-04 microcuries/ml total activity.

The dose or dose commitment to an Individual from radioactive materials in liquid effluents released to unrestricted areas shall be limited:

- a. During any calendar quarter to less than or equal to 1.5 mrem to the total body and less than or equal to 5 mrem to any organ, and
- b. During any calendar year to less than or equal to 3 mrem to the whole body and to less than or equal to 10 mrem to any organ.

2.1.4 Uranium Fuel Cycle Sources

The annual (calendar year) dose or dose commitment to any member of the public due to releases of radioactivity and to radiation from uranium fuel cycle sources shall be limited to less than or equal to 25 mrem to the total body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem.

2.2 Maximum Permissible Concentrations

2.2.1 The maximum permissible concentration values specified in Appendix B, Table II, Column 2 to 10CFR20.001 to 20.601 are used to calculate release rates and permissible concentrations of liquid radioactive effluents at the unrestricted area boundary. A value of 2.0E-4 microcuries/ml is used as the limiting concentration for dissolved and entrained noble gases in liquid effluents.

2.2.2 For gaseous effluents, maximum permissible concentrations are not utilized in release rate calculations since the applicable limits are based on dose rate at the site boundary. The "Percent of Tech Spec Limit" for Table 1A is therefore not applicable to the Callaway Plant.

2.3 Average Energy

This requirement is not applicable to the Callaway Plant radiological effluent monitoring program since the release rate limits for fission and activation gases in gaseous effluent are not based on the average energy of the radionuclide mixture.

2.4 Measurements and Approximations of Total Radioactivity

Radionuclide concentrations in liquid and gaseous effluents were obtained by effluent sampling and radiological analysis in accordance with the requirements of Table 9.3-A and Table 9.6-A of APA-ZZ-01003, Offsite Dose Calculation Manual.

Gamma spectroscopy was the primary analysis technique used to determine the radionuclide composition and concentration of liquid and gaseous effluents. Composite samples were analyzed for Sr-89, Sr-90, and Fe-55 by an independent laboratory. Tritium and gross alpha were measured for both liquid and gaseous effluents using

liquid scintillation counting and gas flow proportional counting techniques, respectively.

The total radioactivity in effluent releases was determined from the measured concentrations of each radionuclide present and the total volume of effluents discharged.

2.5 Batch Releases

Summary information relating to batch releases of gaseous and liquid effluents to the environment from the Callaway Plant during this year is presented below.

2.5.1 Liquid

	<u>UNITS</u>	<u>PERIOD JAN - JUN</u>	<u>PERIOD JUL - DEC</u>
Number of batch releases:		118	120
Total time period for batch releases:	Minutes	47878	54631
Maximum time period for batch release:	Minutes	762	965
Average time period for batch releases:	Minutes	406	455
Minimum time period for batch release:	Minutes	1	218
Average Missouri River flow during periods of release of effluent into the river: ¹	Cubic feet per second	151369	100141

2.5.2 Gaseous

	<u>UNITS</u>	<u>PERIOD JAN - JUN</u>	<u>PERIOD JUL - DEC</u>
Number of batch releases:		38	37
Total time period for batch releases:	Minutes	58357	19308
Maximum time period for batch release:	Minutes	26235	3870
Average time period for batch releases:	Minutes	1536	522
Minimum time period for batch release:	Minutes	1	15

2.6 Unplanned Releases

2.6.1 Liquid

Number of releases: 2

Total Activity released: 9.62E + 01 Ci

¹ Letter, S. Ternes, United States Department of the Interior - Geological Survey - Water Resource Division to B. Holderness, Union Electric Company, dated January 17, 1996.

2.6.2 Gaseous

Number of releases: 2

Total Activity released: 6.05 E-02 Ci

3.0 SUMMARY OF GASEOUS RADIOACTIVE EFFLUENTS

3.1 The quantity of radioactive material released in gaseous effluents during the year is summarized in Tables 1A and 1B. During this year all gaseous effluents were considered as ground level releases.

4.0 SUMMARY OF LIQUID RADIOACTIVE EFFLUENTS

4.1 The quantity of radioactive material released in liquid effluents during the year is summarized in Tables 2A and 2B. During this year there was no continuous release of liquid effluent from the plant.

5.0 SOLID WASTES

5.1 The quantities of radioactive material released in shipments of solid waste for burial and irradiated fuel transported from the site during the year are summarized in Table 3. The total quantity and radioactivity reported in Table 3 for each waste type was for waste buried and include wastes buried by waste reprocessors after volume reduction. The activity and fractional abundance of each nuclide was determined for each waste type based upon radiochemical analysis by an independent laboratory. The curie concentration of each nuclide listed in Table 3 was determined as the product of the fractional abundance and the total curies shipped. Those nuclides which comprise at least 1% of the total activity for a particular waste type are presented in Table 3.

6.0 RELATED INFORMATION

6.1 Unplanned Releases

Unplanned releases are: 1) Inadvertent or accidental releases of radioactive material; 2) Releases of radioactive material via normal pathways without a release permit, proper authorization, or proper sampling and analysis; and 3) Releases which are conducted in such a manner as to result in significant deviation from the requirements of the release permit.

There were four unplanned releases during the reporting period.

6.1.1 On February 6, 1995, The Count Room Technician noted a sampling requirement deviation in the 12 hour noble gas grab sample from the unit vent required by APA-ZZ-01003, Table 9.2.a, Action Statement 40. With the Unit Vent radiation monitor (GT-RE-21B) out of service, Action Statement 40 allows continued release of effluent by this pathway for 30 days provided that grab samples are taken at least once per 12 hours and analyzed for radioactivity within 24 hours. Contrary to this requirement, the 12 hour sampling period was exceeded by 19 minutes. This deviation was determined to be caused by human error and was discussed with the personnel involved. During this period there were no abnormal operational events that would have significantly increased the activity being released from the plant.

A complete description of this event is documented in suggestion occurrence solution (SOS) 95-0162.

6.1.2 On April 3, 1995, radioactivity was detected in the Auxiliary Boiler system by the auxiliary steam condensate recovery radioactivity monitor. Follow-up sampling of the Auxiliary Boiler confirmed the presence of 12 radionuclides at the following concentrations.

H-3	7.50E-06 μ Ci/ml
Ce-144	6.10E-07 μ Ci/ml
Cs-137	2.17E-06 μ Ci/ml
Cs-134	9.23E-07 μ Ci/ml
I-131	2.56E-07 μ Ci/ml
Zr-95	4.36E-07 μ Ci/ml
Nb-95	4.59E-07 μ Ci/ml
Co-57	4.65E-08 μ Ci/ml
Co-58	7.49E-06 μ Ci/ml
Co-60	3.20E-06 μ Ci/ml
Mn-54	9.57E-07 μ Ci/ml
Cr-51	3.35E-06 μ Ci/ml

The plant operations department was notified immediately to ensure that area drains and boiler blowdown were routed to the liquid radwaste system. Attempts were made to blowdown the boiler to remove the contamination. However, low levels of activity still remained.

A 10CFR50.59 evaluation was initiated immediately along with an investigation to determine the source of the activity which had concentrated in the auxiliary boiler. The source of the activity was caused by the failure of four radwaste components. The failure of these four components coupled with the design and operation of the secondary liquid waste evaporator and the auxiliary steam system, allowed radioactivity to backflow into the auxiliary steam system.

Dose calculations were performed based on the isotopic analyses of the Auxiliary Boiler contents and the estimated volume of steam released from continue operation. The calculations were performed according to the methodology in the Offsite Dose Calculation Manual, APA-ZZ-01003.

The 10CFR50.59 evaluation concluded that the resulting doses to a member of the public from the release of radioactive material to the environment would be a small fraction of the regulatory dose limits. Therefore, continued operation of the Auxiliary Boiler would not pose any significant safety or environmental concerns.

The Auxiliary Boiler operated continuously from April 3 through May 11 and intermittently during the remainder of 1995. The 1995 post release evaluation for the Auxiliary Boiler showed that the following activity was released to the environment during 1995.

H-3	1.36E-02 Ci
Cr-51	2.25E-04 Ci
Mn-54	1.14E-04 Ci
Co-58	4.27E-04 Ci
Co-60	3.45E-04 Ci
Xe-135	1.36E-07 Ci
Kr-85	7.54E-06 Ci
Co-57	4.06E-07 Ci
Nb-95	4.53E-05 Ci
Zr-95	3.12E-05 Ci
Nb-97	1.73E-06 Ci
Tc-99m	5.22E-07 Ci
Sb-125	2.34E-05 Ci
Ru-105	3.99E-05 Ci
Rh-106	1.46E-05 Ci
Ru-106	1.46E-05 Ci
I-131	2.64E-05 Ci
I-132	6.18E-07 Ci
I-133	2.35E-06 Ci
Cs-134	6.52E-05 Ci
Cs-137	1.54E-04 Ci
Ce-144	1.80E-05 Ci
Pr-144	1.80E-05 Ci

The maximum organ dose to a member of the public from these releases was calculated to be 3.67E-03 mrem which is negligible when compared to the quarterly and annual effluent control limits. As a result, the releases of radioactive material from operation of the Auxiliary Boiler did not endanger the health or safety of the public or the environment.

The activity released from the Auxiliary Boiler during 1995 is reported in Table 1A and 1B and is also included in the annual dose calculations (see Section 8.0).

A description of this event along with the completed safety evaluation and corrective actions to prevent recurrence was documented in Suggestion Occurrence Solution SOS 95-0610.

6.1.3

On May 12, 1995, a release occurred from Discharge Monitor Tank (DMT) A which resulted in the release of 1000 gallons of liquid effluent without the required dilution flow.

Release permit RP09-1995-L0083 was generated for the release of DMT A with a required dilution flow of 5000 GPM. However, during initiation of the release the status of two release checklist items was incorrectly communicated to the technician initiating the release. Due to the miscommunication, the steps of the checklist which require that the main control room be contacted to verify adequate dilution flow were not performed. In addition, a malfunction of plant equipment allowed the discharge to be initiated without the required dilution flow. When the technician notified the main control room that the release had been initiated, the control room identified that there was no dilution flow. At this time the technician immediately terminated the release and the control room initiated 6000 GPM dilution flow. The root cause of

this event was the failure of a plant component along with human error in completing the release checklist.

The post event evaluation showed that 4.54E-02 Ci of H-3, 6.13E-08 Ci of Co-58, and 3.85E-07 Ci of Co-60 was released to the environment without dilution flow. This resulted in a tritium concentration 4 times the Technical Specification 6.8.4(e)(2) limits for tritium concentration in liquid effluent released to unrestricted areas as specified in Appendix B to 10CFR20, Table II, Column 2. The maximum organ dose to a member of the public from this event was calculated to be 1.80E-06 mrem which is negligible when compared to the quarterly and annual liquid effluent control limits. As a result, the release of radioactive material from this event did not endanger the health or safety of the public or the environment.

A complete description of this event is documented in SOS 95-1217.

6.1.4 On October 9, a report was made to the control room that there was a water leak between Logan Creek and Highway 94. An outside equipment operator was dispatched and discovered a leak in the discharge line from the plant. The leak in the discharge line was approximately two miles upstream of the discharge point to the Missouri River. This site is about 200 yards north of highway 94 and on the south bank of Logan Creek. The water was discharging into Logan Creek and draining to the Missouri River.

A routine inspection of discharge line performed on May 15, 1995, found no evidence of leakage. The area was heavily flooded by the Missouri River during the months of June and July 1995. The discharge pipe would have stayed full of water due to river elevations until August 25, when the river level dropped below 511 feet. At sometime after August 25, the discharge pipe became buoyant causing a misalignment of the pipeline resulting in the break. For conservatism, it was assumed the break occurred on August 1 and an environmental evaluation was performed for the period of August 1 through October 9.

The release permits for liquid effluent releases during the period from August 1, through October 9, 1995, were evaluated to determine the activity and the dose commitment to an individual assuming release to Logan Creek. Considering the size of the hole on the pipe, it was estimated that 2000 gals/min was discharged into Logan Creek.

During this period, 96.2 Curies of radioactive material were released in liquid effluents to Logan Creek. Tritium was the major nuclide released and accounted for greater than 99 percent of the total activity. Listed below is the activity released to Logan Creek.

<u>NUCLIDE</u>	<u>ACTIVITY (Ci)</u>
H-3	9.62E+01
Mn-54	9.29E-06
Co-58	5.62E-05
Co-60	8.92E-05
Nb-95	7.28E-06
Ru-106	1.39E-05
Sb-125	4.76E-06
Cs-134	1.97E-06
Cs-137	2.91E-05
Pr-144	1.88E-05
Ce-144	1.88E-05
Hf-181	1.39E-06

All releases during this period were conducted according to existing plant procedures for discharging radioactive liquid effluents. The waste flow rate and dilution flow rate were set by the release permits to assure concentration of radioactive material released to unrestricted areas was within concentration limits specified in 10CFR20.1-20.601, Appendix B, Table II

Doses were calculated using methodology described in the Offsite Dose Calculation Manual, APA-ZZ-01003 and NUREG 0133. For this evaluation, near field mixing for Logan Creek was considered to be negligible.

The releases to Logan Creek resulted in a total committed dose to the maximum exposed individual of 0.0141 mrem to the total body and a maximum organ dose of 0.0164 mrem. In addition the quarterly and annual liquid effluent control limits were not exceeded due to this event. Therefore, this event did not endanger the health or safety of the public or the environment.

The activity released into Logan Creek is reported in Table 2A and 2B and the additional dose due to this event is included in Table 8.

A description of this event was documented in SOS 95-1940.

6.2 Changes to the Process Control Program

There were no changes made to Administrative Procedure APA-ZZ-01011, "Process Control Program Manual", during this year.

6.3 Changes to the Offsite Dose Calculation Manual

Revision 5 of Administrative Procedure APA-ZZ-01003, Offsite Dose Calculation Manual (ODCM) was approved February 16, 1995.

The changes incorporated into revision 5 include the following:

- 1) Removal of airborne pathway dose conversion factors for airborne particulate nuclides with half-lives of less than 8 days and removal of liquid and airborne pathway dose conversion factors for Carbon-14, Phosphorus-32, Nickel-63, and Tellurium-125m.
- 2) The meat, milk, and vegetation pathway dispersion parameters were removed and the applicability of the dispersion parameters and locations for calculating dose were clarified.
- 3) Changed the reporting frequency for the effluent release report from semiannual to annual.
- 4) Relocated Radiological Effluent Controls 9.1 and 9.2 to FSAR Chapter 16 and the radiological environmental monitoring sample locations to plant procedure FDP-ZZ-03001, "Radiological Environmental Monitoring Program".
- 5) Revised footnotes to the gaseous effluent sampling and analysis table to require additional sampling of the unit vent in the event of a reactor power transient, only if the unit vent noble gas monitor shows an activity increase by a factor of 3 or greater.

- 6) Added a section providing instructions for determining the dose to a member of the public from the on-site storage of low level radioactive waste.

A complete copy of Administrative Procedure APA-ZZ-01003, Revision 5 is included as Attachment 1.

6.4 Major Changes to Radwaste Treatment Systems

There were no changes to the plant during the year which would be considered a major change to a Liquid, Gaseous, or Solid Radwaste Treatment System.

6.5 Land Use Census Changes

No changes were identified in critical receptor locations for dose calculations during 1995 Land Use Census.

6.6 Inoperability of Effluent Monitoring Instrumentation

All effluent monitoring instrumentation was OPERABLE within limits specified in FSAR Chapters 16.3.3.6 and 16.3.3.7B during the year.

6.7 Instances of Liquid Holdup Tanks or Waste Gas Decay Tanks Exceeding Technical Specification Limits

All liquid tanks and waste gas decay tanks were within limits specified in FSAR Chapters 16.11.1 and 16.11.3 during the reporting period.

7.0 METEOROLOGICAL DATA

The on-site meteorological data for this reporting period is presented in Table 4. The data is presented as Cumulative Joint Frequency Distributions of wind speed and wind direction by atmospheric stability class for the 10 and 60 meter tower elevations. Valid data recovery for 1995 was greater than 90% for all required parameters.

8.0 ASSESSMENT OF DOSES

Assessment of doses to the maximum exposed individuals from gaseous and liquid effluents released was performed in accordance with Administrative Procedure APA-ZZ-01003 as described in the following sections. For all effluent released from the Callaway Plant during this year, the annual dose to the maximum exposed individuals was less than 1% of the Radiological Effluent Control Limits presented in Section 2.1 of this report.

8.1 Dose at the Site Boundary from Gaseous Effluents

The dose at the Site Boundary was due to plume exposure from noble gases, ground plane exposure, and inhalation. It was conservatively assumed a hypothetical maximum exposed individual was present at the Site Boundary location with the most limiting atmospheric dispersion parameter, based on actual meteorological conditions for the year. Dose was conservatively calculated using a child as the critical age group.

The dose from gaseous effluent at the Site Boundary for 1995 is presented in Table 5.

8.2 Dose to the MEMBER OF THE PUBLIC

The MEMBER OF THE PUBLIC was considered to be a real individual, not occupationally associated with the plant, who used portions of the plant site for recreational or other purposes not associated with the plant operation. This individual's utilization of areas both inside and outside the Site Boundary was characterized for this calculation.

To evaluate total dose from the Uranium Fuel Cycle to any MEMBER OF THE PUBLIC, the critical MEMBER OF THE PUBLIC within the Site Boundary, and the Nearest Resident were evaluated.

8.2.1 Dose at the Nearest Resident from Gaseous Effluent

The dose to the Nearest Resident was due to plume exposure from noble gases, ground plane exposure, and inhalation and ingestion. Dose was calculated at the nearest actual residence with the most limiting atmospheric dispersion, based on meteorological conditions for the year. It was conservatively assumed that each ingestion pathway (meat, milk, and vegetation) existed at this location. Dose was conservatively calculated assuming the child as the critical age group. Dose from activities within the Site Boundary was negligible and not included in this calculation.

The doses to the Nearest Resident for 1995 are presented in Table 5.

8.2.2 Dose to the MEMBER OF THE PUBLIC from Activities within the Site Boundary

Based on existing land use within the Site Boundary, the MEMBER OF THE PUBLIC with the highest dose was a farmer. Dose from farming activities within the Site Boundary was due to direct radiation exposure, plume exposure from noble gases, ground plane exposure, and inhalation. The current tenant estimates spending 1100 hours per year working within the Site Boundary area. Dose was calculated using the adult farmer as the critical age group.

Dose to the MEMBER OF THE PUBLIC from activities within the Site Boundary is presented in Table 6.

8.3 Total Dose Due to the Uranium Fuel Cycle

Since there are no other Uranium Fuel Cycle facilities within 8 kilometers of the Callaway Plant, the total dose to the most likely exposed MEMBER OF THE PUBLIC resulted from direct radiation exposure and radioactive effluents from Callaway Plant itself. Therefore, Dose from mining, fuel fabrication, and waste disposal were not included in this calculation.

Since dose via liquid releases was conservatively evaluated, reasonable assurance exists that no real individual received a significant dose from radioactive liquid release pathways. Therefore, only dose to individuals from airborne pathways and dose resulting from direct radiation were considered in this assessment.

The total dose to the MEMBER OF THE PUBLIC within the Site Boundary (Table 7) was the sum of the dose due to activities within the Site Boundary (Table 6) and the dose due to gaseous effluents at his residence. It was assumed that each food ingestion pathway exists at his residence. Dose was calculated using the adult farmer as the critical age group.

The total dose from the Uranium Fuel Cycle is presented in Table 7.

8.4 Dose Due to Liquid Effluents

Dose due to liquid effluents assumed contributions from the maximum exposed individual's consumption of fish and potable water, as appropriate. An adult was considered to be the maximum exposed individual in this assessment.

Since there are no potable water intakes within 50 river miles of the discharge point to the Missouri River, the potable water pathway was not included in the dose assessment. Therefore, dose contribution from fish consumption accounted for 95% of the total dose from liquid effluents discharged to the river. Dose from recreational activities' contributed the additional 5%. It is conservatively assumed the hypothetical maximum exposed individual obtained his entire annual fish intake from near the plant discharge.

Total dose due to liquid effluents from Callaway Plant during the year is presented in Table 8.

TABLE 1A

SEMIANNUAL SUMMATION OF GASEOUS RELEASES
ALL AIRBORNE EFFLUENTS

QUARTERS 1 AND 2, 1995

TYPE OF EFFLUENT	UNITS	FIRST QUARTER	SECOND QUARTER	EST TOTAL ERROR % (a)
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A. FISSION AND ACTIVATION GASES

1. TOTAL RELEASE	CURIES	3.90E+01	2.66E+00	20
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	5.01E+00	3.39E-01	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

B. RADIOIODINES

1. TOTAL IODINE-131	CURIES	2.05E-06	3.89E-05	23
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	2.64E-07	4.95E-06	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

C. PARTICULATES

1. PARTICULATE (HALF-LIVES > 8 DAYS)	CURIES	1.58E-07	1.52E-03	30
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	2.03E-08	1.93E-04	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
4. GROSS ALPHA RADIOACTIVITY	CURIES	1.89E-07	2.25E-07	

D. TRITIUM

1. TOTAL RELEASE	CURIES	9.44E+00	2.74E+01	14
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	1.21E+00	3.48E+00	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

(a) Safety Analysis Calculation 87-063-00, January 6, 1988

TABLE 1A (continued)

SEMIANNUAL SUMMATION OF GASEOUS RELEASES
ALL AIRBORNE EFFLUENTS

QUARTERS 3 AND 4, 1995

TYPE OF EFFLUENT	UNITS	THIRD QUARTER	FOURTH QUARTER	EST TOTAL ERROR % (a)
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A. FISSION AND ACTIVATION GASES

1. TOTAL RELEASE	CURIES	2.72E+00	4.93E+00	20
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	3.43E-01	6.21E-01	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

B. RADIOIODINES

1. TOTAL IODINE-131	CURIES	9.33E-07	1.69E-06	23
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	1.17E-07	2.13E-07	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

C. PARTICULATES

1. PARTICULATE (HALF-LIVES > 8 DAYS)	CURIES	8.27E-07	1.97E-07	30
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	1.04E-07	2.47E-08	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
4. GROSS ALPHA RADIOACTIVITY	CURIES	1.88E-07	2.32E-07	

D. TRITIUM

1. TOTAL RELEASE	CURIES	3.11E+01	3.18E+01	14
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	3.91E+00	4.00E+00	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

(a) Safety Analysis Calculation 87-063-00, January 6, 1988

TABLE 1B

SEMIANNUAL AIRBORNE CONTINUOUS AND BATCH RELEASES
GROUND LEVEL RELEASES
FISSION GASES, IODINES, AND PARTICULATES

QUARTERS 1 AND 2, 1995

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER

1. FISSION GASES

AR-41	CURIES	0.00E+00	0.00E+00	6.92E-01	3.26E-02
XE-133	CURIES	7.46E+00	1.69E+00	2.34E+01	3.73E-03
XE-135	CURIES	4.12E-01	1.22E-01	4.44E+00	3.30E-05
XE-131M	CURIES	0.00E+00	0.00E+00	3.64E-03	2.49E-03
KR-85	CURIES	0.00E+00	0.00E+00	1.60E+00	8.15E-01
KR-85M	CURIES	0.00E+00	0.00E+00	1.75E-01	0.00E+00
XE-133M	CURIES	0.00E+00	0.00E+00	6.36E-01	0.00E+00
KR-88	CURIES	0.00E+00	0.00E+00	1.73E-01	0.00E+00
KR-87	CURIES	0.00E+00	0.00E+00	1.53E-04	0.00E+00
XE-135M	CURIES	0.00E+00	0.00E+00	9.94E-05	0.00E+00
TOTAL FOR PERIOD	CURIES	7.87E+00	1.81E+00	3.11E+01	8.53E-01

2. IODINES

I-131	CURIES	2.05E-06	1.24E-05	1.33E-09	2.65E-05
I-132	CURIES	7.45E-05	3.56E-04	1.14E-06	1.70E-04
I-133	CURIES	7.38E-07	0.00E+00	1.08E-06	2.02E-04
I-134	CURIES	0.00E+00	0.00E+00	8.81E-07	0.00E+00
I-135	CURIES	0.00E+00	0.00E+00	1.57E-06	0.00E+00
TOTAL FOR PERIOD	CURIES	7.73E-05	3.68E-04	4.67E-06	3.98E-04

3. PARTICULATES

CO-57	CURIES	1.58E-07	0.00E+00	0.00E+00	4.05E-07
CE-144	CURIES	0.00E+00	0.00E+00	0.00E+00	1.79E-05
CO-58	CURIES	0.00E+00	2.74E-07	0.00E+00	4.27E-04
CO-60	CURIES	0.00E+00	1.98E-07	0.00E+00	3.44E-04
CR-51	CURIES	0.00E+00	0.00E+00	0.00E+00	2.24E-04
CS-134	CURIES	0.00E+00	0.00E+00	0.00E+00	6.51E-05
CS-137	CURIES	0.00E+00	0.00E+00	0.00E+00	1.53E-04
MN-54	CURIES	0.00E+00	0.00E+00	0.00E+00	1.13E-04
NB-95	CURIES	0.00E+00	0.00E+00	0.00E+00	4.52E-05
PR-144	CURIES	0.00E+00	0.00E+00	0.00E+00	1.79E-05
RU-105	CURIES	0.00E+00	0.00E+00	0.00E+00	3.99E-05
RU-106	CURIES	0.00E+00	0.00E+00	0.00E+00	1.45E-05
SB-125	CURIES	0.00E+00	0.00E+00	0.00E+00	2.34E-05
TC-99M	CURIES	0.00E+00	0.00E+00	0.00E+00	5.22E-07

TABLE 1B (continued)

SEMIANNUAL AIRBORNE CONTINUOUS AND BATCH RELEASES
GROUND LEVEL RELEASES
FISSION GASES, IODINES, AND PARTICULATES

QUARTERS 1 AND 2, 1995

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER

3. PARTICULATES

ZR-95	CURIES	0.00E+00	0.00E+00	0.00E+00	3.11E-05
SR-89	CURIES	0.00E+00	1.33E-07	0.00E+00	0.00E+00
SR-90	CURIES	0.00E+00	4.22E-08	0.00E+00	0.00E+00
AI PHA	CURIES	1.89E-07	2.25E-07	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	3.47E-07	8.73E-07	0.00E+00	1.52E-03

4. TRITIUM

H-3	CURIES	8.06E+00	2.70E+01	1.38E+00	3.88E-01
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TABLE 1B (continued)

SEMIANNUAL AIRBORNE CONTINUOUS AND BATCH RELEASES
GROUND LEVEL RELEASES
FISSION GASES, IODINES, AND PARTICULATES

QUARTERS 3 AND 4, 1995

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER

1. FISSION GASES

AR-41	CURIES	0.00E+00	0.00E+00	1.05E-01	4.33E-01
XE-133	CURIES	7.42E-01	3.47E+00	1.57E-02	4.83E-01
XE-135	CURIES	2.93E-02	0.00E+00	1.07E-04	2.35E-01
XE-131M	CURIES	8.65E-01	0.00E+00	2.52E-04	0.00E+00
KR-85	CURIES	0.00E+00	0.00E+00	9.65E-01	0.00E+00
KR-85M	CURIES	0.00E+00	0.00E+00	0.00E+00	2.35E-02
XE-133M	CURIES	0.00E+00	1.57E-01	0.00E+00	0.00E+00
KR-88	CURIES	0.00E+00	0.00E+00	1.12E-04	4.18E-02
KR-87	CURIES	0.00E+00	0.00E+00	0.00E+00	2.88E-02
XE-135M	CURIES	0.00E+00	0.00E+00	0.00E+00	1.31E-02
XE-138	CURIES	0.00E+00	0.00E+00	0.00E+00	4.79E-02
TOTAL FOR PERIOD	CURIES	1.64E+00	3.63E+00	1.09E+00	1.31E+00

2. IODINES

I-131	CURIES	9.33E-07	1.69E-06	0.00E+00	0.00E+00
I-133	CURIES	3.77E-06	4.78E-06	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	4.70E-06	6.48E-06	0.00E+00	0.00E+00

3. PARTICULATES

CO-58	CURIES	0.00E+00	1.97E-07	0.00E+00	0.00E+00
SR-89	CURIES	6.28E-07	0.00E+00	0.00E+00	0.00E+00
SR-90	CURIES	1.99E-07	0.00E+00	0.00E+00	0.00E+00
ALPHA	CURIES	1.88E-07	2.32E-07	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.02E-06	4.28E-07	0.00E+00	0.00E+00

4. TRITIUM

H-3	CURIES	3.04E+01	2.40E+01	7.29E-01	7.81E+00
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TABLE 2A

SEMIANNUAL SUMMATION OF LIQUID RELEASES
ALL LIQUID EFFLUENTS

QUARTERS 1 AND 2, 1995

TYPE OF EFFLUENT	UNITS	FIRST QUARTER	SECOND QUARTER	EST TOTAL ERROR % (a)
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A. FISSION AND ACTIVATION PRODUCTS

1. TOTAL RELEASE [NOT INCLUDING TRITIUM, GASES, ALPHA]	CURIES	7.92E-04	5.34E-03	20
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.68E-09	1.24E-08	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

B. TRITIUM

1. TOTAL RELEASE	CURIES	3.11E+02	8.68E+01	14
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	6.61E-04	2.02E-04	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

C. DISSOLVED AND ENTRAINED GASES

1. TOTAL RELEASE	CURIES	3.77E-02	1.15E-03	27
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	8.01E-08	2.68E-09	

D. GROSS ALPHA RADIOACTIVITY

1. TOTAL RELEASE	CURIES	1.97E-03	1.99E-04	29
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E. WASTE VOLUME RELEASED (PRE-DILUTION)	GAL	4.94E+06	5.68E+06	10
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F. VOLUME OF DILUTION WATER USED	GAL	1.19E+08	1.08E+08	10
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(a) Safety Analysis Calculation 87-063-00, January 6, 1988

TABLE 2A (continued)

SEMIANNUAL SUMMATION OF LIQUID RELEASES
ALL LIQUID EFFLUENTS

QUARTERS 3 AND 4, 1995

TYPE OF EFFLUENT	UNITS	THIRD QUARTER	FOURTH QUARTER	EST TOTAL ERROR % (a)
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A. FISSION AND ACTIVATION PRODUCTS

1. TOTAL RELEASE [NOT INCLUDING TRITIUM, GASES, ALPHA]	CURIES	8.64E-04	1.04E-03	20
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.71E-09	2.54E-09	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

B. TRITIUM

1. TOTAL RELEASE	CURIES	1.50E+02	2.44E+02	14
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	4.70E-04	5.97E-04	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	

C. DISSOLVED AND ENTRAINED GASES

1. TOTAL RELEASE	CURIES	1.06E-03	2.42E-03	27
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	3.34E-09	5.90E-09	

D. GROSS ALPHA RADIOACTIVITY

1. TOTAL RELEASE	CURIES	1.43E-03	9.71E-03	29
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E. WASTE VOLUME RELEASED (PRE-DILUTION)	GAL	5.79E+06	5.41E+06	10
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F. VOLUME OF DILUTION WATER USED	GAL	7.84E+07	1.03E+08	10
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(a) Safety Analysis Calculation 87-063-00, January 6, 1988

TABLE 2B

SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
TOTALS FOR EACH NUCLIDE RELEASED

QUARTERS 1 AND 2, 1995

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER
I. ALL NUCLIDES					
ALPHA	CURIES	0.00E+00	0.00E+00	1.97E-03	1.99E-04
H-3	CURIES	0.00E+00	0.00E+00	3.11E+02	8.68E+01
SR-90	CURIES	0.00E+00	0.00E+00	2.49E-04	0.00E+00
XE-133	CURIES	0.00E+00	0.00E+00	3.56E-02	1.23E-04
XE-135	CURIES	0.00E+00	0.00E+00	1.11E-03	7.94E-06
CO-60	CURIES	0.00E+00	0.00E+00	3.07E-04	2.72E-03
XE-133M	CURIES	0.00E+00	0.00E+00	6.88E-04	0.00E+00
CS-137	CURIES	0.00E+00	0.00E+00	4.66E-05	1.35E-04
I-131	CURIES	0.00E+00	0.00E+00	2.20E-06	9.95E-06
XE-131M	CURIES	0.00E+00	0.00E+00	2.57E-04	0.00E+00
CS-134	CURIES	0.00E+00	0.00E+00	1.27E-05	8.30E-06
CE-144	CURIES	0.00E+00	0.00E+00	7.17E-05	9.41E-05
MN-54	CURIES	0.00E+00	0.00E+00	7.98E-06	1.20E-04
PR-144	CURIES	0.00E+00	0.00E+00	7.17E-05	9.41E-05
TE-129	CURIES	0.00E+00	0.00E+00	2.37E-05	0.00E+00
I-133	CURIES	0.00E+00	0.00E+00	0.00E+00	8.37E-06
CO-58	CURIES	0.00E+00	0.00E+00	0.00E+00	1.01E-03
NB-95	CURIES	0.00E+00	0.00E+00	0.00E+00	1.87E-04
CR-51	CURIES	0.00E+00	0.00E+00	0.00E+00	6.20E-04
FE-59	CURIES	0.00E+00	0.00E+00	0.00E+00	2.03E-05
ZR-95	CURIES	0.00E+00	0.00E+00	0.00E+00	1.20E-04
AG-110M	CURIES	0.00E+00	0.00E+00	0.00E+00	1.11E-05
CE-141	CURIES	0.00E+00	0.00E+00	0.00E+00	4.44E-05
LA-140	CURIES	0.00E+00	0.00E+00	0.00E+00	1.30E-05
RU-106	CURIES	0.00E+00	0.00E+00	0.00E+00	9.32E-05
SN-113	CURIES	0.00E+00	0.00E+00	0.00E+00	1.43E-05
RU-103	CURIES	0.00E+00	0.00E+00	0.00E+00	1.66E-08
SB-125	CURIES	0.00E+00	0.00E+00	0.00E+00	3.21E-08
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	4.06E-06
ZR-97	CURIES	0.00E+00	0.00E+00	0.00E+00	2.81E-06
RU-105	CURIES	0.00E+00	0.00E+00	0.00E+00	1.31E-05
KR-85	CURIES	0.00E+00	0.00E+00	0.00E+00	1.02E-03
TC-99M	CURIES	0.00E+00	0.00E+00	0.00E+00	2.81E-06
TOTALS FOR PERIOD	CURIES	0.00E+00	0.00E+00	3.11E+02	8.68E+01

TABLE 2B (continued)

SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
TOTALS FOR EACH NUCLIDE RELEASED

QUARTERS 3 AND 4, 1995

NUCLIDE	UNITS	CONTINUOUS RELEASES		BATCH RELEASES	
		THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER
1. ALL NUCLIDES					
ALPHA	CURIES	0.00E+00	0.00E+00	1.43E-03	9.71E-03
H-3	CURIES	0.00E+00	0.00E+00	1.50E+02	2.44E+02
XE-133	CURIES	0.00E+00	0.00E+00	8.74E-04	2.25E-03
XE-135	CURIES	0.00E+00	0.00E+00	2.08E-05	1.62E-04
CO-60	CURIES	0.00E+00	0.00E+00	2.52E-04	2.30E-04
CS-137	CURIES	0.00E+00	0.00E+00	1.45E-04	1.21E-05
XE-131M	CURIES	0.00E+00	0.00E+00	1.69E-04	0.00E+00
CS-134	CURIES	0.00E+00	0.00E+00	9.02E-06	8.84E-06
CE-144	CURIES	0.00E+00	0.00E+00	3.04E-05	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	3.28E-05	1.65E-05
PR-144	CURIES	0.00E+00	0.00E+00	3.04E-05	0.00E+00
CO-58	CURIES	0.00E+00	0.00E+00	1.56E-04	7.64E-04
NB-95	CURIES	0.00E+00	0.00E+00	2.39E-05	0.00E+00
ZR-95	CURIES	0.00E+00	0.00E+00	6.16E-06	0.00E+00
RU-106	CURIES	0.00E+00	0.00E+00	2.24E-05	0.00E+00
SN-113	CURIES	0.00E+00	0.00E+00	0.00E+00	2.50E-06
RU-103	CURIES	0.00E+00	0.00E+00	0.00E+00	2.76E-06
SB-125	CURIES	0.00E+00	0.00E+00	7.39E-06	0.00E+00
TC-99M	CURIES	0.00E+00	0.00E+00	0.00E+00	2.17E-06
TC-101	CURIES	0.00E+00	0.00E+00	1.46E-04	0.00E+00
HF-181	CURIES	0.00E+00	0.00E+00	2.23E-06	0.00E+00
CO-57	CURIES	0.00E+00	0.00E+00	0.00E+00	3.33E-06
TOTALS FOR PERIOD	CURIES	0.00E+00	0.00E+00	1.50E+02	2.44E+02

TABLE 3
SOLID WASTE & IRRADIATED FUEL SHIPMENTS
1995

A. SOLID WASTE BURIED (DOES NOT INCLUDE IRRADIATED FUEL)

1. TYPE OF WASTE	UNITS	PERIOD	PERIOD	EST. TOTAL ERROR (%)
		JAN - JUN	JUL - DEC	
a. Spent resins, filter sludges evaporator bottoms, etc.	m ³	0.0	11.3	±25%
	Ci	0.00E+00	1.77E+02	
b. Dry compressible waste, contaminated equipment, etc.	m ³	0.0	7.1	±25%
	Ci	0.00E+00	9.31E-02	
c. Irradiated components, control rods, etc.	m ³	0.0	0.0	±25%
	Ci	0.00E+00	0.00E+00	
d. Other	m ³	0.0	0.0	±25%
	Ci	0.00E+00	0.00E+00	

2. ESTIMATE OF MAJOR NUCLIDE COMPOSITION (by Type of Waste)

Nuclide	PERIOD JAN - JUN		PERIOD JUL - DEC	
	Percent Abundance	Curies	Percent Abundance	Curies
a. Co-60			33.73%	5.97E+01
Ni-63			32.43%	5.74E+01
Cs-137			13.56%	2.40E+01
Fe-55			8.11%	1.44E+01
Cs-134			8.01%	1.42E+01
Sb-125			1.23%	2.18E+00
b. Fe-55			46.94%	4.37E-02
Co-60			14.67%	1.37E-02
Ni-63			11.05%	1.03E-02
Co-58			10.19%	9.49E-03
Mn-54			5.11%	4.76E-03
Cr-51			4.42%	4.12E-03
Nb-95			2.27%	2.11E-03
Cs-137			1.76%	1.64E-03
Sb-125			1.59%	1.48E-03
Zr-95			1.04%	9.68E-04
c.				
d.				

TABLE 3 (continued)
SOLID WASTE & IRRADIATED FUEL SHIPMENTS
 1995

3. SOLID WASTE DISPOSITION:

Number of Shipments	Mode of Transportation	Destination	Class of Solid Waste Shipped	Type of Container
10*	Truck	Scientific Ecology Group	A	LSA
1*	Truck	American Ecology	A	LSA
* Above shipments sent to waste reprocessors for volume reduction before burial.				
2	Cask	Barnwell, SC	C	LSA

4. SOLIDIFICATION AGENT:

None used.

B. IRRADIATED FUEL SHIPMENTS (DISPOSITION)

Number of Shipments	Mode of Transportation	Destination

TABLE 4

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:19.83

Meteorological Data
Averages Using Hourly Averaged Data

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

		UNITS	VALUES	% GOOD DATA
Stability Class		A - G	E	98%
Total Precipitation		CM.	1.80E+02	90%
10 Meter Level:	Wind Speed	Meter/Sec	3.31E+00	100%
	Wind Direction	Degrees	2.23E+02	96%
	Wind Direction Variability	Degrees	1.27E+01	96%
	Reference Temperature	Degrees C	1.23E+01	98%
	Dewpoint	Degrees C	4.85E+00	99%
60 Meter Level:	Wind Speed	Meter/Sec	5.17E+00	97%
	Wind Direction	Degrees	2.15E+02	96%
	Wind Direction Variability	Degrees	8.53E+00	98%
	Dewpoint	Degrees C	NONE	0%
	Temperature Difference 60 - 10	Degrees C	2.83E-01	98%

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:42.00

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: A

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	3	2	0	0	0	5
NNE	0	1	1	0	0	0	2
NE	0	0	0	0	0	0	0
ENE	1	0	0	0	0	0	1
E	1	1	0	0	0	0	2
ESE	0	4	4	0	0	0	8
SE	1	19	7	1	0	0	28
SSE	0	21	10	4	0	0	35
S	0	29	18	2	2	0	51
SSW	1	40	25	4	0	0	70
SW	1	22	15	1	0	0	39
WSW	1	3	3	0	0	0	7
W	0	1	13	3	0	0	17
WNW	1	2	6	4	0	0	13
NW	0	2	4	0	0	0	6
NNW	1	1	0	0	0	0	2
TOT	8	149	108	19	2	0	286

Hours of Calm Data: 0
Hours of Invalid Data: 22

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:42.00

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: B

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	1	7	0	0	0	8
NNE	0	2	1	0	0	0	3
NE	0	2	0	2	0	0	4
ENE	0	0	0	0	0	0	0
E	0	3	2	0	0	0	5
ESE	0	5	8	1	0	0	14
SE	0	8	18	2	0	0	28
SSE	0	15	12	3	2	0	32
S	1	15	16	10	0	0	42
SSW	2	9	10	1	0	0	22
SW	1	15	11	2	0	0	29
WSW	0	6	3	0	0	0	9
W	2	7	7	3	0	0	19
WNW	2	8	22	5	0	0	37
NW	0	5	9	0	0	0	14
NNW	1	0	3	0	0	0	4
TOT	9	101	129	29	2	0	270

Hours of Calm Data: 0
Hours of Invalid Data: 20

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:42.00

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: C

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	9	16	0	0	0	26
NNE	1	14	4	2	0	0	21
NE	2	5	1	1	0	0	9
ENE	1	5	2	0	0	0	8
E	0	8	3	0	0	0	11
ESE	1	5	8	5	0	0	19
SE	2	12	12	2	1	0	29
SSE	4	8	12	1	0	0	25
S	3	14	19	6	1	0	43
SSW	2	13	9	4	0	0	28
SW	1	15	5	1	0	0	22
WSW	0	10	6	3	0	0	19
W	0	7	7	7	1	0	22
WNW	2	13	3	3	1	0	22
NW	1	11	11	3	0	0	26
NNW	1	7	18	0	0	0	26
TOT	22	156	136	38	4	0	356

Hours of Calm Data: 0
Hours of Invalid Data: 28

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:42.00

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: D

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	9	56	63	7	1	0	136
NNE	5	45	32	1	0	0	83
NE	14	29	20	2	0	0	65
ENE	5	26	23	6	0	0	60
E	5	26	34	9	0	0	74
ESE	2	30	41	8	0	0	81
SE	16	59	84	13	1	0	173
SSE	11	57	67	11	1	0	147
S	11	49	49	22	1	0	132
SSW	7	39	40	13	1	1	101
SW	14	38	31	22	2	2	109
WSW	6	29	27	14	5	3	84
W	13	48	42	30	5	0	138
WNW	11	46	68	37	5	0	167
NW	11	71	73	36	2	0	193
NNW	10	81	85	11	6	0	193
TOT	150	729	779	242	30	6	1936

Hours of Calm Data:
Hours of Invalid Data:

1
68

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:42.00

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: E

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	28	102	112	18	0	0	260
NNE	21	99	39	1	0	0	160
NE	39	50	15	0	0	0	104
ENE	28	66	26	1	0	0	121
E	27	111	47	4	0	0	189
ESE	30	102	74	8	0	0	214
SE	20	149	164	11	0	0	344
SSE	23	126	142	26	0	0	317
S	31	79	99	27	3	0	239
SSW	19	62	41	10	0	0	132
SW	19	52	49	8	3	0	131
WSW	27	56	44	10	7	0	144
W	32	94	88	12	0	0	226
WNW	31	104	91	14	0	0	240
NW	46	131	93	53	1	0	324
NNW	27	140	119	22	2	0	310
TOT	448	1523	1243	225	16	0	3455

Hours of Calm Data: 13
Hours of Invalid Data: 65

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:42.00

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: F

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	22	34	0	5	3	0	64
NNE	29	39	4	3	4	0	79
NE	38	24	4	0	0	0	66
ENE	48	35	2	0	0	0	85
E	26	25	2	0	0	0	53
ESE	30	43	2	0	0	0	75
SE	38	141	26	0	0	0	205
SSE	35	153	38	0	0	0	226
S	27	86	35	0	0	0	148
SSW	31	47	11	0	0	0	89
SW	15	41	9	0	0	0	65
WSW	16	15	6	0	0	0	37
W	26	28	17	0	0	0	71
WNW	34	33	12	0	0	0	79
NW	20	59	5	8	4	0	96
NNW	15	37	5	4	2	0	63
TOT	450	840	178	20	13	0	1501

Hours of Calm Data: 15
Hours of Invalid Data: 60

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:42.00

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: G

	Wind Speed at 10.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	17	15	1	1	1	0	35
NNE	17	21	8	2	0	0	48
NE	33	5	2	0	0	0	40
ENE	23	7	0	0	0	0	30
E	9	2	0	0	0	0	11
ESE	14	1	0	0	0	0	15
SE	15	31	5	0	0	0	51
SSE	22	61	18	0	0	0	101
S	12	20	8	0	0	0	40
SSW	13	13	1	0	0	0	27
SW	16	21	2	0	0	0	39
WSW	8	1	3	0	0	0	12
W	14	5	7	2	0	0	28
WNW	13	8	0	0	0	0	21
NW	11	21	0	6	2	0	40
NNW	13	16	2	3	7	0	41
TOT	250	248	57	14	10	0	579

Hours of Calm Data:

21

Hours of Invalid Data:

36

Hours of Good Data:

8433 = 96.3% of Total Hours

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:58.47

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: A

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	1	1	4	0	0	0	6
NNE	0	1	1	0	0	0	2
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	1	0	0	0	0	1
ESE	0	3	1	2	0	0	6
SE	0	8	16	4	0	0	28
SSE	0	11	18	3	0	0	32
S	0	18	23	14	1	2	58
SSW	0	19	48	8	0	0	75
SW	0	5	36	6	1	0	48
WSW	0	3	3	1	0	0	7
W	0	1	9	5	3	0	18
WNW	0	0	5	5	3	0	13
NW	0	0	4	3	0	0	7
NNW	0	0	0	0	0	0	0
TOT	1	71	168	51	8	2	301

Hours of Calm Data: 0
Hours of Invalid Data: 7

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:58.47

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: B

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	0	7	0	0	0	7
NNE	0	1	2	0	0	0	3
NE	0	1	0	2	0	0	3
ENE	0	2	0	0	0	0	2
E	0	1	1	0	0	0	2
ESE	0	3	13	2	1	0	19
SE	0	6	14	5	0	0	25
SSE	0	10	14	8	4	0	36
S	1	9	14	10	7	1	42
SSW	1	8	17	5	1	0	32
SW	0	7	16	6	1	0	30
WSW	0	9	4	2	0	0	15
W	0	6	8	4	3	0	21
WNW	0	5	10	14	2	1	32
NW	1	1	9	4	0	0	15
NNW	0	0	4	0	0	0	4
TOT	3	69	133	62	19	2	288

Hours of Calm Data: 0
Hours of Invalid Data: 2

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:58.47

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: C

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	2	17	0	0	0	19
NNE	1	10	13	2	0	0	26
NE	0	5	2	1	0	0	8
ENE	2	5	2	1	0	0	10
E	0	7	2	1	0	0	10
ESE	0	3	13	5	1	0	22
SE	0	12	13	3	2	0	30
SSE	2	11	12	3	0	0	28
S	0	16	19	10	3	1	49
SSW	2	8	10	3	4	0	27
SW	0	13	13	3	2	0	31
WSW	0	5	4	3	2	1	15
W	0	3	10	5	4	2	24
WNW	1	9	4	4	2	1	21
NW	0	11	9	8	1	0	29
NNW	3	4	14	5	2	0	28
TOT	11	124	157	57	23	5	377

Hours of Calm Data: 0
Hours of Invalid Data: 7

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:58.47

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: D

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	2	24	72	23	2	6	129
NNE	2	32	47	11	0	0	92
NE	6	34	21	12	2	0	75
ENE	5	14	23	12	3	0	57
E	4	12	32	19	0	0	67
ESE	2	25	44	14	3	0	88
SE	8	30	59	47	2	1	147
SSE	4	38	67	36	6	1	152
S	3	36	56	38	11	3	147
SSW	1	26	41	25	8	2	103
SW	3	30	38	26	15	10	122
WSW	3	19	21	21	11	12	87
W	9	22	32	34	19	11	127
WNW	4	21	51	46	27	8	157
NW	4	36	79	49	22	7	197
NNW	3	44	74	29	6	0	156
TOT	63	443	757	442	137	61	1903

Hours of Calm Data:
Hours of Invalid Data:

1
101

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:58.47

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: E

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	6	42	125	78	10	0	261
NNE	8	44	100	31	0	0	183
NE	8	41	64	5	0	0	118
ENE	5	30	68	14	1	0	118
E	9	43	85	23	3	0	163
ESE	6	49	120	45	3	0	223
SE	4	26	129	128	5	1	293
SSE	7	25	125	138	29	0	324
S	3	27	105	111	22	3	271
SSW	8	35	64	58	13	0	178
SW	4	31	44	50	17	4	150
WSW	8	22	46	42	9	8	135
W	6	22	61	90	17	2	198
WNW	0	24	89	95	13	1	222
NW	4	37	122	103	40	9	315
NNW	2	42	134	86	14	0	278
TOT	88	540	1481	1097	196	28	3430

Hours of Calm Data:
Hours of Invalid Data:

0
103

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:58.47

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: F

Wind Speed at 60.00 Meter Level (MPH)

	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	5	4	18	16	5	5	53
NNE	2	14	30	12	4	2	64
NE	3	17	45	1	1	2	69
ENE	0	9	41	6	0	0	56
E	0	18	60	14	0	0	92
ESE	0	18	77	8	0	0	103
SE	1	17	91	35	0	0	144
SSE	0	19	103	66	1	0	189
S	2	26	112	61	0	0	201
SSW	1	10	54	64	0	0	129
SW	3	12	35	37	9	0	96
WSW	3	11	22	5	3	0	44
W	1	8	24	28	0	0	61
WNW	3	9	32	21	2	0	67
NW	4	12	30	16	6	0	68
NNW	4	9	40	33	2	0	88
TOT	32	213	814	423	33	9	1524

Hours of Calm Data: 0
Hours of Invalid Data: 52

TABLE 4 (continued)

Union Electric - Callaway Plant

Report Date/Time: 26-APR-1996 10:47:58.47

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-1995 00:00:00.00 to 31-DEC-1995 23:00:00.00

Stability Class: G

	Wind Speed at 60.00 Meter Level (MPH)						TOTAL
	1-3	4-7	8-12	13-18	19-24	>24	
N	0	4	7	9	1	2	23
NNE	0	6	10	7	0	0	23
NE	0	9	31	7	0	0	47
ENE	0	6	23	11	0	0	40
E	0	3	36	3	0	0	42
ESE	0	4	16	1	0	0	21
SE	0	6	13	5	0	0	24
SSE	1	11	12	19	0	0	43
S	0	11	51	14	0	0	76
SSW	1	10	27	18	5	0	61
SW	0	9	24	14	1	0	48
WSW	0	6	7	5	0	0	18
W	0	3	8	7	6	0	24
WNW	0	5	14	3	0	0	22
NW	1	2	7	5	5	2	22
NNW	0	7	10	15	0	10	42
TOT	3	102	296	143	18	14	576

Hours of Calm Data: 0
 Hours of Invalid Data: 60
 Hours of Good Data: 8400 = 95.9% of Total Hours

TABLE 5

DOSE AT THE SITE BOUNDARY AND TO THE NEAREST RESIDENT
FROM GASEOUS EFFLUENTS

ORGAN	UNITS	SITE BOUNDARY		NEAREST RESIDENT	
		LOCATION: 1.40 km SSE		LOCATION: 1900.00 km WSW	
		AGE GROUP: CHILD		AGE GROUP: CHILD	
		DOSE	% LIMIT(a)	DOSE	% LIMIT(b)
1. GAMMA AIR DOSE *	MRAD	1.06E-03	0.01	7.65E-04	N/A
2. BETA AIR DOSE *	MRAD	1.78E-03	0.01	1.28E-03	N/A
3. WHOLE BODY ***	MREM	2.51E-03	N/A	1.31E-03	N/A
4. SKIN ***	MREM	3.56E-03	N/A	2.07E-03	N/A
5. BONE **	MREM	1.55E-03	N/A	2.58E-03	0.02
6. LIVER **	MREM	4.18E-03	N/A	1.96E-02	0.13
7. TOTAL BODY **	MREM	4.18E-03	N/A	1.79E-02	0.12
8. THYROID **	MREM	4.22E-03	N/A	2.04E-02	0.14
9. KIDNEY **	MREM	4.18E-03	N/A	1.82E-02	0.12
10. LUNG **	MREM	4.26E-03	N/A	1.78E-02	0.12
11. GI-LLI **	MREM	4.18E-03	N/A	1.77E-02	0.12

* Dose from Noble Gases only

** Dose from Tritium, Radioiodines, and Particulates only

*** Dose from Noble Gases plus Ground Plane dose

(a) Annual dose limits of Offsite Dose Calculation Manual (APA-ZZ-01003)
of 10 mrad gamma air dose and 20 mrad beta air dose.

(b) Annual dose limits of Offsite Dose Calculation Manual (APA-ZZ-01003)
of 15 mrem to any organ from I-131, I-133, H-3 and particulate
radionuclides with half-lives greater than 8 days.

TABLE 6

DOSE TO THE MEMBER OF THE PUBLIC FROM ACTIVITIES
WITHIN THE SITE BOUNDARY

ORGAN	UNITS	EFFLUENT DOSE WITHIN THE SITE BOUNDARY	DIRECT RADIATION FROM THE UNIT	DIRECT RADIATION FROM OUTSIDE TANKS	TOTAL DOSE FOR THE YEAR
1. SKIN	MREM	5.00E-04	N/A	N/A	5.00E-04
2. BONE	MREM	5.94E-02	8.79E-03	2.85E-04	6.84E-02
3. LIVER	MREM	6.02E-02	8.79E-03	2.85E-04	6.93E-02
4. TOTAL BODY	MREM	6.04E-02	8.79E-03	2.85E-04	6.95E-02
5. THYROID	MREM	6.02E-02	8.79E-03	2.85E-04	6.93E-02
6. KIDNEY	MREM	6.02E-02	8.79E-03	2.85E-04	6.93E-02
7. LUNG	MREM	6.02E-02	8.79E-03	2.85E-04	6.93E-02
8. GI-LLI	MREM	6.02E-02	8.79E-03	2.85E-04	6.93E-02

TABLE 7

TOTAL DOSE DUE TO THE URANIUM FUEL CYCLE
(MEMBER OF THE PUBLIC)

ORGAN	UNITS	DOSE AT THE RESIDENCE LOCATION	DOSE FROM ACTIVITIES WITHIN SITE BOUNDARY	TOTAL DOSE TO THE MEMBER OF THE PUBLIC	% LIMITS *
1. SKIN	MREM	6.36E-04	5.00E-04	1.14E-03	0.00
2. BONE	MREM	7.88E-04	6.84E-02	6.92E-02	0.28
3. LIVER	MREM	5.22E-03	6.93E-02	7.45E-02	0.30
4. TOTAL BODY	MREM	5.38E-03	6.95E-02	7.49E-02	0.30
5. THYROID	MREM	5.39E-03	6.93E-02	7.47E-02	0.10
6. KIDNEY	MREM	4.86E-03	6.93E-02	7.41E-02	0.30
7. LUNG	MREM	4.75E-03	6.93E-02	7.41E-02	0.30
8. GI-LLI	MREM	4.95E-03	6.93E-02	7.42E-02	0.30

* Annual dose limits from 40CFR190.10(a) of 25 mrem whole body, 75 mrem to the thyroid, and 25 mrem to any other organ.

TABLE 8

DOSE DUE TO LIQUID EFFLUENTS
(MEMBER OF THE PUBLIC)

1995

ORGAN	UNITS	DOSE **	LIMIT *	% LIMIT
1. BONE	MREM	7.96E-03	10.00	7.96E-02
2. LIVER	MREM	2.00E-02	10.00	2.00E-01
3. TOTAL BODY	MREM	1.74E-02	3.00	5.80E-01
4. THYROID	MREM	1.09E-02	10.00	1.09E-01
5. KIDNEY	MREM	1.40E-02	10.00	1.40E-01
6. LUNG	MREM	1.19E-02	10.00	1.19E-01
7. GI-LLI	MREM	1.98E-02	10.00	1.98E-01

* Annual dose limits of APA-ZZ-01003, Section 9.4.1.1.

** Reported dose includes the dose from the Logan Creek event

ATTACHMENT 1

APA-ZZ-01003, OFFSITE DOSE CALCULATION MANUAL, REVISION 5