AmerenUE
Callaway Plant

PO Box 620
Fulton, MO 65251

April 23, 2007

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

Ladies and Gentlemen: ULNRC-05401

DOCKET NUMBER 50-483
CALLAWAY PLANT UNIT 1
UNION ELECTRIC CO.
FACILITY OPERATING LICENSE NPF-30
2006 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Please find enclosed the 2006 Annual Radioactive Effluent Release Report for the Callaway Plant and the Offsite Dose Calculation Manual – Radioactive Effluent Controls (FSAR Section 16.11). These documents are submitted in accordance with Sections 5.6.3 and 5.5.1 of the Technical Specifications.

Very truly yours,

David T. Fitzgerald
Manager, Regulatory Affairs

DJW/tdp

Attachments: 1. Annual Radioactive Effluent Release Report
2. Offsite Dose Calculation Manual – Radioactive Effluent Controls (FSAR Section 16.11)

IE48
A009

cc: U.S. Nuclear Regulatory Commission (Original and 1 copy)
Attn: Document Control Desk
Mail Stop P1-137
Washington, DC 20555-0001

Mr. Bruce S. Mallett
Regional Administrator
U.S. Nuclear Regulatory Commission
Region IV
611 Ryan Plaza Drive, Suite 400
Arlington, TX 76011-4005

Senior Resident Inspector
Callaway Resident Office
U.S. Nuclear Regulatory Commission
8201 NRC Road
Steedman, MO 65077

Mr. Jack N. Donohew (2 copies)
Licensing Project Manager, Callaway Plant
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Mail Stop O7-D1
Washington, DC 20555-2738

Manager, Electric Department
Missouri Public Service Commission
PO Box 360
Jefferson City, MO 65102-0360

Mr. Edward Everett
ANI Account Engineer
95 Glastonbury
Glastonbury, CT 06033

Regional Administrator
Department of Natural Resources
Central Regional Office
P.O. Box 176
Jefferson City, MO 65102-0176

bcc: C. D. Naslund (w/o)
A. C. Heflin (w/o)
D. T. Fitzgerald (w/o)
G. A. Hughes (w/a)
D. E. Shafer (w/a) (470) (2 copies)
S. L. Gallagher (w/o) (100)
L. M. Belsky (w/a) (NSRB)
B. F. Holderness (w/a)
R. E. Farnam
J. R. Pozzo
H. A. Osborn (w/a)
D. J. Walker (w/a)
A160.0761

Certrec Corporation
4200 South Hulen, Suite 422
Fort Worth, TX 76109

(Certrec receives ALL attachments as long as they are non-safeguards and public disclosed).

Send the following without attachments:

Ms. Diane M. Hooper
Supervisor, Licensing
WCNOC
P.O. Box 411
Burlington, KS 66839

Mr. Dennis Buschbaum
TXU Power
Comanche Peak SES
P.O. Box 1002
Glen Rose, TX 76043

Mr. Scott Bauer
Regulatory Affairs
Palo Verde NGS
P.O. Box 52034,
Mail Station 7636
Phoenix, AZ 85072-2034

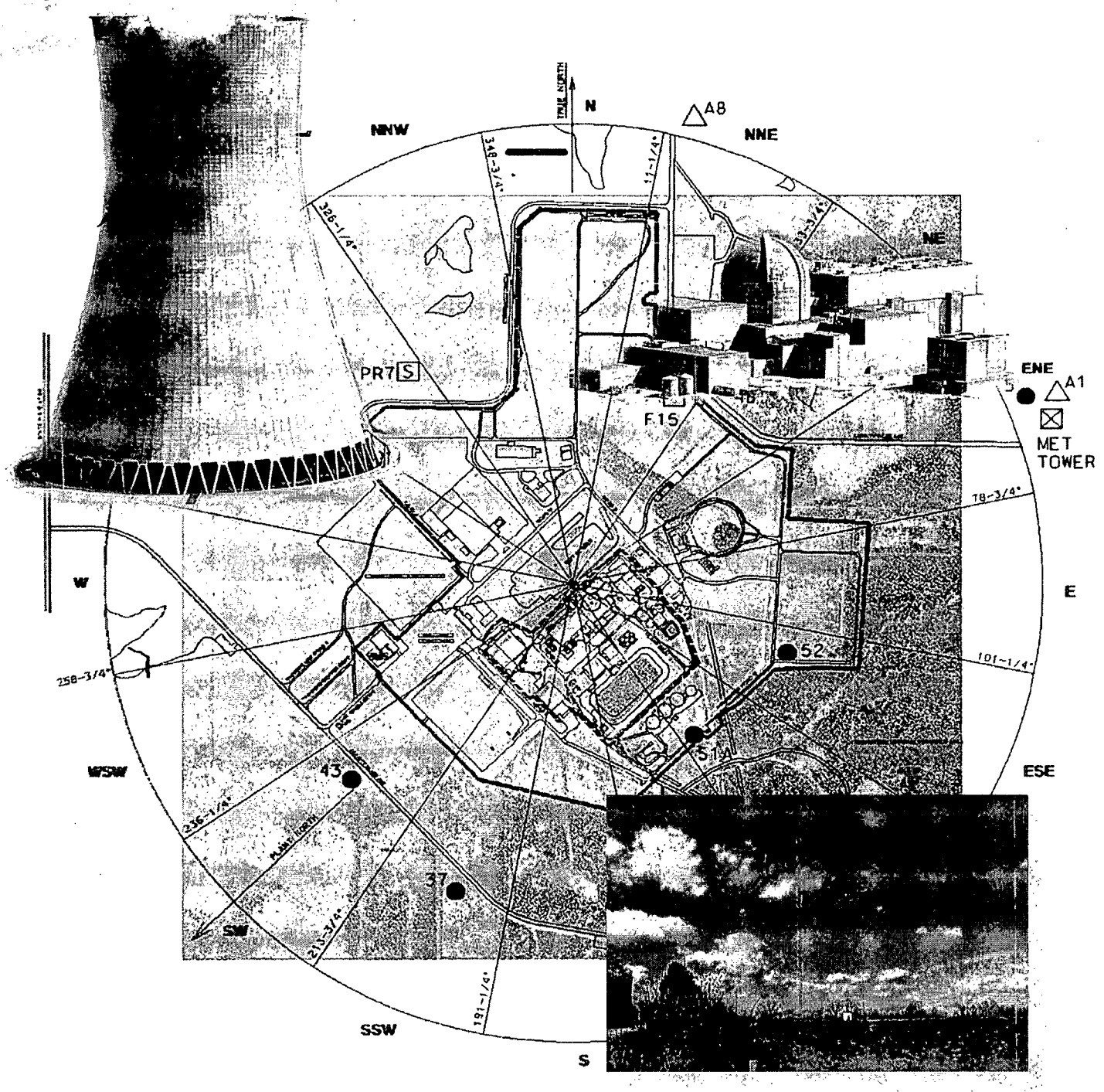
Mr. Stan Ketelsen
Manager, Regulatory Services
Pacific Gas & Electric
Mail Stop 104/5/536
P.O. Box 56
Avila Beach, CA 93424

Mr. Scott Head
Supervisor, Licensing
South Texas Project NOC
Mail Code N5014
P.O. Box 289
Wadsworth, TX 77483

Mr. John O'Neill
Pillsbury Winthrop Shaw Pittman LLP
2300 N. Street N.W.
Washington, DC 20037

2006 Callaway Plant

Radioactive Effluent Release Report



Docket no. 50-483

Table of Contents

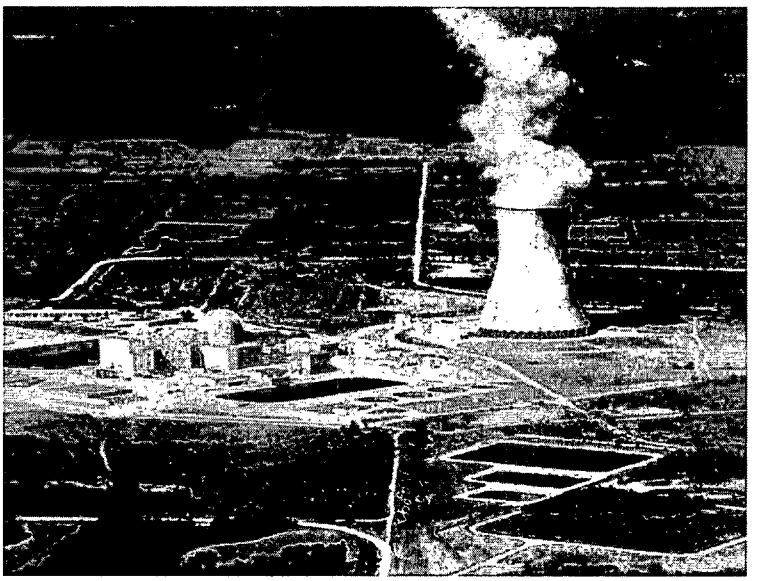
List of Tables

1.0 Introduction

This report describes the Union Electric Co. Callaway Plant radioactive effluent releases for 2006. It is submitted in accordance with Section 5.6.3 of the Callaway Plant Technical Specifications.

A summary of radioactivity released in liquid and gaseous effluents and solid waste shipped from the Callaway Plant during the period from January 1, 2006 to December 31, 2006 is presented.

All liquid and gaseous effluents discharged during this reporting period complied with federal regulations and the limits in the Offsite Dose Calculation Manual (ODCM). Any exceptions are noted in this report.



2.0 Supplemental Information

2.1 Regulatory Limits

The Radioactive Effluent Control (REC) limits applicable to the release of radioactive material in liquid and gaseous effluents are provided below.

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.

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.

Liquid Effluent

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to ten times the concentrations specified in Appendix B, Table 2, Column 2 of 10CFR20 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.

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 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.

2.3 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 Final Safety Analysis Report Table 16.11-1 and Table 16.11-4.

Gamma spectroscopy was the primary analysis technique used to determine the radionuclide composition and concentration of liquid and gaseous effluents. Liquid composite samples were analyzed for Sr-89, Sr-90, Fe-55, Ni-63, and transuranic nuclides by Environmental Inc. - Midwest Laboratory (EIML). Gaseous composite samples were analyzed for Sr-89, Sr-90, and Fe-55 by EIML. 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.

2.4 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.

LIQUID

	UNITS	JAN-JUN	JUL-DEC
Number of batch releases:	——	24	33
Total time period for batch releases:	Minutes	11,913	13,785
Maximum time period for batch releases:	Minutes	1,192	564
Average time period for batch releases:	Minutes	496	418
Minimum time period for batch releases:	Minutes	365	168
Average Missouri River flow during periods of effluent release to the river[1] :	ft^3/sec	44,446	37,174

GASEOUS

	UNITS	JAN - JUN	JUL - DEC
Number of batch releases:	——	32	40
Total time period for batch releases:	Minutes	2,354	3,404
Maximum time period for batch releases:	Minutes	644	628
Average time period for batch releases:	Minutes	74	85
Minimum time period for batch releases:	Minutes	29	35

[1] E-mail, S. Ternes, United States Department of the Interior - Geological Survey - Water Resources Division dated January 2007

2.5 Abnormal Releases

LIQUID

Number of releases: 0

Total Activity released: 0 Curies

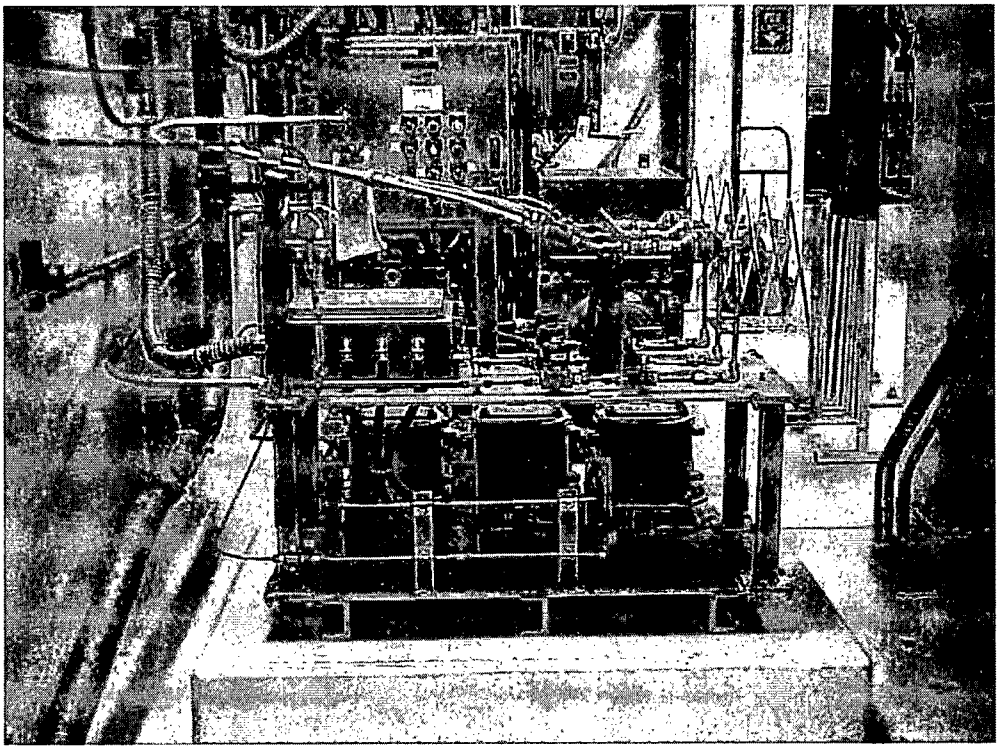
GASEOUS

Number of releases: 0

Total Activity released: 0 Curies

3.0 Summary of Gaseous Radioactive Effluents

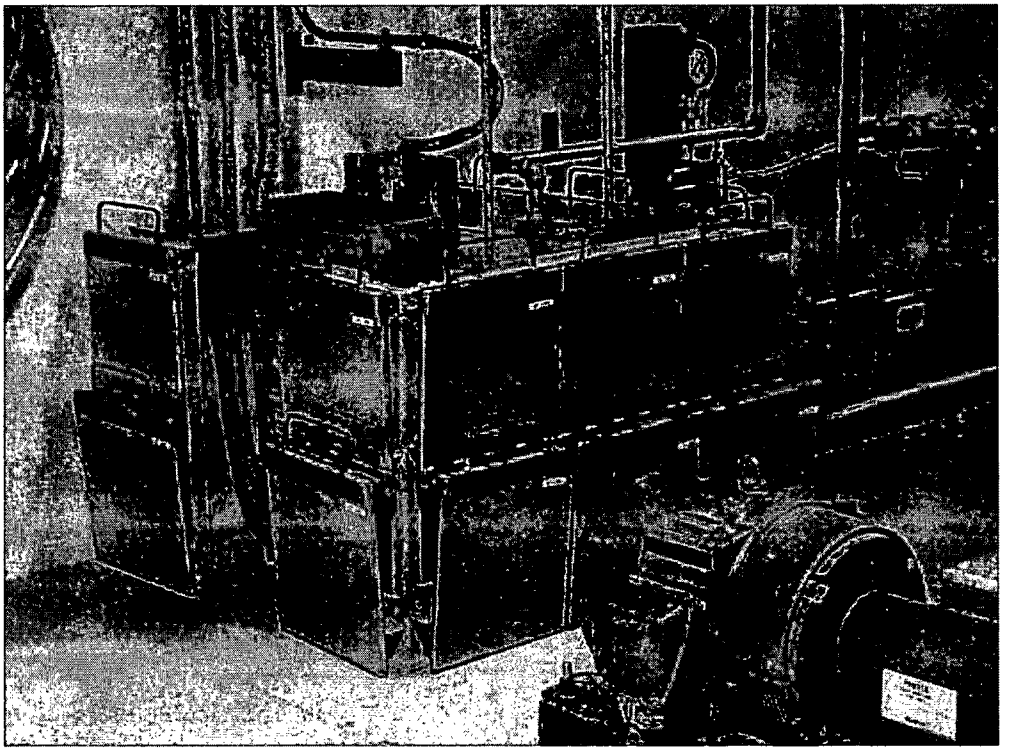
The quantity of radioactive material released in gaseous effluents during the year is summarized in Tables 1A and 1B. During 2006, all gaseous effluents were considered as ground level releases. The one exception being low level releases of tritium from the cooling tower.



Gaseous effluents from the plant are continuously monitored. Instrumentation provides on-line and grab sampling for iodine, particulates and noble gas.

4.0 Summary of Liquid Radioactive Effluents

The quantity of radioactive material released in liquid effluents during the year is summarized in Tables 2A and 2B. During 2006, there was no continuous release of liquid effluent from the plant.



Liquid effluents from the plant are continuously monitored. Shown is a liquid radiation monitor shielded by lead to increase its sensitivity for sampling discharged water.

5.0 Solid Wastes

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 includes wastes buried by waste reprocesses 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.

3) Releases which are conducted in such a manner as to result in significant deviation from the requirements of the release permit.

There were no unplanned releases from Callaway Plant during 2006.

6.2 Changes to the Offsite Dose Calculation Manual

No changes were made to the Callaway Offsite Dose Calculation Manual (ODCM - Callaway plant procedure APA-ZZ-01003) in 2006.

A couple of minor changes were made to Final Safety Analysis Report - Standard Plant (FSAR - SP) Chapter 16.11, Offsite Dose Calculation Manual - Radioactive Effluent Controls (ODCM-RECs) in 2006. FSAR-SP Change Notice 05-006 added Co-60 to Table 16.11.1 Note 3.

FSAR-SP Change Notice 05-004 removed monthly particulate and iodine sampling requirements for the Unit Vent and Radwaste Vent since these are performed weekly.

FSAR-SP Change Notice 05-013 added a statement to FSAR-SP Chapter 16.11.2.8.2 to further describe the origin and bases for Xe-133 equivalent.

6.3 Major Changes to Radwaste Systems

During 2006, there were no major changes to Radwaste systems:

6.4 Land Use Census Changes

No changes were identified that required a change to the location of the nearest resident yielding the highest calculated dose commitment.

6.5 Inoperability of Effluent Monitoring Instrumentation

During 2006 all effluent monitoring instrumentation was OPERABLE, except for following instances, within the limits specified in Radioactive Effluent Controls 16.11.1.3 and 16.11.2.4.

While performing a retest on SP01 on 4/21/06, Unit Vent monitor GT-RE-21B stopped while GT-RE-21A went into accident isolate mode at 17:10. GT-RE-21A was restarted and resumed particulate and iodine sampling at 17:21. This resulted in a period of 11 minutes where particulate and iodine samples were not collected from the Unit Vent. Unit Vent monitor GT-RE-21B was repaired and returned to service later that evening at 18:24. Grab samples were taken per the ODCM-RECs due to the loss of noble gas channels on the Unit Vent (CAR 200603178).

On 11/23 the Unit Vent monitor GT-RE-21A went to accident isolate due to failure of the microprocessor. This resulted in a period of 14 minutes where particulate and iodine samples were not collected from the Unit Vent (CAR 200609685).

An ODCM-REC required Unit Vent grab sample was missed on 6/1/06. During performance of scheduled maintenance on Unit Vent monitor, a grab sample should have been collected at 03:22 on 6/1/06 as per FSAR-SP 16.11.2.4. The missed sample was discovered during shift turnover and taken at 06:30 on 6/1/06 (CAR 200604338).

6.6 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 Radioactive Effluent Controls 16.11.1 and 16.11.2 during 2006.

7.0 Meteorological Data

2006 Data Capture

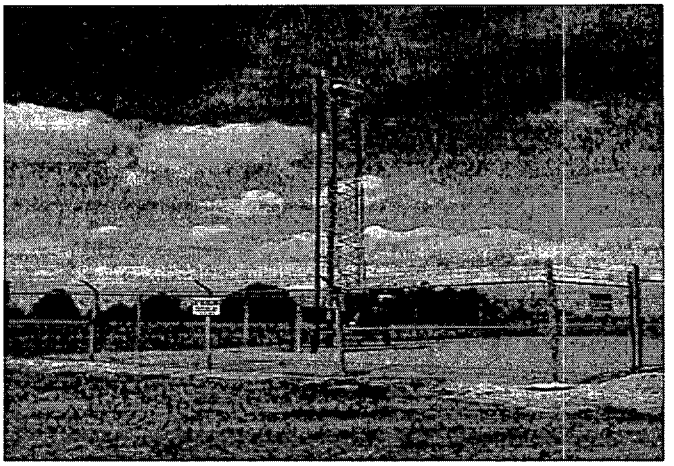
The on-site meteorological data for 2006 is presented as Cumulative Joint Frequency Distributions of wind speed and wind direction by atmospheric stability class for the 10 and 60 meter tower elevations.

In a continuing effort to reduce instrument downtime, additional safeguards were put in place during 2006 to more quickly discover instrument problems in the network and minimize downtime. The contract meteorologist accessed the raw 5sec data stream each day and evaluated the performance of each instrument over the most recent 24 hour period. Any noted problems were immediately communicated to the systems engineer who rapidly initiated mitigating or corrective actions.

Subsequently, the 15min averaged meteorological data for each individual day of the year were statistically and graphically reviewed, analyzed, and validated by a boundary layer meteorologist. Following validation, the 15 minute data were used to calculate the hourly averages needed for model input.

Valid data recovery for 2006 was greater than 97% for all required parameters which is indicative of the success of the additional quality functions initiated in the past 2 years following earlier program problems. Specific valid recovery rates for the year are listed below:

60m WS	98.0%
60m WD	97.7%
60m sigma-theta	99.2%
60m-10m delta-T	98.4%
10m WS	99.2%
10m WD	99.2%
10m sigma-theta	99.2%
10m T	99.9%



Pictured is the Secondary Meteological Tower. This station obtains measurements at a height of 10 meters, and provides backup data for the Primary Meteological Tower readings at 10, 60 and 90 meters.

Severe Winter Storm

The biggest issue encountered during 2006 affecting valid data capture was a severe ice and snow storm from late November 29th through December 1st. Heavy rain on November 29th changed to freezing rain near midnight and continued through the night coating all of the wind sensors with ice. The steady freezing rain was followed by periods of mixtures of freezing rain, sleet, and heavy snow through about noon on December 2nd which added more than a foot of snow and sleet atop the initial accumulated ice on the ground.

Although all wind sensors had working heaters, the ice mass accumulations on the cups and vane bodies retarded the ability to accurately measure the winds. The instruments were declared out-of-service and the control room notified. Wind data were unreliable until ambient warming began melting the ice during the afternoon of December 2nd. All instruments were declared operational by 1500 on the 2nd except the 90m level sensors which did not shed ice loads until ~ 1100 CST on December 3rd.

Instrument Failures

Physical instrument failures were quite minimal and usually rectified quickly during the year. However, failure of the 90m wind speed on January 23rd could not be fixed until after the tower anchors were replaced in February. Other failures during the year included:

1. Failure of the primary tower 10m wind direction on May 10th which was repaired on May 12th (CAR 200603672).
2. Failure of the 60m wind speed on August 26th. The instrument was returned to service on August 30th.
3. The 90m dew point sensor failed on November 22nd with JOB 06122401 written to repair. Partially due to the weather delays, the data were not declared valid again until December 12th.

Communication Link Failures

Usually associated with momentary or short term power failures (and switching to backup power) the communications link was quite reliable through the year and data losses were insignificant.

90m WS Reduction

Although not a primary measurement, the 90m wind speed is occasionally affected by apparent mechanical interference. A tower related obstruction at the 90m level is reducing the measured wind speed (as determined by difference analysis with 60m shear layers) whenever the wind direction is near 45 degrees (effect maximized at 45 degrees and becomes undetectable at about 22 degrees and 57 degrees). All data obtained in the 22-57 degree sector were flagged and each block of affected 90m WS 15 minute averages was examined and the data invalidated when the apparent error reached 0.5 m/s.

Snowfall

The raingauge heater did not function properly so most snowfall was not recorded at the gauge as it fell, but rather as it melted. The periods of missing bucket tips (during snowfall) were carefully determined and the precipitation records flagged as invalid. Likewise data were removed when the snow was melting but being recorded as falling precipitation. The rain gauge is being replaced in early 2007.

Other 2006 MET Program Actions

Replacement of Primary Met Tower Anchors

An inspection of the tower anchors was performed by Tower Systems Inc. in late 2005. The initial results of the inspection indicated that there was some degradation of the anchor rods near the concrete slabs in which they were embedded. Replacement of the anchors was completed in February 2006.

8.0 Assessment of Doses

Assessment of doses to the maximum exposed individual from gaseous and liquid effluents released was performed in accordance with the ODCM as described in the following sections. For all liquid and airborne effluents released from the Callaway Plant during 2006, the annual dose to the maximum exposed individual was less than 1% of the Radioactive 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 that a hypothetical maximum exposed individual was present at the Site Boundary location with the most limiting atmospheric dispersion (based on actual meteorological conditions for the year). Dose was conservatively calculated using a child as the critical age group.

The dose from gaseous effluents at the Site Boundary for 2006 is presented in Table 5.

8.2 Dose to the Member of the Public

The Member of the Public is considered to be a real individual, not occupationally associated with the plant, who uses portions of the plant site for recreational or other purposes not associated with plant operation. This individual's utilization of areas both inside and outside the Site Boundary was characterized for this calculation and is described in the ODCM.

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 each evaluated.

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 actual 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 2006 are presented in Table 5.

Dose To The Member Of The Public From Activities Within The Site Boundary

Based on the 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 farmer estimates spending 1100 hours per year working within the Site Boundary area. Dose was calculated using the adult as the critical age group.

Dose to the Member of the Public for 2006 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 the Callaway Plant itself.

The total dose to the Member of the Public (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 conservatively assumed that each food ingestion pathway exists at his residence and that the adult is 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 includes contributions from the maximum exposed individual's consumption of fish and recreational activities. An adult was considered the maximum exposed individual in this assessment.

It is conservatively assumed that the hypothetical maximum exposed individual obtained his entire annual fish intake from near the plant discharge.

Table 1A Semiannual Summation of Gaseous Releases

All Airborne Effluents

TABLE 1A

SEMIANNUAL SUMMATION OF GASEOUS RELEASES
ALL AIRBORNE EFFLUENTS

QUARTERS 1 AND 2, 2006

TYPE OF EFFLUENT	UNITS	FIRST QUARTER	SECOND QUARTER	EST TOTAL ERROR % (a)
A. FISSION AND ACTIVATION GASES				
1. TOTAL RELEASE	CURIES	2.22E+00	1.37E-01	20
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	2.86E-01	1.74E-02	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	0.00E+00	0.00E+00	23
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	0.00E+00	0.00E+00	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
C. PARTICULATES				
1. PARTICULATE (HALF-LIVES > 8 DAYS)	CURIES	0.00E+00	7.34E-08	30
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	0.00E+00	9.33E-09	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
4. GROSS ALPHA RADIOACTIVITY	CURIES	2.18E-07	3.49E-07	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	5.00E+00	6.06E+00	14
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	6.43E-01	7.70E-01	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	

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

Table 1A Semiannual Summation of Gaseous Releases

All Airborne Effluents Continued

TABLE 1A

SEMIANNUAL SUMMATION OF GASEOUS RELEASES
ALL AIRBORNE EFFLUENTS

QUARTERS 3 AND 4, 2006

TYPE OF EFFLUENT	UNITS	THIRD QUARTER	FOURTH QUARTER	EST TOTAL ERROR % (a)
A. FISSION AND ACTIVATION GASES				
1. TOTAL RELEASE	CURIES	9.41E-01	1.85E-01	20
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	1.18E-01	2.32E-02	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
B. RADIOIODINES				
1. TOTAL IODINE-131	CURIES	0.00E+00	0.00E+00	23
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	0.00E+00	0.00E+00	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
C. PARTICULATES				
1. PARTICULATE (HALF-LIVES > 8 DAYS)	CURIES	0.00E+00	2.49E-05	30
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	0.00E+00	3.13E-06	
3. PERCENT OF TECH SPEC LIMIT	%	N/A	N/A	
4. GROSS ALPHA RADIOACTIVITY	CURIES	5.18E-07	5.53E-07	
D. TRITIUM				
1. TOTAL RELEASE	CURIES	1.13E+01	7.84E+00	14
2. AVERAGE RELEASE RATE FOR PERIOD	uCi/SEC	1.43E+00	9.87E-01	
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*

TABLE 1B

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

QUARTERS 1 AND 2, 2006

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNITS	FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER
1. FISSION GASES					
AR-41	CURIES	0.00E+00	0.00E+00	4.63E-02	3.88E-02
XE-133	CURIES	6.89E-02	9.70E-02	1.44E-03	9.69E-04
XE-135	CURIES	4.35E-02	0.00E+00	0.00E+00	0.00E+00
KR-85	CURIES	0.00E+00	0.00E+00	2.06E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	1.12E-01	9.70E-02	2.11E+00	3.97E-02
2. IODINES					
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. PARTICULATES					
CD-109	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	CURIES	0.00E+00	0.00E+00	0.00E+00	7.34E-08
ALPHA	CURIES	2.18E-07	3.49E-07	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	2.18E-07	3.49E-07	0.00E+00	7.34E-08
4. TRITIUM					
H-3	CURIES	4.67E+00	4.89E+00	3.28E-01	1.16E+00

Table 1B Semiannual Airborne Continuous and Batch Releases, Ground Level Releases

Fission Gases, Iodines, and Particulates

TABLE 1B

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

QUARTERS 3 AND 4, 2006

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNITS	THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER
1. FISSION GASES					
AR-41	CURIES	0.00E+00	0.00E+00	5.54E-02	8.64E-02
XE-133	CURIES	0.00E+00	0.00E+00	2.47E-03	2.98E-03
XE-135	CURIES	0.00E+00	1.58E-02	0.00E+00	0.00E+00
KR-85	CURIES	0.00E+00	0.00E+00	8.82E-01	0.00E+00
XE-131M	CURIES	0.00E+00	0.00E+00	1.02E-03	0.00E+00
XE-133M	CURIES	0.00E+00	7.94E-02	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	0.00E+00	9.52E-02	9.41E-01	8.93E-02
2. IODINES					
TOTAL FOR PERIOD	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. PARTICULATES					
CD-109	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
CO-60	CURIES	0.00E+00	0.00E+00	0.00E+00	2.46E-05
SB-125	CURIES	0.00E+00	2.53E-07	0.00E+00	0.00E+00
ALPHA	CURIES	5.18E-07	5.53E-07	0.00E+00	0.00E+00
TOTAL FOR PERIOD	CURIES	5.18E-07	8.06E-07	0.00E+00	2.46E-05
4. TRITIUM					
H-3	CURIES	1.05E+01	7.17E+00	8.09E-01	6.72E-01

Table 2A Semiannual Summation of Liquid Releases

All Liquid Effluents

TABLE 2A

SEMIANNUAL SUMMATION OF LIQUID RELEASES
ALL LIQUID EFFLUENTS

QUARTERS 1 AND 2, 2006

TYPE OF EFFLUENT	UNITS	FIRST QUARTER	SECOND QUARTER	EST TOTAL ERROR % (a)
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE [NOT INCLUDING TRITIUM, GASES, ALPHA]	CURIES	3.58E-03	9.00E-03	20
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	4.06E-08	4.79E-08	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	1.28E+01	3.08E+02	14
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.46E-04	1.64E-03	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	0.00E+00	2.96E-04	27
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	0.00E+00	1.57E-09	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	0.00E+00	1.83E-04	29
E. WASTE VOLUME RELEASED (PRE-DILUTION)	GAL	8.22E+05	1.34E+06	10
F. VOLUME OF DILUTION WATER USED	GAL	2.25E+07	4.83E+07	10

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

Table 2A Semiannual Summation of Liquid Releases

All Liquid Effluents

TABLE 2A

SEMIANNUAL SUMMATION OF LIQUID RELEASES
ALL LIQUID EFFLUENTS

QUARTERS 3 AND 4, 2006

TYPE OF EFFLUENT	UNITS	THIRD QUARTER	FOURTH QUARTER	EST TOTAL ERROR % (a)
A. FISSION AND ACTIVATION PRODUCTS				
1. TOTAL RELEASE [NOT INCLUDING TRITIUM, GASES, ALPHA]	CURIES	6.93E-03	1.81E-03	20
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	4.44E-08	1.12E-08	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
B. TRITIUM				
1. TOTAL RELEASE	CURIES	1.58E+02	2.46E+02	14
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	1.01E-03	1.53E-03	
3. PERCENT OF APPLICABLE LIMIT	%	N/A	N/A	
C. DISSOLVED AND ENTRAINED GASES				
1. TOTAL RELEASE	CURIES	4.04E-06	1.59E-05	27
2. AVERAGE DILUTED CONCENTRATION DURING PERIOD	uCi/ML	2.58E-11	9.88E-11	
D. GROSS ALPHA RADIOACTIVITY				
1. TOTAL RELEASE	CURIES	1.34E-03	0.00E+00	29
E. WASTE VOLUME RELEASED (PRE-DILUTION)	GAL	1.46E+06	1.43E+06	10
F. VOLUME OF DILUTION WATER USED	GAL	3.98E+07	4.11E+07	10

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

Table 2B Semiannual Liquid Continuous & Batch Releases

Totals for Each Nuclide Released

TABLE 2B

SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
TOTALS FOR EACH NUCLIDE RELEASED

QUARTERS 1 AND 2, 2006

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNITS	FIRST QUARTER	SECOND QUARTER	FIRST QUARTER	SECOND QUARTER
1. ALL NUCLIDES					
CO-58	CURIES	0.00E+00	0.00E+00	1.62E-03	4.58E-03
CO-60	CURIES	0.00E+00	0.00E+00	1.92E-04	1.16E-03
CS-134	CURIES	0.00E+00	0.00E+00	5.43E-05	1.02E-04
CS-137	CURIES	0.00E+00	0.00E+00	7.39E-05	1.44E-04
H-3	CURIES	0.00E+00	0.00E+00	1.28E+01	3.08E+02
NI-63	CURIES	0.00E+00	0.00E+00	7.78E-04	2.49E-03
NP-237	CURIES	0.00E+00	0.00E+00	6.22E-07	0.00E+00
SB-125	CURIES	0.00E+00	0.00E+00	8.63E-04	4.12E-04
ALPHA	CURIES	0.00E+00	0.00E+00	0.00E+00	1.83E-04
TE-132	CURIES	0.00E+00	0.00E+00	0.00E+00	3.89E-06
TC-101	CURIES	0.00E+00	0.00E+00	0.00E+00	6.12E-06
XE-133	CURIES	0.00E+00	0.00E+00	0.00E+00	2.96E-04
CO-57	CURIES	0.00E+00	0.00E+00	0.00E+00	7.57E-05
MN-54	CURIES	0.00E+00	0.00E+00	0.00E+00	2.19E-05
TOTALS FOR PERIOD	CURIES	0.00E+00	0.00E+00	1.28E+01	3.08E+02

Table 2B Semiannual Liquid Continuous & Batch Releases

Totals for Each Nuclide Released

TABLE 2B

SEMIANNUAL LIQUID CONTINUOUS AND BATCH RELEASES
TOTALS FOR EACH NUCLIDE RELEASED

QUARTERS 3 AND 4, 2006

		CONTINUOUS RELEASES		BATCH RELEASES	
NUCLIDE	UNITS	THIRD QUARTER	FOURTH QUARTER	THIRD QUARTER	FOURTH QUARTER
1. ALL NUCLIDES					
CO-58	CURIES	0.00E+00	0.00E+00	2.36E-03	2.21E-04
CO-60	CURIES	0.00E+00	0.00E+00	8.69E-04	2.49E-04
CS-134	CURIES	0.00E+00	0.00E+00	2.45E-04	1.75E-04
CS-137	CURIES	0.00E+00	0.00E+00	3.94E-04	2.93E-04
H-3	CURIES	0.00E+00	0.00E+00	1.58E+02	2.46E+02
NI-63	CURIES	0.00E+00	0.00E+00	1.77E-03	5.14E-04
NP-237	CURIES	0.00E+00	0.00E+00	0.00E+00	1.41E-06
SB-125	CURIES	0.00E+00	0.00E+00	1.27E-03	3.11E-04
ALPHA	CURIES	0.00E+00	0.00E+00	1.34E-03	0.00E+00
TE-132	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TC-101	CURIES	0.00E+00	0.00E+00	0.00E+00	0.00E+00
XE-133	CURIES	0.00E+00	0.00E+00	4.04E-06	1.59E-05
CO-57	CURIES	0.00E+00	0.00E+00	2.38E-05	0.00E+00
MN-54	CURIES	0.00E+00	0.00E+00	0.00E+00	1.06E-05
SN-113	CURIES	0.00E+00	0.00E+00	0.00E+00	3.35E-06
BE-7	CURIES	0.00E+00	0.00E+00	0.00E+00	1.99E-05
SB-124	CURIES	0.00E+00	0.00E+00	0.00E+00	7.42E-06
TOTALS FOR PERIOD	CURIES	0.00E+00	0.00E+00	1.58E+02	2.46E+02

Table 3 Solid Waste & Irradiated Fuel Shipments 2006

A. SOLID WASTE SHIPPED OFFSITE FOR BURIAL OR DISPOSAL (DOES NOT INCLUDE IRRADIATED FUEL)

1. TYPE OF WASTE	UNITS	PERIOD JAN - JUN	PERIOD JUL - DEC	EST. TOTAL ERROR (%)
a. Spent resins, filter sludges, evaporator bottoms, etc.	m^3	10.8	7.9	
	Ci	693.0	79.4	±25%
b. Dry compressible waste, contaminated equipment, etc.	m^3	92.3	67.0	
	Ci	3.22E-2	7.9E-2	±25%
c. Irradiated components, control rods, etc.	m^3	3.50E-2	0	
	Ci	1.2	0	±25%
d. Other	m^3	0	14.6	
	Ci	0	6.4E-1	±25%

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

Nuclide	% Abundance	PERIOD JAN - JUN Curies	% Abundance	PERIOD JUL - DEC Curies
a. Fe-55	6.5	45.2	4.4	3.5
Co-58	2.5	17.6	0.6	0.5
Ni-63	20.7	143.0	26.5	21.0
Co-60	8.0	55.5	11.8	9.4
Cs-137	30.7	213.0	31.7	25.2
Cs-134	28.6	198.0	22.8	18.1
Mn-54	1.5	10.3	1.3	1.0
b. Fe-55	36.9	1.19E-2	47.5	3.75E-2
Co-58	13.6	4.37E-3	5.2	4.07E-3
Cs-137	14.0	4.51E-3	3.6	2.85E-3
Ni-63	13.2	4.25E-3	22.5	1.78E-2
Co-60	8.3	2.66E-3	12.1	9.58E-3
Nb-95	3.1	1.00E-3	3.6	2.87E-3
Mn-54	3.9	1.25E-3	0.7	5.51E-4
Cs-134	4.0	1.27E-3	1.4	1.01E-3
Zr-95	1.9	6.01E-4	N/A	N/A
c. Fe-55	8.9	0.10	N/A	N/A
Co-60	40.0	0.47	N/A	N/A
Ni-63	49.9	0.58	N/A	N/A
d. Mn-54	N/A	N/A	4.2	2.70E-2
Fe-55	N/A	N/A	35.3	2.26E-1
Co-58	N/A	N/A	24.3	1.55E-1
Co-60	N/A	N/A	7.0	4.46E-2
Ni-63	N/A	N/A	9.6	6.14E-2
Zr-95	N/A	N/A	2.5	1.62E-2
Nb-95	N/A	N/A	4.9	3.12E-2
Cs-134	N/A	N/A	2.3	1.44E-2
Cs-137	N/A	N/A	7.8	4.99E-2

Table 3 Solid Waste & Irradiated Fuel Shipments 2006

3. SOLID WASTE DISPOSITION:

Number of Shipments	Mode of Transport	Destination	Class of Solid Waste Shipped	Type of Container
9*	Truck	Duratek	A	Drum/Boxes
1*	Truck	Duratek/Chem Nuclear	B	Drum/Boxes
2*	Cask	Studsvik	A	Poly Liner
1*	Cask	Studsvik	B	Poly Liner
2*	Cask	Studsvik	C	Poly Liner

* Sent to waste processors for volume reduction before burial.

4. SOLIDIFICATION AGENT:
None used.

B. IRRADIATED FUEL SHIPMENTS (DISPOSITION)

Number of Shipments	Mode of Transportation	Destination
0		

Table 4 Meteorological Data

Averages Using Hourly Averaged Data

Union Electric - Callaway Plant Report Date/Time: 21-MAR-2007 11:53:39.35

Meteorological Data
Averages Using Hourly Averaged Data

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

		UNITS	VALUES	% GOOD DATA
Stability Class		A - G	E	98%
Total Precipitation		CM.	5.00E+01	97%
10 Meter Level:	Wind Speed	Meter/Sec	2.94E+00	99%
	Wind Direction	Degrees	2.03E+02	99%
	Wind Direction Variability	Degrees	1.40E+01	99%
	Reference Temperature	Degrees C	1.38E+01	100%
	Dewpoint	Degrees C	6.95E+00	100%
60 Meter Level:	Wind Speed	Meter/Sec	5.26E+00	98%
	Wind Direction	Degrees	2.19E+02	98%
	Wind Direction Variability	Degrees	8.62E+00	99%
	Dewpoint	Degrees C	NONE	0%
	Temperature Difference 60 - 10	Degrees C	6.52E-02	98%

Callaway does not collect 60m dewpoint data

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant Report Date/Time: 21-MAR-2007 11:53:41.12

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: A

	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	9	22	0	0	0	31
NNE	0	3	12	0	0	0	15
NE	2	9	2	0	0	0	13
ENE	3	10	9	0	0	0	22
E	5	16	7	0	0	0	28
ESE	5	14	12	2	0	0	33
SE	3	38	39	6	0	0	86
SSE	5	37	54	2	0	0	98
S	3	39	49	12	0	0	103
SSW	5	40	47	6	0	0	98
SW	5	30	25	15	0	0	75
WSW	4	16	14	10	0	0	44
W	2	25	32	14	0	0	73
WNW	3	36	46	5	0	0	90
NW	2	19	39	5	0	0	65
NNW	1	20	13	3	0	0	37
TOT	48	361	422	80	0	0	911

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

Table 4 Meteorological Data Continued

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 11:53:41.12

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: B

	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	8	9	0	0	0	17
NNE	0	8	2	2	0	0	12
NE	0	8	2	0	0	0	10
ENE	1	10	3	0	0	0	14
E	1	6	4	0	0	0	11
ESE	0	8	3	0	0	0	11
SE	2	28	15	0	0	0	45
SSE	6	24	20	2	0	0	52
S	1	24	19	5	0	0	49
SSW	2	27	15	4	0	0	48
SW	3	12	6	3	0	0	24
WSW	1	8	7	1	0	0	17
W	1	12	8	2	0	0	23
WNW	1	20	7	0	1	0	29
NW	1	16	27	2	0	0	46
NNW	0	10	19	2	0	0	31
TOT	20	229	166	23	1	0	439

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

Table 4 Meteorological Data Continued

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 11:53:41.12

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: C

	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4	22	9	0	0	0	35
NNE	2	22	11	0	0	0	35
NE	0	19	2	0	0	0	21
ENE	2	8	3	0	0	0	13
E	1	14	6	1	1	0	23
ESE	1	8	2	0	0	0	11
SE	3	19	11	4	0	0	37
SSE	5	19	20	2	0	0	46
S	6	25	25	7	0	0	63
SSW	4	26	10	3	1	0	44
SW	4	15	18	1	0	0	38
WSW	3	9	6	2	1	0	21
W	5	8	9	2	0	0	24
WNW	3	21	14	1	1	0	40
NW	0	23	22	1	0	0	46
NNW	4	23	26	0	0	0	53
TOT	47	281	194	24	4	0	550

Hours of Calm Data: 0
Hours of Invalid Data: 3

Table 4 Meteorological Data Continued

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant Report Date/Time: 21-MAR-2007 11:53:41.12

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: D

	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	15	104	65	24	8	0	216
NNE	21	109	48	3	0	0	181
NE	25	65	14	0	0	0	104
ENE	20	67	11	0	0	0	98
E	10	53	38	10	0	0	111
ESE	13	69	53	4	0	0	139
SE	17	72	76	11	1	0	177
SSE	19	63	85	10	2	0	179
S	10	44	64	15	0	0	133
SSW	26	44	44	7	0	0	121
SW	29	59	38	3	0	0	129
WSW	23	35	23	6	0	0	87
W	18	56	48	13	1	0	136
WNW	22	71	53	14	0	0	160
NW	18	122	114	33	1	0	288
NNW	19	116	114	35	6	0	290
TOT	305	1149	888	188	19	0	2549

Hours of Calm Data: 6
Hours of Invalid Data: 41

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant Report Date/Time: 21-MAR-2007 11:53:41.12

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: E

	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	32	80	7	0	0	0	119
NNE	28	40	0	1	0	0	69
NE	37	18	0	0	0	0	55
ENE	31	24	0	0	0	0	55
E	32	50	4	0	0	0	86
ESE	31	82	13	2	0	0	128
SE	30	195	90	8	0	0	323
SSE	24	146	133	4	0	0	307
S	29	146	134	7	0	0	316
SSW	21	57	35	2	0	0	115
SW	29	77	25	0	0	0	131
WSW	26	58	15	2	0	0	101
W	46	82	12	1	0	0	141
WNW	50	95	8	1	0	0	154
NW	51	100	35	0	0	0	186
NNW	24	87	5	0	0	0	116
TOT	521	1337	516	28	0	0	2402

Hours of Calm Data: 41
Hours of Invalid Data: 10

Table 4 Meteorological Data Continued

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant Report Date/Time: 21-MAR-2007 11:53:41.12

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: F

	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	20	17	0	0	0	0	37
NNE	23	6	0	0	0	0	29
NE	44	2	0	0	0	0	46
ENE	29	5	0	0	0	0	34
E	18	2	0	0	0	0	20
ESE	40	9	0	0	0	0	49
SE	44	110	27	0	0	0	181
SSE	39	136	32	0	0	0	207
S	27	69	20	0	0	0	116
SSW	34	56	3	0	0	0	93
SW	36	49	2	0	0	0	87
WSW	19	17	2	0	0	0	38
W	50	33	0	0	0	0	83
WNW	51	21	0	0	0	0	72
NW	42	40	0	0	0	0	82
NNW	19	23	0	0	0	0	42
TOT	535	595	86	0	0	0	1216

Hours of Calm Data: 37
Hours of Invalid Data: 7

Table 4 Meteorological Data Continued

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant Report Date/Time: 21-MAR-2007 11:53:41.12

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: G

	Wind Speed at 10.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	20	2	0	0	0	0	22
NNE	31	2	0	0	0	0	33
NE	15	0	0	0	0	0	15
ENE	7	2	0	0	0	0	9
E	11	0	0	0	0	0	11
ESE	15	0	0	0	0	0	15
SE	36	15	0	0	0	0	51
SSE	67	46	0	0	0	0	113
S	24	14	0	0	0	0	38
SSW	23	5	0	0	0	0	28
SW	15	7	0	0	0	0	22
WSW	7	1	0	0	0	0	8
W	10	6	0	0	0	0	16
WNW	21	4	0	0	0	0	25
NW	21	2	0	0	0	0	23
NNW	20	5	0	0	0	0	25
TOT	343	111	0	0	0	0	454

Hours of Calm Data: 86
Hours of Invalid Data: 0
Hours of Good Data: 8691 = 99.2% of Total Hours

Table 4 Meteorological Data Continued

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 12:33:33.77

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: A

	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	8	20	6	0	0	34
NNE	0	2	6	5	0	0	13
NE	0	5	5	0	0	0	10
ENE	1	6	18	0	0	0	25
E	1	8	10	2	0	0	21
ESE	1	6	14	5	1	0	27
SE	3	17	42	12	2	0	76
SSE	2	14	63	15	0	0	94
S	3	18	47	31	7	0	106
SSW	2	22	37	28	7	0	96
SW	1	25	22	22	14	2	86
WSW	2	9	10	7	10	1	39
W	1	18	19	18	9	7	72
WNW	0	15	35	34	12	4	100
NW	1	12	15	33	10	0	71
NNW	1	6	19	9	1	0	36
TOT	19	191	382	227	73	14	906

Hours of Calm Data: 0
Hours of Invalid Data: 5

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 12:33:33.77

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: B

	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	1	15	5	0	0	21
NNE	0	3	5	2	0	0	10
NE	0	1	6	0	0	0	7
ENE	0	6	7	1	0	0	14
E	1	2	8	0	0	0	11
ESE	0	4	5	1	0	0	10
SE	0	9	13	2	0	0	24
SSE	0	21	33	5	1	0	60
S	1	16	17	16	2	0	52
SSW	0	14	18	3	5	0	40
SW	1	6	20	9	3	1	40
WSW	0	7	3	5	1	0	16
W	0	10	3	6	4	0	23
WNW	1	7	15	9	2	1	35
NW	0	3	21	12	5	0	41
NNW	0	6	19	8	1	0	34
TOT	4	116	208	84	24	2	438

Hours of Calm Data: 0
Hours of Invalid Data: 1

Table 4 Meteorological Data Continued

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 12:33:33.77

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: C

	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	13	12	4	0	0	31
NNE	3	13	19	3	0	0	38
NE	0	11	10	2	0	0	23
ENE	1	4	3	1	0	0	9
E	0	7	13	2	0	2	24
ESE	0	7	6	0	0	0	13
SE	0	6	9	2	2	0	19
SSE	2	11	26	5	3	0	47
S	2	16	21	16	6	1	62
SSW	0	15	19	9	3	0	46
SW	0	5	15	16	5	0	41
WSW	2	8	8	4	3	2	27
W	1	7	3	4	4	0	19
WNW	1	8	16	8	5	1	39
NW	0	11	21	21	1	1	55
NNW	0	11	29	8	0	0	48
TOT	14	153	230	105	32	7	541

Hours of Calm Data: 0
Hours of Invalid Data: 12

Table 4 Meteorological Data Continued

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 12:33:33.77

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: D

	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	6	31	84	37	16	14	188
NNE	5	51	110	31	5	0	202
NE	6	57	41	7	0	0	111
ENE	5	36	48	1	0	0	90
E	5	31	39	16	8	2	101
ESE	3	21	56	41	3	0	124
SE	7	40	50	45	14	1	157
SSE	6	26	72	63	7	2	176
S	5	25	51	63	17	0	161
SSW	9	28	35	40	5	2	119
SW	8	27	44	45	12	0	136
WSW	10	21	35	25	7	2	100
W	2	13	25	34	19	4	97
WNW	7	27	63	53	18	11	179
NW	6	26	91	79	32	13	247
NNW	7	44	120	95	33	8	307
TOT	97	504	964	675	196	59	2495

Hours of Calm Data: 1
Hours of Invalid Data: 100

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 12:33:33.77

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: E

	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	10	64	19	0	0	94
NNE	0	14	68	11	0	0	93
NE	4	22	34	0	1	0	61
ENE	1	17	30	2	0	0	50
E	2	24	55	4	0	0	85
ESE	3	22	78	21	0	0	124
SE	3	20	113	105	11	2	254
SSE	3	12	97	166	8	1	287
S	4	20	72	181	13	3	293
SSW	2	22	61	133	6	0	224
SW	2	20	57	55	15	0	149
WSW	1	10	33	33	6	2	85
W	5	19	44	67	4	0	139
WNW	0	17	69	58	1	0	145
NW	5	24	90	72	12	0	203
NNW	3	12	83	14	0	0	112
TOT	39	285	1048	941	77	8	2398

Hours of Calm Data: 4
Hours of Invalid Data: 51

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 12:33:33.77

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: F

	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	6	20	12	0	0	38
NNE	3	11	27	2	0	0	43
NE	3	11	15	0	0	0	29
ENE	2	8	24	7	0	0	41
E	1	2	35	3	0	0	41
ESE	0	11	33	4	0	0	48
SE	4	5	58	28	1	0	96
SSE	0	9	60	97	8	0	174
S	1	16	81	57	1	0	156
SSW	3	10	45	70	4	0	132
SW	2	3	36	50	5	0	96
WSW	3	7	23	26	2	0	61
W	0	10	25	18	0	0	53
WNW	1	18	38	41	0	0	98
NW	1	10	48	12	0	0	71
NNW	0	5	34	21	0	0	60
TOT	24	142	602	448	21	0	1237

Hours of Calm Data: 0
Hours of Invalid Data: 23

Totals of Hours at Each Wind Speed & Direction

Union Electric - Callaway Plant

Report Date/Time: 21-MAR-2007 12:33:33.77

Meteorological Data
Totals of Hours at Each Wind Speed & Direction

1-JAN-2006 00:00:00.00 to 31-DEC-2006 23:59:59.00

Stability Class: G

	Wind Speed at 60.00 Meter Level (MPH)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	7	7	1	0	0	15
NNE	2	6	12	5	0	0	25
NE	2	8	14	0	0	0	24
ENE	0	6	25	6	0	0	37
E	2	7	8	0	0	0	17
ESE	2	11	23	0	0	0	36
SE	5	14	11	2	0	0	32
SSE	2	11	17	17	0	0	47
S	4	15	37	8	0	0	64
SSW	5	14	47	14	0	0	80
SW	1	2	13	19	0	0	35
WSW	6	7	12	6	0	0	31
W	3	6	4	3	0	0	16
WNW	2	5	6	16	0	0	29
NW	0	2	16	5	0	0	23
NNW	2	12	12	1	0	0	27
TOT	38	133	264	103	0	0	538

Hours of Calm Data: 2
Hours of Invalid Data: 0
Hours of Good Data: 8560 = 97.7% of Total Hours

Table 5 Dose at the Site Boundry and to the Nearest Resident From Gaseous Effluents

TABLE 5

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

		SITE BOUNDARY		NEAREST RESIDENT	
		LOCATION: 1.40 km SSW		LOCATION: 2.90 km NNW	
		AGE GROUP: CHILD		AGE GROUP: CHILD	
ORGAN	UNITS	DOSE	% LIMIT(a)	DOSE	% LIMIT(b)
1. GAMMA AIR DOSE *	MRAD	8.87E-04	0.01	4.77E-04	N/A
2. BETA AIR DOSE *	MRAD	2.00E-03	0.01	1.07E-03	N/A
3. WHOLE BODY ***	MREM	1.14E-03	N/A	6.10E-04	N/A
4. SKIN ***	MREM	2.09E-03	N/A	1.12E-03	N/A
5. BONE **	MREM	3.68E-04	N/A	2.28E-04	0.00
6. LIVER **	MREM	2.11E-03	N/A	8.27E-03	0.06
7. TOTAL BODY **	MREM	2.11E-03	N/A	8.25E-03	0.06
8. THYROID **	MREM	2.11E-03	N/A	8.40E-03	0.06
9. KIDNEY **	MREM	2.11E-03	N/A	8.24E-03	0.05
10. LUNG **	MREM	2.14E-03	N/A	8.25E-03	0.05
11. GI-LLI **	MREM	2.11E-03	N/A	8.26E-03	0.06

* 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 halflives greater than 8 days.

Table 6 Dose to the Member of the Public

From Activities within the Site Boundary

TABLE 6

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

ORGAN	UNITS	EFFLUENT DOSE WITHIN THE SITE BOUNDARY	DIRECT RADIATION FROM THE UNIT	DIRECT RADIATION FROM OUTSIDE TANKS	DIRECT RADIATION FROM RAM STORAGE *	EFFLUENT DOSE FROM CLG TWR	TOTAL DOSE FOR THE YEAR
SKIN	mrem	6.10E-05	N/A	N/A	N/A	N/A	6.10E-05
BONE	mrem	2.19E-05	8.79E-03	5.13E-04	5.99E-03	N/A	1.53E-02
LIVER	mrem	3.12E-04	8.79E-03	5.13E-04	5.99E-03	2.20E-04	1.58E-02
TOTAL BODY	mrem	3.30E-04	8.79E-03	5.13E-04	5.99E-03	2.20E-04	1.58E-02
THYROID	mrem	3.12E-04	8.79E-03	5.13E-04	5.99E-03	2.20E-04	1.58E-02
KIDNEY	mrem	3.12E-04	8.79E-03	5.13E-04	5.99E-03	2.20E-04	1.58E-02
LUNG	mrem	3.13E-04	8.79E-03	5.13E-04	5.99E-03	2.20E-04	1.58E-02
GI-LLI	mrem	3.12E-04	8.79E-03	5.13E-04	5.99E-03	2.20E-04	1.58E-02

* Direct Radiation dose from Stores II, OSGSF, Modification 03-1008 (Equipment Hatch Platform and Missile Shield Modification), and from the RW storage area.

Table 7 Total Dose Due to the Uranium Fuel Cycle

(Member of the Public)

TABLE 7

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

ORGAN	UNITS	EFFLUENT DOSE AT RESIDENCE LOCATION	DOSE FROM ACTIVITIES IN SITE BOUNDARY	DOSE FROM CLG TWR H-3 AT NEAREST RESIDENCE	TOTAL DOSE TO THE MEMBER OF THE PUBLIC	% LIMITS *
SKIN	mrem	2.04E-03	6.10E-05	N/A	2.10E-03	0.01%
BONE	mrem	1.76E-04	1.53E-02	N/A	1.55E-02	0.06%
LIVER	mrem	4.24E-03	1.58E-02	1.50E-04	2.02E-02	0.08%
TOTAL BODY	mrem	4.98E-03	1.58E-02	1.50E-04	2.09E-02	0.08%
THYROID	mrem	4.18E-03	1.58E-02	1.50E-04	2.01E-02	0.03%
KIDNEY	mrem	4.19E-03	1.58E-02	1.50E-04	2.01E-02	0.08%
LUNG	mrem	4.18E-03	1.58E-02	1.50E-04	2.01E-02	0.08%
GI-LLI	mrem	4.20E-03	1.58E-02	1.50E-04	2.02E-02	0.08%

* Annual dose limits from 40 CFR 190.10(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)

TABLE 8

DOSE DUE TO LIQUID EFFLUENTS
(MEMBER OF THE PUBLIC)

2006

ORGAN	UNITS	DOSE	LIMIT *	% LIMIT
1. BONE	MREM	5.55E-03	10.00	5.55E-02
2. LIVER	MREM	8.51E-03	10.00	8.51E-02
3. TOTAL BODY	MREM	6.56E-03	3.00	2.19E-01
4. THYROID	MREM	1.32E-03	10.00	1.32E-02
5. KIDNEY	MREM	3.67E-03	10.00	3.67E-02
6. LUNG	MREM	2.10E-03	10.00	2.10E-02
7. GI-LLI	MREM	1.70E-03	10.00	1.70E-02

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

16.11 (ODCM 9.0) OFFSITE DOSE CALCULATION MANUAL RADIOACTIVE EFFLUENT CONTROLS

16.11.1 LIQUID EFFLUENT

16.11.1.1 LIQUID EFFLUENTS CONCENTRATION LIMITING CONDITION FOR OPERATION

(ODCM 9.3.1)

The concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS (see Figure 16.11-1) shall be limited to 10 times the concentration values in Appendix B, Table 2, Column 2 to 10 CFR 20.1001-20.2402, for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2×10^{-4} microCurie/ml total activity.

APPLICABILITY: At all times.

ACTION:

a. With the concentration of radioactive material released in liquid effluents to UNRESTRICTED AREAS exceeding the above limits, immediately restore the concentration to within the above limits.

b. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.1.1.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.3.2)

16.11.1.1.1.a

Radioactive liquid wastes shall be sampled and analyzed according to the sampling and analysis program of Table 16.11-1.

16.11.1.1.1.b

The results of the radioactivity analysis shall be used in accordance with the methodology and parameters in the ODCM to assure that the concentrations at the point of release are maintained within the limits of Section 16.11.1.1.

16.11.1.1.2 BASES

This section is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to UNRESTRICTED AREAS will be less than 10 times the concentration in Appendix B, Table 2, Column 2 to 10 CFR 20.1001-20.2402. This limitation provides additional assurance that the levels of radioactive materials in bodies

of water in UNRESTRICTED AREAS will result in exposures within: (1) the Section II.A design objectives of Appendix I, 10 CFR Part 50, to a MEMBER OF THE PUBLIC, and (2) the limits of 10 CFR Part 20.1301 to the population. The concentration limit for dissolved or entrained noble gases is based upon the assumption that Xe-135 is the controlling radioisotope and its MPC in air (submersion) was converted to an equivalent concentration in water using the methods described in International Commission on Radiological Protection (ICRP) Publication 2.

The required detection capabilities for radioactive materials in liquid waste samples are tabulated in terms of the lower limits of detection (LLD's).

16.11.1.2 DOSE FROM LIQUID EFFLUENTS LIMITING CONDITION FOR OPERATION

(ODCM 9.4.1)

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to UNRESTRICTED AREAS (see Figure 16.11-1) shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mrems to the whole body and to less than or equal to 5 mrems to any organ, and

b. During any calendar year to less than or equal to 3 mrems to the whole body and to less than or equal to 10 mrems to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of radioactive materials in liquid effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits. This Special Report shall also include: (1) the results of radiological analyses of the drinking water source, and (2) the radiological impact on finished drinking water supplies with regard to the requirements of 40 CFR Part 141, Clean Drinking Water Act.*

b. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.1.2.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.4.2)

Cumulative dose contributions from liquid effluents for the current calendar quarter and the current calendar year shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

* The requirements of ACTION a.(1) and (2) are applicable only if drinking water supply is taken from the receiving water body within 3 miles of the plant discharge. In the case of river-sited plants this is 3 miles downstream only.

16.11.1.2.2 BASES

This section is provided to implement the requirements of Sections II.A and IV.A of Appendix I, 10 CFR Part 50. The Limiting Condition for Operation implements the guides set forth in Section II.A of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in liquid effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable".

Also, for fresh water sites with drinking water supplies that can be potentially affected by plant operations, there is reasonable assurance that the operation of the facility will not result in radionuclide concentrations in the finished drinking water that are in excess of the requirements of 40 CFR Part 141. The dose calculation methodology and parameters in the ODCM implement the requirements in Section III.A of Appendix I which specify that conformance with the guides of Appendix I be shown by calculational procedures based on models and data, such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The equations specified in the ODCM for calculating the doses due to the actual release rates of radioactive materials in liquid effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculations of Annual Doses to Man from Routine Releases of Reactor Effluents with 10 CFR Part 50, Appendix I", Revision 1, October 1977 and Regulatory Guide 1.113, "Estimating Aquatic and Dispersion of Effluents from accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I", April 1977.

The reporting requirements of Action(a) implement the requirements of 10CFR20.2203.

16.11.1.3 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION LIMITING CONDITION FOR OPERATION

(ODCM 9.1.1)

The radioactive liquid effluent monitoring instrumentation channels shown in Table 16.11-2 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Section 16.11.1.1 are not exceeded. The Alarm/Trip Setpoints of these channels shall be determined and adjusted in accordance with the methodology and parameters in the ODCM.

APPLICABILITY: At all times.

ACTION:

a. With a radioactive liquid effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above, immediately suspend the release of radioactive liquid effluents monitored by the affected channel, or declare the channel inoperable.

b. With less than the minimum number of radioactive liquid effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 16.11-2. Restore the inoperable instrumentation to OPERABLE status within 30 days and, if unsuccessful, explain in the next Radioactive Effluent Release Report, pursuant to Technical Specification 5.6.3, why this inoperability was not corrected within the time specified.

c. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.1.3.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.1.2)

Each radioactive liquid effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL OPERATIONAL TEST at the frequencies shown in Table 16.11-3.

16.11.1.3.2 BASES

The radioactive liquid effluent monitoring instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential releases of liquid effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is

consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50.

16.11.1.4 LIQUID RADWASTE TREATMENT SYSTEM LIMITING CONDITION FOR OPERATION

(ODCM 9.5.1)

The Liquid Radwaste Treatment System shall be OPERABLE and appropriate portions of the system shall be used to reduce releases of radioactivity when the projected doses due to the liquid effluent, from each unit, to UNRESTRICTED AREAS (see Figure 16.11-1) would exceed 0.06 mrem to the whole body or 0.2 mrem to any organ in a 31 day period.

APPLICABILITY: At all times.

ACTION:

I. With radioactive liquid waste being discharged in excess of the above limits and the Liquid Radwaste Treatment Systems are not being fully utilized, prepare and submit to the Commission within 30 days a Special Report that includes the following information:

   1) Explanation of why liquid radwaste was being discharged without treatment, identification of any inoperable equipment or subsystems, and the reason for the inoperability.

   2) Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3) Summary description of action(s) taken to prevent a recurrence.

II. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.1.4.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.5.2)

16.11.1.4.1.a

Doses due to liquid releases from each unit to UNRESTRICTED AREAS shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

16.11.1.4.1.b

The installed Liquid Radwaste Treatment System shall be considered OPERABLE by meeting Sections 16.11.1.1 and 16.11.1.2.

16.11.1.4.2 BASES

The OPERABILITY of the Liquid Radwaste Treatment System ensures that this system will be available for use whenever liquid effluents require treatment prior to release to the environment. The requirement that the appropriate portions of this system be used when specified provides assurance that the releases of radioactive materials in liquid effluents will be kept "as low as is reasonably achievable". This section implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50 and the design objective given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the Liquid Radwaste Treatment System were specified as a suitable fraction of the dose design objectives set forth in Section II.A of Appendix I, 10 CFR Part 50, for liquid effluents.

16.11.1.5 LIQUID HOLDUP TANKS
(3/4.11.1.4) LIMITING CONDITION FOR OPERATION

(3.11.1.4)

The quantity of radioactive material contained in each of the following unprotected outdoor tanks shall be limited to less than or equal to 150 Curies, excluding tritium and dissolved or entrained noble gases:

a. Reactor Makeup Water Storage Tank,

b. Refueling Water Storage Tank,

c. Condensate Storage Tank, and

d. Outside temporary tanks, excluding demineralizer vessels and the liner being used to solidify radioactive waste.

APPLICABILITY: At all times.

ACTION:

a. With the quantity of radioactive material in any of the above listed tanks exceeding the above limit, immediately suspend all additions of radioactive material to the tank, within 48 hours reduce the tank contents to within the limit, and describe the events leading to this condition in the next Radioactive Effluent Release Report, pursuant to Technical Specification 5.6.3.

b. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.1.5.1 SURVEILLANCE REQUIREMENTS

(4.11.1.4)

The quantity of radioactive material contained in each of the above listed tanks shall be determined to be within the above limit by analyzing a representative sample of the tank's contents at least once per 7 days when radioactive materials are being added and within 7 days following any addition of radioactive material to the tank. The provisions of Sections 16.0.2.2 and 16.0.2.3 are applicable, however the allowed surveillance interval extension beyond 25% shall not be exceeded. These tanks are also covered by Administrative Controls Section 5.5.12.

16.11.1.5.2 BASES

The tanks listed above include all those outdoor radwaste tanks that are not surrounded by liners, dikes, or walls capable of holding the tank contents and that do not have tank

overflows and surrounding area drains connected to the Liquid Radwaste Treatment System.

Restricting the quantity of radioactive material contained in the specified tanks provides assurance that in the event of an uncontrolled release of the tanks' contents, the resulting concentrations would be less than the limits of 10 CFR Part 20.1-20.602, Appendix B, Table II, Column 2, (redesignated at 56FR23391, May 21, 1991) at the nearest potable water supply and the nearest surface water supply in an UNRESTRICTED AREA.

16.11.2 GASEOUS EFFLUENTS

16.11.2.1 GASEOUS EFFLUENTS DOSE RATE LIMITING CONDITION OF OPERATION

(ODCM 9.6.1)

The dose rate due to radioactive materials released in gaseous effluents from the site to areas at and beyond the SITE BOUNDARY (see Figure 16.11-2) shall be limited to the following:

a. For noble gases: Less than or equal to 500 mrems/yr to the whole body and less than or equal to 3000 mrems/yr to the skin, and

b. For Iodine-131 and 133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1500 mrems/yr to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the dose rate(s) exceeding the above limits, immediately restore the release rate to within the above limit(s).

b. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.2.1.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.6.2)

16.11.2.1.1.a

The dose rate due to noble gases in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM.

16.11.2.1.1.b

The dose rate due to Iodine-131 and 133, tritium and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents shall be determined to be within the above limits in accordance with the methodology and parameters in the ODCM by obtaining representative samples and performing analyses in accordance with the sampling and analysis program specified in Table 16.11-4.

16.11.2.1.2 BASES

This section is provided to ensure that the dose at any time at and beyond the SITE BOUNDARY from gaseous effluents from all units on the site will be within the annual dose limits of 10 CFR Part 20 to UNRESTRICTED AREAS. The dose rate limits are the doses associated with the concentrations of 10 CFR Part 20.1-20.601, Appendix B, Table II, Column 1. These limits provide reasonable assurance that radioactive material discharged in gaseous effluents will not result in the exposure of a MEMBER OF THE PUBLIC in an UNRESTRICTED AREA, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the dose limits specified in 10 CFR Part 20 10 CFR 20.1301. For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy of that MEMBER OF THE PUBLIC will usually be sufficiently low to compensate for any increase in the atmospheric diffusion factor above that for the SITE BOUNDARY. Examples of calculations for such MEMBERS OF THE PUBLIC, with the appropriate occupancy factors, shall be given in the ODCM. The specified release rate limits restrict, at all times, the corresponding gamma and beta dose rates above background to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY to less than or equal to 500 mrem/year to the whole body or to less than or equal to 3000 mrems/year to the skin. These release rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to less than or equal to 1500 mrems/year.

The required detection capabilities for radioactive materials in gaseous waste samples are tabulated in terms of the lower limits of detection (LLD's).

The requirement for additional sampling of the Unit Vent following a reactor power transient is provided to ensure that the licensee is aware of and properly accounts for any increases in the release of gaseous effluents due to spiking which may occur as a result of the power transient. Monitoring the Unit Vent for increased noble gas activity is appropriate because it is the release point for any increased activity which may result from the power transient.

Since the escape rate coefficients for the noble gas nuclides is equal to or greater than the escape rate coefficient for iodine and the particulate nuclides*,** , it is reasonable to assume that the RCS spiking behavior of the noble gas nuclides is similar to that of the particulate and iodine nuclides. Considering the effects of iodine and particulate partitioning, plateout on plant and ventilation system surfaces, and the 99% efficiency of the Unit Vent HEPA filters and charcoal absorbers, it is reasonable to assume that the relative concentrations of the noble gas nuclides will be much greater than those of the

---

* Cohen, Paul, Water Coolant Technology of Power Reactors, Table 5.19, page 198. American Nuclear Society. 1980.

** NUREG-0772, "Technical Bases for Estimating Fission Product Behavior During LWR Accidents", Silberberg, M., editor, USNRC; Figure 4.3, page 4.22. June, 1981.

iodine and particulate nuclides. Therefore, an increase in the iodine and particulate RCS activity is not an appropriate indicator of an increase in the Unit Vent activity, and it is appropriate to monitor the Unit Vent effluent activity as opposed to the RCS activity as an indicator of the need to perform post-transient sampling. In addition, it is appropriate to monitor the noble gas activity due to its relatively greater concentration in the Unit Vent.

16.11.2.2 DOSE - NOBLE GASES LIMITING CONDITION OF OPERATION

(ODCM 9.7.1)

The air dose due to noble gases released in gaseous effluents, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 16.11-2) shall be limited to the following:

During any calendar quarter: Less than or equal to 5 mrads for gamma radiation and less than or equal to 10 mrads for beta radiation, and

During any calendar year: Less than or equal to 10 mrads for gamma radiation and less than or equal to 20 mrads for beta radiation.

APPLICABILITY: At all times.

ACTION:

a. With the calculated air dose from radioactive noble gases in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.2.2.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.7.2)

Cumulative dose contributions for the current calendar quarter and current calendar year for noble gases shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

16.11.2.2.2 BASES

This section is provided to implement the requirements of Sections II.B, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Limiting Conditions for Operation implements the guides set forth in Section II.B of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as is reasonably achievable".

The Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE

PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The dose calculation methodology and parameters established in the ODCM for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases on Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I", Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors", Revision 1, July 1977. The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

The reporting requirements of Action(a) implement the requirements of 10CFR20.2203.

16.11.2.3 DOSE - IODINE-131 AND 133, TRITIUM, AND RADIOACTIVE MATERIAL IN PARTICULATE FORM LIMITING CONDITION OF OPERATION

(ODCM 9.8.1)

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 8 days in gaseous effluents released, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 16.11-2) shall be limited to the following:

a. During any calendar quarter: Less than or equal to 7.5 mrems to any organ, and

b. During any calendar year: Less than or equal to 15 mrems to any organ.

APPLICABILITY: At all times.

ACTION:

a. With the calculated dose from the release of Iodine-131 and 133, tritium, and radionuclides in particulate form with half-lives greater than 8 days, in gaseous effluents exceeding any of the above limits, prepare and submit to the Commission within 30 days a Special Report that identifies the cause(s) for exceeding the limits and defines the corrective actions that have been taken to reduce the releases and the proposed corrective actions to be taken to assure that subsequent releases will be in compliance with the above limits.

b. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.2.3.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.8.2)

Cumulative dose contributions for the current calendar quarter and current calendar year for Iodine-131 and 133, tritium, and radionuclides in particulate form with half-lives greater than 8 days shall be determined in accordance with the methodology and parameters in the ODCM at least once per 31 days.

16.11.2.3.2 BASES

This section is provided to implement the requirements of Sections II.C, III.A, and IV.A of Appendix I, 10 CFR Part 50. The Limiting Conditions for Operation are the guides set forth in Section II.C of Appendix I. The ACTION statements provide the required operating flexibility and at the same time implement the guides set forth in Section IV.A of Appendix I to assure that the release of radioactive material in gaseous effluents to UNRESTRICTED AREAS will be kept "as low as reasonably achievable". The ODCM calculational methods specified in the Surveillance Requirements implement the requirements in Section III.A of Appendix I that conformance with the guides of Appendix

I be shown by calculational procedures based on models and data such that the actual exposure of a MEMBER OF THE PUBLIC through appropriate pathways is unlikely to be substantially underestimated. The ODCM calculational methodology and parameters for calculating the doses due to the actual release rates of the subject materials are consistent with the methodology provided in Regulatory Guide 1.109, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I", Revision 1, October 1977 and Regulatory Guide 1.111, "Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water Cooled Reactors", Revision 1, July 1977. These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate controls for Iodine-131, and 133, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent upon the existing radionuclide pathways to man, in the areas at and beyond the SITE BOUNDARY. The pathways that were examined in the development of these calculations were: (1) individual inhalation of airborne radionuclides, (2) deposition of radionuclides onto green leafy vegetation with subsequent consumption by man, (3) deposition of radionuclides onto grassy areas where milk animals and meat-producing animals graze with consumption of the milk and meat by man, and (4) deposition on the ground with subsequent exposure of man.

The reporting requirements of Action(a) implement the requirements of 10CFR20.2203.

16.11.2.4 RADIOACTIVE GASEOUS EFFLUENT MONITORING (3/4.3.3.10) INSTRUMENTATION LIMITING CONDITION FOR OPERATION

(ODCM 9.2.1)

The radioactive gaseous effluent monitoring instrumentation channels shown in Table 16.11-5 shall be OPERABLE with their Alarm/Trip Setpoints set to ensure that the limits of Section 16.11.2.1 are not exceeded. The Alarm/Trip Setpoints of these channels meeting Section 16.11.2.1 shall be determined and adjusted in accordance with the methodology and parameters in the ODCM.

APPLICABILITY: As shown in Table 16.11-5.

ACTION:

a. With a radioactive gaseous effluent monitoring instrumentation channel Alarm/Trip Setpoint less conservative than required by the above, immediately declare the channel inoperable.

b. With less than the minimum number of radioactive gaseous effluent monitoring instrumentation channels OPERABLE, take the ACTION shown in Table 16.11-5. Restore the inoperable instrumentation to OPERABLE status within the time specified in the ACTION, or explain in the next Radioactive Effluent Release Report, pursuant to Technical Specification 5.6.3, why this inoperability was not corrected within the time specified.

c. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.2.4.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.2.2)

Each radioactive gaseous effluent monitoring instrumentation channel shall be demonstrated OPERABLE by performance of the CHANNEL CHECK, SOURCE CHECK, CHANNEL CALIBRATION and CHANNEL OPERATIONAL TEST at the frequencies shown in Table 16.11-6.

16.11.2.4.2 BASES

The radioactive gaseous effluent monitoring instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in gaseous effluents during actual or potential releases of gaseous effluents. The Alarm/Trip Setpoints for these instruments shall be calculated and adjusted in accordance with the methodology and parameters in the ODCM to ensure that the alarm/trip will occur prior to exceeding the limits of 10 CFR Part 20. The OPERABILITY and use of this instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR Part 50. The sensitivity of any noble gas activity monitor used to show

compliance with the gaseous effluent release requirements of Section 16.11.2.1 shall be such that concentrations as low as 1 x 10^{-6} μCi/cc are measurable.

The monitors GT-RE-22 and GT-RE-33 are only required fo automatic containment purge isolation in MODES 1 through 4. For plant conditions during CORE ALTERATIONS and during movement of irradiated fuel within containment, the function of the monitors is to alarm only and the trip signals for automatic actuation of CPIS may be bypassed. Based on the guidance provided in Regulatory Guide 1.97 concerning monitoring requirements for containment or purge effluent, the monitors GT-RE-22 and GT-RE-33 do not need to meet the single failutre criterion for an Alarm function only during CORE ALTERATIONS or during movement of irradiated fuel in containment. One instrumentation channel at a minimum is required for the alarm only function during refueling activities.

16.11.2.5 GASEOUS RADWASTE TREATMENT SYSTEM LIMITING CONDITION OF OPERATION

(ODCM 9.9.1)

The VENTILATION EXHAUST TREATMENT SYSTEM and the WASTE GAS HOLDUP SYSTEM shall be OPERABLE and appropriate portions of these systems shall be used to reduce releases of radioactivity when the projected doses in 31 days due to gaseous effluent releases, from each unit, to areas at and beyond the SITE BOUNDARY (see Figure 16.11-2) would exceed:

a. 0.2 mrad to air from gamma radiation, or

b. 0.4 mrad to air from beta radiation, or

c. 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

APPLICABILITY: At all times

ACTION:

I. With radioactive gaseous waste being discharged without treatment and in excess of the above limits, prepare and submit to the Commission within 30 days a Special Report that includes the following information:

   1) Identification of any inoperable equipment or subsystems, and the reason for the inoperability,

   2) Action(s) taken to restore the inoperable equipment to OPERABLE status, and

   3) Summary description of action(s) taken to prevent a recurrence.

II. The provision of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.2.5.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.9.2)

16.11.2.5.1.a

Doses due to gaseous releases from each unit to areas at and beyond the SITE BOUNDARY shall be projected at least once per 31 days in accordance with the methodology and parameters in the ODCM.

16.11.2.5.1.b

The installed VENTILATION EXHAUST TREATMENT SYSTEM and the WASTE GAS HOLDUP SYSTEMS shall be considered OPERABLE by meeting Sections 16.11.2.1 and 16.11.2.2 or 16.11.2.3.

16.11.2.5.2 BASES

The OPERABILITY of the WASTE GAS HOLDUP SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the system will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable". This control implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

The installed VENTILATION EXHAUST TREATMENT SYSTEM and the WASTE GAS HOLDUP SYSTEMS shall be considered OPERABLE by meeting Sections 16.11.2.1 and 16.11.2.2 or 16.11.2.3.

16.11.2.5.2 BASES

The OPERABILITY of the WASTE GAS HOLDUP SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM ensures that the system will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that the appropriate portions of these systems be used, when specified, provides reasonable assurance that the releases of radioactive materials in gaseous effluents will be kept "as low as is reasonably achievable". This control implements the requirements of 10 CFR Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR Part 50, and the design objectives given in Section II.D of Appendix I to 10 CFR Part 50. The specified limits governing the use of appropriate portions of the systems were specified as a suitable fraction of the dose design objectives set forth in Sections II.B and II.C of Appendix I, 10 CFR Part 50, for gaseous effluents.

16.11.2.6 EXPLOSIVE GAS MIXTURE LIMITING CONDITION FOR OPERATION

The concentration of oxygen in the WASTE GAS HOLDUP SYSTEM shall be limited to less than or equal to 3% by volume whenever the hydrogen concentration exceeds 4% by volume.

APPLICABILITY: At all times.

ACTION:

a. With the concentration of oxygen in the WASTE GAS HOLDUP SYSTEM greater than 3% by volume but less than or equal to 4% by volume, reduce the oxygen concentration to the above limit within 48 hours.

b. With the concentration of oxygen in the WASTE GAS HOLDUP SYSTEM greater than 4% by volume and the hydrogen concentration greater than 4% by volume, immediately suspend all additions of waste gases to the system and reduce the concentration on oxygen to less than or equal to 4% by volume, then take ACTION a. above.

c. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.2.6.1 SURVEILLANCE REQUIREMENTS

The concentrations of hydrogen and oxygen in the WASTE GAS HOLDUP SYSTEM shall be determined to be within the above limits by continuously monitoring the waste gases in the WASTE GAS HOLDUP SYSTEM with the hydrogen and oxygen monitors required OPERABLE by Section 16.11.2.7. The provisions of Sections 16.0.2.2 and 16.0.2.3 are applicable, however the allowed surveillance interval extension beyond 25% shall not be exceeded. This system is also covered by Administrative Controls Section 5.5.12.

16.11.2.6.2 BASES

This specification is provided to ensure that the concentration of potentially explosive gas mixtures contained in the WASTE GAS HOLDUP SYSTEM is maintained below the flammability limits of hydrogen and oxygen. Automatic control features are included in the system to prevent the hydrogen and oxygen concentrations from reaching these flammability limits. These automatic control features include isolation of the source of hydrogen and/or oxygen. Maintaining the concentration of hydrogen and oxygen below their flammability limits provides assurance that the releases of radioactive materials will be controlled in conformance with the requirements of General Design Criterion 60 of Appendix A to 10 CFR Part 50.

16.11.2.7 WASTE GAS HOLDUP SYSTEM RECOMBINER EXPLOSIVE GAS MONITORING INSTRUMENTATION LIMITING CONDITION FOR OPERATION

At least one hydrogen and both the inlet and outlet oxygen explosive gas monitoring instrument channels for each WASTE GAS HOLDUP SYSTEM recombiner shall be OPERABLE with their Alarm/Trip Setpoints (with the exception of the "FEED H2 4%/ FEED O2 3%" and "FEED H2 4%/FEED O2 4%" alarms) set to ensure that the limits of Section 16.11.2.6 are not exceeded.

APPLICABILITY: During WASTE GAS HOLDUP SYSTEM operation.

ACTION:

a. With an outlet oxygen monitor channel inoperable, operation of the system may continue provided grab samples are taken and analyzed at least once per 24 hours.

b. With both oxygen or both hydrogen channels or both the inlet oxygen and inlet hydrogen monitor channels for one recombiner inoperable, suspend oxygen supply to the recombiner. Addition of waste gas to the system may continue provided grab samples are taken and analyzed at least; 1) once per 4 hours during mechanical or chemical degassing in preparation for plant shutdown and 2) once per 24 hours during other operations.

c. With the inlet Oxygen analyzer inoperable, operation of the system may continue provided the inlet Hydrogen is maintained less than 4%. If inlet Hydrogen is greater than 4%, suspend oxygen to the recombiner. Addition of waste gas to the system may continue provided grab samples are taken and analyzed at least; 1) once per 4 hours during mechanical or chemical degassing operations in preparation for plant shutdown and 2) once per 24 hours during other operations.

d. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.2.7.1 SURVEILLANCE REQUIREMENTS

The provisions of Sections 16.0.2.2 and 16.0.2.3 are applicable, however the allowed surveillance interval extension beyond 25% shall not be exceeded. This system is also covered by Administrative Controls Section 5.5.12.

Each waste gas holdup system recombiner explosive gas monitoring instrumentation channel shall be demonstrated OPERABLE by performance of:

a. A CHANNEL CHECK at least once per 24 hours,

b. Not used

c. A CHANNEL CALIBRATION at least once per 92 days with the use of standard gas samples containing a nominal:

1) One volume percent hydrogen, balance nitrogen and four volume percent hydrogen, balance nitrogen for the hydrogen monitor, and

2) One volume percent oxygen, balance nitrogen, and four volume percent oxygen, balance nitrogen for the inlet oxygen monitor, and

3) 10 ppm by volume oxygen, balance nitrogen and 80 ppm by volume oxygen, balance nitrogen for the outlet oxygen monitor.

16.11.2.7.2 BASES

Mechanical 'degassing operation' is defined as the transfer of gas from the Volume Control Tank (VCT) to the Waste Gas Holdup System when establishing a nitrogen blanket on the VCT in preparation for a plant shutdown. Chemical 'degassing operation' is the process of adding hydrogen peroxide to the RCS after the VCT hydrogen blanket has been replaced with nitrogen per the Mechanical degassification process and the RCS has been reduced to less than 180°F. Both Mechanical and Chemical degassification may lead to an explosive gas mixture in the Waste Gas Holdup System, thus requiring the more restrictive 4 hour sampling. Other operations require 24 hour sampling.

The "FEED H2 4%/FEED O2 3%" AND "FEED H2 4%/FEED O2 4%" alarms are not required to be OPERABLE. These alarms result from the combination of inlet Hydrogen and inlet Oxygen analyzer outputs while the FSAR only addresses OPERABILITY of each separate analyzer. Only the individual alarms and control functions associated with each analyzer are to be used to determine its operability. These alarms and control functions are sufficient to ensure that the requirements of Section 16.11.2.6 are not exceeded.

The CHANNEL CALIBRATION will include triggering the following alarms at the analyzer and verifying that the required control board annunciators and control functions actuate:

1) Feed Gas High H_2

2) HARC-1104 OAIC-1112 Hi Hi H_2/O_2 O_2 Shutdown

3) H_2 Reactor High Oxygen O_2 Limit

4) Product Gas High H_2

5) Product Gas High Oxygen

6) Product Gas Hi Hi O_2 Shutdown

This will verify the OPERABILITY of the analyzers' output relays, all interposing relays, and the annunciators. Setpoint verification will consist of verifying that the correct setpoint values are entered in the analyzers' database.

16.11.2.8 GAS STORAGE TANKS LIMITING CONDITION FOR OPERATION

The quantity of radioactivity contained in each gas storage tank shall be limited to less than or equal to 2.5×10^5 Curies of noble gases (considered as Xe-133 equivalent).

APPLICABILITY: At all times.

ACTION:

a. With the quantity of radioactive material in any gas storage tank exceeding the above limit, immediately suspend all additions of radioactive material to the tank and, within 48 hours, reduce the tank contents to within the limit, and describe the events leading to this condition in the next Radioactive Effluent Release Report, pursuant to Technical Specification 5.6.3.

b. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.2.8.1 SURVEILLANCE REQUIREMENTS

The provisions of Sections 16.0.2.2 and 16.0.2.3 are applicable, however the allowed surveillance interval extension beyond 25% shall not be exceeded. This system is also covered by Administrative Controls Section 5.5.12.

The quantity of radioactive material contained in each gas storage tank shall be determined to be within the above limit at least once per 18 months.

16.11.2.8.2 BASES

The tanks included in this specification are those tanks for which the quantity of radioactivity contained is not limited directly or indirectly by another Technical Specification. Restricting the quantity of radioactivity contained in each gas storage tank provides assurance that in the event of an uncontrolled release of the tank's contents, the resulting whole body exposure to a MEMBER OF THE PUBLIC at the nearest SITE BOUNDARY will not exceed 0.5 rem. This is consistent with Standard Review Plan 11.3, Branch Technical Position ETSB 11-5, "Postulated Radioactive Releases Due to a Waste Gas System Leak or Failure," in NUREG-0800, July 1981. The determination of Xe-133 equivalent uses the effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12, EPA-402-R-93-081, "External Exposure to Radionuclides in Air, Water, and Soil," 1993.

5|06

16.11.3 TOTAL DOSE

16.11.3.1 TOTAL DOSE LIMITING CONDITION FOR OPERATION

(ODCM 9.10.1)

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 mrems to the whole body or any organ, except the thyroid, which shall be limited to less than or equal to 75 mrem.

APPLICABILITY: At all times.

ACTION:

a. With the calculated doses from the release of radioactive materials in gaseous effluents exceeding twice the limits of Section 16.11.2.2a, 16.11.2.2b, 16.11.2.3a, or 16.11.2.3b, calculations should be made including direct radiation contributions from the units and from outside storage tanks to determine whether the above limits of Section 16.11.3.1 have been exceeded. If such is the case, prepare and submit to the Commission within 30 days a Special Report that defines the corrective action to be taken to reduce subsequent release to prevent recurrence of exceeding the above limits and includes the schedule for achieving conformance with the above limits. This Special Report, as defined in 10 CFR 20.2203, shall include an analysis that estimates the radiation exposure (dose) to a MEMBER OF THE PUBLIC from uranium fuel cycle sources, including all effluent pathways and direct radiation, for the calendar year that includes the release(s) covered by this report. It shall also describe levels of radiation and concentrations of radioactive material involved, and the cause of the exposure levels or concentrations. If the estimated dose(s) exceeds the above limits, and if the release condition resulting in violation of 40 CFR Part 190 has not already been corrected, the Special Report shall include a request for a variance in accordance with the provisions of 40 CFR Part 190. Submittal of the report is considered a timely request, and a variance is granted until staff action on the request is complete.

b. The provisions of Technical Specifications 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.3.1.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.10.2)

16.11.3.1.1.a

Cumulative dose contributions from gaseous effluents shall be determined in accordance with Sections 16.11.2.2.1, and 16.11.2.3.1, and in accordance with the methodology and parameters in the ODCM.

16.11.3.1.1.b

Cumulative dose contributions from direct radiation from the units and from radwaste storage tanks shall be determined in accordance with the methodology and parameters in the ODCM. This requirements is applicable only under conditions set forth in ACTION a. of Section 16.11.3.1.

16.11.3.1.2 BASES

This specification is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR Part 20.1301. The control requires the preparation and submittal of a Special Report whenever the calculated doses due to releases of radioactivity and the radiation from uranium fuel cycle sources exceed 25 mrems to the whole body or any organ except the thyroid, which shall be limited to less than or equal to 75 mrems. For sites containing up to four reactors, it is highly unlikely that the resultant dose to a MEMBER OF THE PUBLIC will exceed the dose limits of 40 CFR Part 190 if the individual reactors remain within twice the dose design objectives of Appendix I, and if direct radiation doses from the reactor units and from outside storage tanks are kept small. The Special Report will describe a course of action that should result in the limitation of the annual dose to a MEMBER OF THE PUBLIC to within the 40 CFR Part 190 limits.

For the purposes of the Special Report, it may be assumed that the dose commitment to the MEMBER OF THE PUBLIC from other uranium fuel cycle sources is negligible, with the exception that dose contributions from other nuclear fuel cycle facilities at the same site or within a radius of 8 km must be considered. If the dose to any MEMBER OF THE PUBLIC is estimated to exceed the requirements of 40 CFR Part 190, the Special Report with a request for a variance (provided the release conditions resulting in violation of 40 CFR Part 190 have not already been corrected), in accordance with the provisions of 40 CFR Part 190.11 and 10 CFR 20.2203, is considered to be a timely request and fulfills the requirements of 40 CFR Part 190 until NRC staff action is completed. The variance only relates to 40 CFR Part 190, and does not apply in any way to the other requirements for dose limitation of 10 CFR Part 20, as addressed in Sections 16.11.1.1 and 16.11.2.1. An individual is not considered a MEMBER OF THE PUBLIC during any period in which he/she is engaged in carrying out any operation that is part of the nuclear fuel cycle.

There are three defined effluent release categories: 1.) Releases directly to the hydrosphere; 2.) noble gas releases to the atmosphere; 3.) radioiodine and particulate releases to the atmosphere. For each effluent release category, it is assumed in the dose calculations that an individual with the highest dose potential is the receptor. In general, the adult is considered to be the critical age group for liquid effluents, and the child age group is the most limiting for radioiodine and particulates in gaseous effluents.

Thus, it is highly unlikely or impossible for the same individual to simultaneously receive the highest dose via all three effluent categories. For most reactor sites, it is also unlikely that all different potential dose pathways would contribute to the dose to a single real individual. Since it is difficult or impossible to continually determine actual food use patterns and critical age group, for calculational purposes, assumptions are made which tend to maximize doses. Any refinement in the assumptions would have the effect of reducing the estimated dose. For radionuclides released to the hydrosphere, the degree of overestimation in most situations is such that no individual will receive a significant dose. These conservative assumptions generally result in an overestimation of dose by one or two orders of magnitude. Since these assumptions are reflected in the Radiological Effluent Controls limiting radionuclide releases to design objective individual doses, no offsite individual is likely to actually receive a significant dose. Since the doses from liquid releases are very conservatively evaluated, there is reasonable assurance that no real individual will receive a significant dose from radioactive liquid release pathway. Therefore, only doses to individuals via airborne pathways and dose resulting from direct radiation need to be considered in determining potential compliance to 40 CFR 190*.

The reporting requirements of Action(a) implement the requirements of 10CFR20.2203.

---

* NUREG-0543, "Methods for Demonstrating LWR compliance with the EPA Uranium Fuel Cycle Standard (40 CFR 190)", Congel, F. J., Office of Nuclear Reactor Regulation, USNRC. January, 1980. pp. 5-8.

16.11.4 RADIOLOGICAL ENVIRONMENTAL MONITORING

16.11.4.1 MONITORING PROGRAM LIMITING CONDITION OF OPERATION

(ODCM 9.11.1)

The Radiological Environmental Monitoring Program shall be conducted as specified in Table 16.11-7.

APPLICABILITY: At all times.

ACTION:

a. With the Radiological Environmental Monitoring Program not being conducted as specified in Table 16.11-7, prepare and submit to the Commission, in the Annual Radiological Environmental Operating Report required by Technical Specification 5.6.2, a description of the reasons for not conducting the program as required and the plans for preventing a recurrence.

b. With the level of radioactivity as the result of plant effluents in an environmental sampling medium at a specified location exceeding the reporting levels of Table 16.11-8 when averaged over any calendar quarter, prepare and submit to the Commission within 30 days a Special Report that identifies the cause(s) for exceeding the limit(s) and defines the corrective actions to be taken to reduce radioactive effluents so that the potential annual dose* to a MEMBER OF THE PUBLIC is less than the calendar year limits of Sections 16.11.1.2, 16.11.2.2, or 16.11.2.3. When more than one of the radionuclides in Table 16.11-8 are detected in the sampling medium, this report shall be submitted if:

$$\frac{\text{concentration (1)}}{\text{reporting level (1)}} + \frac{\text{concentration (2)}}{\text{reporting (2)}} + \ldots \geq 1.0$$

When radionuclides other than those in Table 16.11-8 are detected and are the result of plant effluents, this report shall be submitted if the potential annual dose* to A MEMBER OF THE PUBLIC from all radionuclides is equal to or greater than the calendar year limits of Sections 16.11.1.2, 16.11.2.2 or 16.11.2.3. This report is not required if the measured level of radioactivity was not the result of plant effluents; however, in such an event, the condition shall be reported and described in the Annual Radiological Environmental Operating Report, required by Technical Specification 5.6.2.

c. With milk or fresh leafy vegetable samples unavailable from one or more of the sample locations required by Table 16.11-7, identify specific locations for

* The methodology and parameters used to estimate the potential annual dose to a MEMBER OF THE PUBLIC shall be indicated in this report.

obtaining replacement samples and add them within 30 days to the Radiological Environmental Monitoring Program*. The specific locations from which samples were unavailable may then be deleted from the monitoring program. In the next Annual Radiological Environmental Operating Report include the revised figure(s) and tables reflecting the new sample location(s) with supporting information identifying the cause of the unavailability of samples and justifying the selection of new location(s) for obtaining samples.

d. When LLDs specified in Table 16.11-9 are unachievable due to uncontrollable circumstances, (such as background fluctuations, unavailable small sample sizes, the presence of interfering nuclides, etc.) the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report.

e. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.4.1.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.11.2)

The radiological environmental monitoring samples shall be collected pursuant to Table 16.11-7 and shall be analyzed pursuant to the requirements of Table 16.11-7 and the detection capabilities required by Table 16.11-9.

16.11.4.1.2 BASES

The Radiological Environmental Monitoring Program required by this REC provides representative measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides that lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the station operation. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and thereby supplements the Radiological Effluent Monitoring Program by verifying that the measurable concentrations of radioactive materials and levels of radiation are not higher than expected on the basis of the effluent measurements and the modeling of the environmental exposure pathways. Guidance for this monitoring program is provided by the Radiological Assessment Branch Technical Position on Environmental Monitoring, Revision 1, November 1979. The initially specified monitoring program will be effective for at least the first 3 years of commercial operation. Following this period, program changes may be initiated based on operational experience.

The required detection capabilities for environmental sample analyses are tabulated in terms of the lower limits of detection (LLD's). The LLD's required by Table 16.11-9 are considered optimum for routine environmental measurements in industrial laboratories.

---

* Excluding short term or temporary unavailability.

16.11.4.2 LAND USE CENSUS LIMITING CONDITION OF OPERATION

(ODCM 9.12.1)

A Land Use Census shall be conducted and shall identify within a distance of 8 km (5 miles) the location in each of the 16 meteorological sectors of the nearest milk animal, the nearest residence and the nearest garden* of greater than $50m^2$ ($500 ft^2$) producing broad leaf vegetation. The Land Use Census shall identify water intakes constructed within 10 river miles downstream of the plant discharge point.

APPLICABILITY: At all times.

ACTION:

a. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment greater than the values currently being calculated by Section 16.11.2.3.1, identify the new location(s) in the next Radioactive Effluent Release Report, pursuant to Technical Specification 5.6.3.

b. With a Land Use Census identifying a location(s) that yields a calculated dose or dose commitment (via the same exposure pathway) 20% greater than at a location from which samples are currently being obtained in accordance with Section 16.11.4.1, add the new location(s) within 30 days to the Radiological Environmental Monitoring Program except for vegetation samples which shall be added to the program before the next growing season. The sampling location(s), excluding the control station location, having the lowest calculated dose or dose commitment(s), via the same exposure pathway, may be deleted from this monitoring program after October 31 of the year in which this Land Use Census was conducted. In the next Annual Radiological Environmental Operating Report include the revised figure(s) and tables reflecting the new sample location(s) with information supporting the change in sample location.

c. With a Land Use Census identifying a water intake within 10 river miles downstream of the plant discharge point, implement the appropriate waterborne or ingestion sampling required by Table 16.11-7.

d. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

---

* Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the SITE BOUNDARY in each to two different direction sectors with the highest predicted D/Q's in lieu of the garden census. Specifications for broad leaf vegetation sampling in Table 9.11-A, Part 4.c shall be followed, including analysis of control samples.

16.11.4.2.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.12.2)

The Land Use Census shall be conducted during the growing season at least once per 12 months using that information which will provide the best results, such as, but not limited to, door-to-door survey, aerial survey, or by consulting local agriculture authorities and/or residents. The results of the Land Use Census shall be included in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 5.6.2.

16.11.4.2.2 BASES

This specification is provided to ensure that changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the Radiological Environmental Monitoring Program given in the ODCM are made if required by the results of this census. Information that will provide the best results, such as door-to-door survey, aerial survey, or consulting with local agricultural authorities, shall be used. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50.

Restricting the census to gardens of greater than 50 m^2 provides assurance that significant exposure pathways via leafy vegetables will be identified and monitored since a garden of this size is the minimum required to produce the quantity (26 kg/year) of leafy vegetables assumed in Regulatory Guide 1.109 for consumption by a child. To determine this minimum garden size, the following assumptions were made: (1) 20% of the garden was used for growing broad leaf vegetation (i.e., similar to lettuce and cabbage), and (2) a vegetation yield of 2 kg/m^2.

16.11.4.3 INTERLABORATORY COMPARISON PROGRAM LIMITING CONDITION OF OPERATION

(ODCM 9.13.1)

Analyses shall be performed on radioactive materials supplied as part of an Interlaboratory Comparison Program that has been approved by the USNRC.

APPLICABILITY: At all times.

ACTION:

a. With analyses not being performed as required above, report the corrective actions taken to prevent a recurrence to the Commission in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 5.6.2.

b. The provisions of Sections 16.0.1.3 and 16.0.1.4 are not applicable.

16.11.4.3.1 SURVEILLANCE REQUIREMENTS

(ODCM 9.13.2)

The Interlaboratory Comparison Program shall be described in the plant procedures. A summary of the results obtained as part of the above required Interlaboratory Comparison Program shall be included in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 5.6.2.

16.11.4.3.2 BASES

The requirement for participation in an approved Interlaboratory Comparison Program is provided to ensure that independent checks on the precision and accuracy of the measurements of radioactive material in environmental sample matrices are performed as part of the quality assurance program for environmental monitoring in order to demonstrate that the results are valid for the purpose of Section IV.B.2 of Appendix I to 10 CFR Part 50.

16.11.5 ADMINISTRATIVE CONTROLS

16.11.5.1 ANNUAL RADIOLOGICAL ENVIRONMENTAL OPERATING REPORT (ODCM 7.1)

Routine Annual Radiological Environmental Operating Report covering the operation of the unit during the previous calendar year shall be submitted prior to May 1 of each year.

The Annual Radiological Environmental Operating Report shall include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period, including a comparison with preoperational studies, with operational controls and with previous environmental surveillance reports, and an assessment of the observed impacts of the plant operation on the environment. The reports shall include the results of Land Use Census required by Section 16.11.4.2. It shall also include a listing of new locations for environmental monitoring identified by the Land Use Census pursuant to Section 16.11.4.2.

The Annual Radiological Environmental Operating Report shall include the results of analysis of all radiological environmental samples and of all environmental radiation measurements taken during the period pursuant to Section 16.11.4.1, as well as summarized tabulated results of these analyses and measurements in the format of the table in the Radiological Assessment Branch Technical Position, Revision 1, November 1979. In the event that some individual results are not available for inclusion with the report, the report shall be submitted noting and explaining the reasons for the missing results. The missing data shall be submitted as soon as possible in a supplementary report. The reports shall also include the following: a summary description of the radiological environmental monitoring program; at least two legible maps* covering all sampling locations keyed to a table giving distances and directions from the midpoint between the two reactors; the results of licensee participation in the Interlaboratory Comparison Program and the corrective action being taken if the specified program is not being performed as required by Section 16.11.4.3; reasons for not conducting the Radiological Environmental Monitoring Program as required by Section 16.11.4.1 and discussion of all deviations from the sampling schedule of Table 16.11-7, discussion of environmental sample measurements that exceed the reporting levels of Table 16.11-8, but are not the result of the plant effluents, pursuant to Section 16.11.4.1; and discussion of all analyses in which the LLD required by Table 16.11-9 was not achievable.

16.11.5.1.1 BASES

The reporting requirement for the Annual Radiological Environmental Operating Report is provided to ensure compliance with Technical Specification 5.6.2. This requirement was relocated from the Offsite Dose Calculation Manual to FSAR Chapter 16.

---

* One map shall cover stations near the SITE BOUNDARY; a second shall include the more distant stations.

16.11.5.2 RADIOACTIVE EFFLUENT RELEASE REPORT

(ODCM 7.2)

Routine Radioactive Effluent Release Reports covering the operation of the unit during the previous calendar year shall be submitted prior to May 1 of each year.

The Radioactive Effluent Release Report shall include a summary of the quantities of radioactive liquid and gaseous effluents released from the unit as outlined in Regulatory Guide 1.21, "Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, "Revision 1, June 1974, with data summarized on a quarterly basis following the format of Appendix B thereof.

The Radioactive Effluent Release Report shall include an annual summary of hourly meteorological data collected over the previous calender year. This annual summary may be either in the form of an hour-by-hour listing on magnetic tape of wind speed, wind direction, atmospheric stability, and precipitation (if measured), or in the form of joint frequency distribution of wind speed, wind direction, and atmospheric stability* .

This report shall also include an assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit during the previous calendar year. This report shall also include an assessment of the radiation doses from radioactive liquid and gaseous effluents to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY (Figures 16.11-1 and 16.11-2) during the report period using historical average atmospheric conditions. All assumptions used in making these assessments, i.e., specific activity, exposure time and location, shall be included in these reports. The meteorological conditions concurrent with the time of release of radioactive materials in gaseous effluents, as determined by sampling frequency and measurement, shall be used for determining the gaseous pathway doses. Assessment of radiation doses shall be performed in accordance with the methodology and parameters in the OFFSITE DOSE CALCULATION MANUAL (ODCM).

The Radioactive Effluent Release Report shall include an assessment of radiation doses to the most likely exposed MEMBER OF THE PUBLIC from reactor releases and other nearby uranium fuel cycle sources, including doses from primary effluent pathways and direct radiation, for the previous calendar year to show conformance with 40 CFR Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operation." Doses to the MEMBER OF THE PUBLIC shall be calculated using the methodology and parameters of the ODCM.

---

* In lieu of submission with the Annual Radioactive Effluent Release Report, Union Electric has the option of retaining this summary of required meteorological data on site in a file that shall be provided to the NRC upon request.

The Radioactive Effluent Release Report shall include a list and description of unplanned releases from the site to UNRESTRICTED AREAS of radioactive materials in gaseous and liquid effluents made during the reporting period.

The Radioactive Effluent Release Report shall include a summary description of any major changes made during the year to any Liquid or Gaseous Treatment Systems, pursuant to Offsite Dose Calculation Manual. It shall also include a listing of new locations for dose calculations identified by the Land Use Census pursuant to Section 16.11.4.2.

Reporting requirements for changes to Solid Waste Treatment Systems are addressed in APA-ZZ-01011, PROCESS CONTROL PROGRAM (PCP).

The Radioactive Effluent Release Report shall also include the following information: An explanation as to why the inoperability of liquid or gaseous effluent monitoring instrumentation was not corrected within the time specified, and a description of the events leading the liquid holdup tanks or gas storage tanks exceeding the limits of Section 16.11.1.5 or 16.11.2.8.

The Radioactive Effluent Release Report shall include as part of or submitted concurrent with, a complete and legible copy of all revisions of the ODCM that occurred during the year pursuant of Technical Specification 5.5.1.

Solid Waste reporting is addressed in APA-ZZ-01011, PROCESS CONTROL PROGRAM (PCP).

16.11.5.2.1 BASES

The reporting requirement for the Radioactive Effluent Release Report is provided to ensure compliance with Technical Specification 5.6.3. This requirement was relocated from the Offsite Dose Calculation Manual to FSAR Chapter 16.

TABLE 16.11-1 RADIOACTIVE LIQUID WASTE SAMPLING AND ANALYSIS PROGRAM

1. Discharge Monitor Tanks (Batch Release) (2)			
SAMPLING FREQUENCY(7)	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LLD (1) (μCi/ml)
Prior to Each Batch	Prior to Each Batch	Principal Gamma Emitters (3)	5E-7
		I-131	1E-6
		Dissolved and Entrained Gases (Gamma Emitters)	1E-5
		H-3	1E-5
	Monthly Composite (4)	Gross Alpha	1E-7
	Quarterly Composite (4)	Sr-89, Sr-90	5E-8
		Fe-55	1E-6
		Np-237	5E-9
		Pu-238	5E-9
		Pu-239/240	5E-9
		Pu-241	5E-7
		Am-241	5E-9
		Cm-242	5E-9
		Cm-243/244	5E-9

2. Steam Generator Blowdown (Concinuous Release) (5)			
SAMPLING FREQUENCY(7)	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LLD (1) (μCi/ml)
Daily Grab Sample (6)	Daily	Principal Gamma Emitters (3)	5E-7
		I-131	1E-6
		Dissolved and Entrained Gases (Gamma Emitters)	1E-5
		H-3	1E-5
	MonthlyComposite (4)	Gross Alpha	1E-7
	Quarterly Composite (4)	Sr-89, Sr-90	5E-8
		Fe-55	1E-6

TABLE NOTATIONS

(1) The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive 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:

$$LLD = \frac{4.66\ S_b}{E \times V \times 2.22E6 \times Y \times \exp(-\lambda \Delta t)}$$

Where:

LLD = the "a priori" lower limit of detection (microCuries per unit mass or volume),

S_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22E6= the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec-1), and

TABLE 16.11-1 (Sheet 2)

Δt = the elapsed time between the midpoint of the sample collection period, and the time of counting (sec). For batch releases, $\Delta t=0$.

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as a "a priori" (before the fact) limit representing the capability of a measurement system and not as an "a posteriori" (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLD's will be achieved under routine conditions.

(2) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analyses, each batch shall be isolated, and then thoroughly mixed by a method described in the ODCM to assure representative sampling.

(3) The principal gamma emitters for which the LLD control applies include the following radionuclides: Mn-54, Fe-59, Co-58, Co-60, Zn-65, Mo-99, Cs-134, Cs-137, Ce-141, and Ce-144. This list does not mean that only these nuclides are to be considered. Other gamma peaks that are identifiable, together with those of the above nuclides, shall also be analyzed and reported in the Radioactive Effluent Release Report pursuant to Technical Specification 5.6.3, in the format outlined in Regulatory Guide 1.21, Appendix B, Revision 1, June 1974. 4/04

(4) A composite sample is one in which the quantity of liquid sampled is proportional to the quantity of liquid waste discharged and in which the method of sampling employed results in a specimen that is representative of the liquids released. Prior to analysis, all samples taken for the composite shall be thoroughly mixed in order for the composite samples to be representative of the effluent release.

(5) A continuous release is the discharge of liquid wastes of a nondiscrete volume, e.g., from a volume of a system that has an input flow during the continuous release.

(6) Samples shall be taken at the initiation of effluent flow and at least once per 24 hours thereafter while the release is occurring. To be representative of the liquid effluent, the sample volume shall be proportioned to the effluent stream discharge volume. The ratio of sample volume to effluent discharge volume shall be maintained constant for all samples taken for the composite sample.

(7) Samples shall be representative of the effluent release.

TABLE 16.11-2 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION

	INSTRUMENT	MINIMUM CHANNELS OPERABLE	ACTION
1.	Radioactivity Monitors Providing Alarm and Automatic Termination of Release		
a.	Liquid Radwaste Discharge Monitor (HB-RE-18)	1	31
b.	Steam Generator Blowdown Discharge Monitor (BM-RE-52)	1	32
2.	Flow Rate Measurement Devices		
a.	Liquid Radwaste Blowdown Discharge Line (HB-FE-2017)	1	34
b.	Steam Generator Blowdown Discharge Line (BM-FE-0054)	1	34
c.	Cooling Tower Blowdown and Bypass Flow Totalizer (FYDB1017A)	1	34
3.	Discharge Monitoring Tanks (DMT's) Level		
a.	DMT A(HB-LI-2004)	1	33
b.	DMT B(HB-LI-2005)	1	33

ACTION STATEMENTS

ACTION 31 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided that prior to initiating a release:

a. At least two independent samples are analyzed in accordance with Section 16.11.1.1.1, and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge line valving.

Otherwise, suspend release of radioactive effluents via this pathway.

TABLE 16.11-2 (Sheet 2)
ACTION STATEMENTS

ACTION 32 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided grab samples are analyzed for principal gamma emitters and I-131 at a lower limit of detection as specified in Table 16.11-1:

a. At least once per 12 hours when the specific activity of the secondary coolant is greater than 0.01 micro-Curie/gram DOSE EQUIVALENT I-131, or

b. At least once per 24 hours when the specific activity of the secondary coolant is less than or equal to 0.01 micro-Curie/gram DOSE EQUIVALENT I-131.

ACTION 33 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the volume discharged is determined by alternate means.

ACTION 34 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue provided the flow rate is estimated at least once per 4 hours during actual releases. Pump performance curves generated in place may be used to estimate flow.

TABLE 16.11-3 RADIOACTIVE LIQUID EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL OPERATIONAL TEST
1. Radioactivity Monitors Providing Alarm and Automatic Termination of Release				
a. Liquid Radwaste Discharge Monitor (HB-RE-18)	D	P	R(2)	Q(1)
b. Steam Generator Blowdown Discharge Monitor (BM-RE-52)	D	M	R(2)	Q(1)
2. Flow Rate Measurement Devices				
a. Liquid Radwaste Blowdown Discharge Line (HB-FE-2017)	D(3)	N.A.	R	N.A.
b. Steam Generator Blowdown Discharge Line (BM-FE-0054)	D(3)	N.A.	R	N.A.
c. Cooling Tower Blowdown and Bypass Flow Totalizer (FYDB1017A)	D(3)	N.A.	R	N.A.
3. Discharge Monitoring Tanks (DMT's) Level				
a. DMT A(HB-LI-2004)	Prior to release (4)	N.A.	R	N.A.
b. DMT B(HB-LI-2005)	Prior to release (4)	N.A.	R	N.A.

TABLE 16.11-3 (Sheet 2)
TABLE NOTATIONS

1. The CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur as appropriate if any of the following conditions exists:

   a. Instrument indicates measured levels above the Alarm/Trip Setpoint (isolation and alarm), or

   b. Circuit failure (alarm only), or

   c. Instrument indicates a downscale failure (alarm only), or

   d. Instrument controls not set in operate mode (alarm only).

2. The initial CHANNEL CALIBRATION shall be performed using one or more of the reference (gas or liquid and solid) standards obtained from the National Institute of Standards and Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy, measurement range, and establish monitor response to a solid calibration source. For subsequent CHANNEL CALIBRATION, NIST traceable standard (gas, liquid, or solid) may be used; or a gas, liquid, or solid source that has been calibrated by relating it to equipment that was previously (within 30 days) calibrated by the same geometry and type of source standard traceable to NIST.

3. CHANNEL CHECK shall consist of verifying indication of flow during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made.

4. CHANNEL CHECK shall consist of verifying indication of tank level during periods of release. CHANNEL CHECK shall be made at least once per 24 hours on days on which continuous, periodic, or batch releases are made from the DMT.

TABLE 16.11-4 RADIOACTIVE GASEOUS EFFLUENTS SAMPLING AND ANALYSIS PROGRAM

1. Waste Gas Decay Tank			
SAMPLING FREQUENCY (9)	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LLD (1) (μCi/ml)
Prior to each release- grab sample	Prior to each tank	Principal Gamma Emitters- particulate, iodine, noble gas (2)	1E-4
Continuous	See footnote 8		

2. Containment Purge or Vent			
SAMPLING FREQUENCY (9)	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LLD (1) (μCi/ml)
Prior to each release- grab sample	Prior to each release	Principal Gamma Emitters- particulate, iodine, noble gas (2) H-3(oxide)	1E-4 1E-6
Continuous	See footnote 8		

3. Unit Vent (3)			
SAMPLING FREQUENCY (9)	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LLD (1) (μCi/ml)
Monthly- grab sample (3)(4)	Monthly (3)(4)	Principal Gamma Emitters- noble gas (2) H-3(oxide)	1E-4 1E-6
Continuous (6)	Weekly (7)	I-131 I-133 Principal Gamma Emitters- particulate nuclides only (2)	1E-12 1E-10 1E-11
	MonthlyComposite	Gross Alpha	1E-11
	Quarterly Composite	Sr-89, Sr-90	1E-11

1 Jan/06

4. Radwaste Building Vent			
SAMPLING FREQUENCY (9)	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LLD (1) (μCi/ml)
Monthly- grab sample	Monthly	Principal Gamma Emitters- noble gas (2)	1E-4
Continuous (6)	Weekly (7)	I-131 I-133 Principal Gamma Emitters- particulate nuclides only (2)	1E-12 1E-10 1E-11
	Monthly Composite	Gross Alpha	1E-11
	Quarterly Composite	Sr-89, Sr-90	1E-11

1 Jan/06

5. Laundry Decontamination Facility Dryer Exhaust			
SAMPLING FREQUENCY (9)	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LLD (1) (μCi/ml)
Continuous (6)	Weekly (7)	Principal Gamma Emitters- particulate nuclides only (2)	1E-11
	Monthly (10) Composite	Gross Alpha	1E-11
	Quarterly (10) Composite	Sr-89, Sr-90	1E-11

TABLE 16.11-4 (Sheet 2)

6. Containment ILRT Depressurization (Post-test Vent)			
SAMPLING FREQUENCY (9)	MINIMUM ANALYSIS FREQUENCY	TYPE OF ACTIVITY ANALYSIS	LLD (1) (μCi/ml)
Prior to each release- grab sample	Prior to each release	Principal Gamma Emitters- particulate, iodine, noble gas (2) H-3(oxide)	1E-4 1E-6

TABLE NOTATIONS

(1) The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive 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:

$$LLD = \frac{4.66\ S_b}{E \times V \times 2.22E6 \times Y \times \exp(-\lambda \Delta t)}$$

Where:

LLD = the "a priori" lower limit of detection (microCuries per unit mass or volume),

S_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

E = the counting efficiency (counts per disintegration),

V = the sample size (units of mass or volume),

2.22E6= the number of disintegrations per minute per microCurie,

Y = the fractional radiochemical yield, when applicable,

λ = the radioactive decay constant for the particular radionuclide (sec^{-1}), and

Δt = the elapsed time between the midpoint of the sample collection period, and the time of counting (sec).

Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as a "a priori" (before the fact) limit representing the capability of a measurement system and not as an "a posteriori" (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLD's will be achieved under routine conditions.

(2) The principal gamma emitters for which the LLD specification applies include the following radionuclides: Kr-87, Kr-88, Xe-133, Xe-133m, Xe-135, and Xe-138 in noble gas releases and Mn-54, Fe-59, Co-58, Co-60, Zn-65, I-131, Cs-134, Cs-137, Ce-141, and Ce-144 in iodine and particulate releases. This list does not mean that only these nuclides are to be considered. Any nuclide which is identified in the sample and which is also listed in the ODCM gaseous effluents dose factor tables, shall be analyzed and reported in the Radioactive Effluent Release Report.

(3) If the Unit Vent noble gas monitor (GT-RE-21B) shows that the effluent activity has increased (relative to the pre-transient activity) by more than a factor of 3 following a reactor shutdown, startup, or a thermal power change which exceeds 15% of the rated thermal power within a 1 hour period, samples shall be obtained and analyzed for noble gas, particulates and iodines. This sampling shall continue to be performed at least once per 24 hours for a period of 7 days or until the Unit Vent noble gas monitor no longer indicates a factor of 3 increase in Unit Vent noble gas activity, whichever comes first.

(4) Tritium grab samples shall be taken and analyzed at least once per 24 hours when the refueling canal is flooded.

(5) Deleted.

(6) The ratio of the sample flow rate to the sampled stream flow rate shall be known for the time period covered by each dose or dose rate calculation made in accordance with Sections 16.11.2.1, 16.11.2.2, and 16.11.2.3.

(7) Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing, or removal from the sampler. When sampling is performed in accordance with footnote 3 (above), then the LLD may be increased by a factor of 10.

(8) Continuous sampling of this batch release pathway is included in the continuous sampling performed for the corresponding continuous release pathway.

(9) Samples shall be representative of the effluent release.

(10) Required only if Mn-54, Fe-59, Co-58, Co-60, Zn-65, Cs-134, Cs-137, Ce-141, or Ce-144 are detected in principle gamma emitter analyses.

TABLE 16.11-5 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION

INSTRUMENT	MINIMUM CHANNELS OPERABLE	APPLICABILITY	ACTION
1. Unit Vent System			
a. Noble Gas Activity Monitor - Providing Alarm (GT-RE-21)	1	At all times	40,46
b. Iodine Sampler	1	At all times	43
c. Particulate Sampler	1	At all times	43
d. Unit Vent Flow Rate	1	At all times	45
e. Particulate and Radioiodine Sampler Flow Rate Monitor	1	At all times	43
2. Containment Purge System			
a. Noble Gas Activity Monitor			
- Providing Alarm and Automatic Termination of Release (GT-RE-22, GT-RE-33)	2	MODES 1,2,3, and 4.	41
- Providing Alarm function only	1	During CORE ALTERATIONS or movement of irradiated fuel within the containment	42
b. Iodine Sampler	1	MODES 1,2,3,4 and during CORE ALTERATIONS or movement of irradiated fuel within the containment	43
c. Particulate Sampler	1	MODES 1,2,3,4 and during CORE ALTERATIONS or movement of irradiated fuel within the containment	43
d. Containment Purge Ventilation Flow Rate	N/A	N/A	N/A

TABLE 16.11-5 (Sheet 2)

e. Particulate and Radioiodine Sampler Flow Rate Monitor	1	MODES 1,2,3,4 and during CORE ALTERATIONS or movement of irradiated fuel within the containment	43
3. Radwaste Building Vent System			
a. Noble Gas Activity Monitor-Providing Alarm and Automatic Termination of Release (GH-RE-10)	1	At all times	38,40
b. Iodine Sampler	1	At all times	43
c. Particulate Sampler	1	At all times	43
d. Radwaste Building Vent Flow Rate	N/A	N/A	N/A
e. Particulate and Radioiodine Sampler Flow Rate Monitor	1	At all times	43
4. Laundry Decontamination Faciliy Dryer Exhaust			
a. Particulate Monitor	1	When the dryers are operating	47
b. Particulate Monitor Flow Rate Meter	1	When the dryers are operating	47
c. Dryer Exhaust Ventilation Flow Rate	NA	NA	NA

ACTION STATEMENTS

ACTION 38 - With the number of low range channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, the contents of the tank(s) may be released to the environment for up to 14 days provided that prior to initiating the release:

a. At least two independent samples of the tank's contents are analyzed, and

b. At least two technically qualified members of the facility staff independently verify the release rate calculations and discharge valve lineup.

TABLE 16.11-5 (Sheet 3)

Otherwise, suspend release of radioactive effluents via this pathway.

ACTION 39 - Deleted.

ACTION 40 - With the number of low range channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via this pathway may continue for up to 30 days provided grab samples are taken at least once per 12 hours and these samples are analyzed for radioactivity within 24 hours.

ACTION 41 - With the number of channels OPERABLE one less than required by the Minimum Channels OPERABLE requirement, restore the affected channel to OPERABLE status within 4 hours. If the inoperable channel is not restored within 4 hours or with no channels OPERABLE, immediately suspend the release of radioactive effluents via this pathway (this Action must be completed whenever this default condition is entered).

ACTION 42 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, and if the containment equipment hatch is open, then immediately suspend CORE ALTERATIONS and movement of irradiated fuel assemblies within containment. If the containment equipment hatch is not open, then suspend the release of radioactive effluents via this pathway or immediately suspend CORE ALTERATIONS and movement of irradiated fuel assemblies within containment.

ACTION 43 - With the number of channels OPERABLE less than required by the Minimum Channels OPERABLE requirement, effluent releases via the affected pathway may continue for up to 30 days provided samples are continuously collected with auxiliary sampling equipment as required in Table 16.11-4.

ACTION 44 - Deleted.

ACTION 45 - Flow rate for this system shall be based on fan status and operating curves or actual measurements.

ACTION 46 - For midrange and high range channels only - with the number of OPERABLE channels less than required by the Minimum Channels OPERABLE requirement, take the action specified in Section 16.3.3.4, ACTION C.

ACTION 47 - With the number of channels OPERABLE less than required by the Minumum Channels OPERABLE requirement, immediately suspend the release of radioactivite effluents via this pathway.

TABLE 16.11-6 RADIOACTIVE GASEOUS EFFLUENT MONITORING INSTRUMENTATION SURVEILLANCE REQUIREMENTS

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
1. Unit Vent System					
a. Noble Gas Activity Monitor - Providing Alarm (GT-RE-21)	D	M	R(3)	Q(2)	At all times
b. Iodine Sampler	W	N.A.	N.A.	N.A.	At all times
c. Particulate Sampler	W	N.A.	N.A.	N.A.	At all times
d. Unit Vent Flow Rate	N.A.	N.A.	R(4)	Q	At all times
e. Particulate and Radioiodine Sampler Flow Rate Monitor	D	N.A.	R	Q	At all times
2. Containment Purge System					
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release (GT-RE-22, GT-RE-33)	N.A.	P	N.A.	N.A.	MODES 1,2,3,4 and during CORE ALTERATIONS or movement of irradiated fuel within the containment
b. Iodine Sampler	W	N.A.	N.A.	N.A.	MODES 1,2,3,4 and during CORE ALTERATIONS or movement of irradiated fuel within the containment
c. Particulate Sampler	W	N.A.	N.A.	N.A.	MODES 1,2,3,4 and during CORE ALTERATIONS or movement of irradiated fuel within the containment
d. Containment Purge Ventilation Flow Rate	N.A.	N.A.	R(4)	N.A.	MODES 1,2,3,4 and during CORE ALTERATIONS or movement of irradiated fuel within the containment

TABLE 16.11-6 (Sheet 2)

INSTRUMENT	CHANNEL CHECK	SOURCE CHECK	CHANNEL CALIBRATION	CHANNEL OPERATIONAL TEST	MODES FOR WHICH SURVEILLANCE IS REQUIRED
e. Particulate and Radioiodine Sampler Flow Rate Monitor	D	N.A.	R	N.A.	MODES 1,2,3,4 and during CORE ALTERATIONS or movement of irradiated fuel within the containment
3. Radwaste Building Vent System					
a. Noble Gas Activity Monitor - Providing Alarm and Automatic Termination of Release (GH-RE-10)	D,P	M,P	R(3)	Q(1)	At all times
b. Iodine Sampler	W	N.A.	N.A.	N.A.	At all times
c. Particulate Sampler	W	N.A.	N.A.	N.A.	At all times
d. Radwaste Building Vent Flow Rate	N.A.	N.A.	R(4)	N.A.	At all times
e. Particulate and Radioiodine Sampler Flow Rate Monitor	D	N.A.	R	N.A.	At all times
4. Laundry Decontamination Facility Dryer Exhaust					
a. Particulate Monitor	NA	D	A	Q(5)	When the dryers are operating
b. Particulate Monitor Flow Rate Meter	D	NA	A	NA	When the dryers are operating
c. Dryer Exhaust Ventilation Flow Rate	NA	NA	R(4)	NA	When the dryers are operating

TABLE 16.11-6 (Sheet 3)

1. The CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation of this pathway and control room alarm annunciation occur as appropriate if any of the following conditions exists:

   a. Instrument indicates measured levels above the Alarm/Trip Setpoint (isolation and alarm), or

   b. Circuit failure (alarm only), or

   c. Instrument indicates a downscale failure (alarm only), or

   d. Instrument controls not set in operate mode (alarm only).

2. The CHANNEL OPERATIONAL TEST shall also demonstrate that control room alarm annunciation occurs if any of the following conditions exists:

   a. Instrument indicates measured levels above the Alarm Setpoint, or

   b. Circuit failure, or

   c. Instrument indicates a downscale failure, or

   d. Instrument controls not set in operate mode.

3. The initial CHANNEL CALIBRATION shall be performed using one or more of the reference (gas or liquid and solid) standards certified by the National Institute of Standards & Technology (NIST) or using standards that have been obtained from suppliers that participate in measurement assurance activities with NIST. These standards shall permit calibrating the system over its intended range of energy, measurement range, and establish monitor response to a solid calibration source. For subsequent CHANNEL CALIBRATION, NIST traceable standard (gas, liquid, or solid) may be used; or a gas, liquid, or solid source that has been calibrated by relating it to equipment that was previously (within 30 days) calibrated by the same geometry and type of source standard traceable to NIST.

4. If flow rate is determined by exhaust fan status and fan performance curves, the following surveillance operations shall be performed at least once per 18 months:

   a. The specific vent flows by direct measurement, or

   b. The differential pressure across the exhaust fan and vent flow established by the fan's "flow-ΔP" curve, or

   c. The fan motor horsepower measured and vent flow established by the fan's "flow-horsepower" curve.

5. The CHANNEL OPERATIONAL TEST shall also demonstrate that automatic isolation of this pathway and the shutdown of the dryers occur as appropriate if any of the following conditions exists:

   a. Instrument indicates measured levels above the Alarm/Trip Setpoint, or

   b. Monitor failure.

TABLE 16.11-7 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS (1)	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
1. Direct Radiation(2)	Forty routine monitoring stations either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously, placed as follows: An inner ring of sixteen stations, one in each meteorological sector in the general area of the SITE BOUNDARY; An outer ring of stations, one in each meteorological sector in the 6- to 8-km (3 to 5 mile) range from the site; and Eight stations to be placed in special interest areas such as population centers, nearby residences, schools, and in one or two areas to serve as control stations.	Quarterly	Gamma dose quarterly
2. Airborne Radioiodine and Particulates	Samples from five locations; Three samples from close to the SITE BOUNDARY locations, in different sectors, with high calculated annual average ground level D/Qs. One sample from the vicinity of a community located near the plant with a high calculated annual average ground level D/Q. One sample from a location in the vicinity of Fulton, MO.	Continuous sampler operation with sample collection weekly, or more frequently if required by dust loading.	Radioiodine Canister: I-131 analysis weekly. Particulate Sampler: Gross beta radioactivity analysis following filter change(4) and gamma isotopic analysis(5) of composite (by location) quarterly.
3. Waterborne			
a. Surface (6)	One sample upstream One sample downstream	Composite sample over 1-month period (7).	Gamma Isotopic(5) and tritium analysis monthly

TABLE 16.11-7 (Sheet 2)

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS [1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
b. Ground	Samples from one or two sources, only if likely to be affected[8]	Quarterly	Gamma Isotopic[5] and tritium analysis quarterly
As there are no ground water sources used for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination, the ground waterborne pathway is currently not included as part of the Callaway Plant Radiological Environmental Monitoring Program.			
c. Drinking	One sample of each of one to three of the nearest water supplies within 10 miles downstream that could be affected by its discharge.	Composite sample over 2-week period[7] when I-131 analysis is performed, monthly composite otherwise.	I-131 analysis on each composite when the dose calculated for the consumption of the water is greater than 1 mrem per year[9]. Composite for gross beta and gamma isotopic analyses[5] monthly. Composite for tritium analysis quarterly.
	One sample from a control location.		
As there are no drinking water intakes within 10 miles downstream of the discharge point, the drinking water pathway is currently not included as part of the Callaway Plant Radiological Environmental Monitoring Program. Should the annual Land Use Census identify water intakes within 10 river miles downstream of the discharge point, the program will be revised to include this pathway.			
d. Sediment from shoreline	One sample from downstream area with existing or potential recreational value	Semiannually	Gamma isotopic analysis[5] semiannually

TABLE 16.11-7 (Sheet 3)

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS [1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
4. Ingestion			
a. Milk	Samples from milking animals in three different meteorological sectors within 5 km (3 mile) distance having the highest dose potential. If there are none, then one sample from milking animals in each of three different meteorological sectors between 5 to 8 km (3 to 5 mile) distance where doses are calculated to be greater than 1 mrem per yr.[9] One sample from milking animals at a control location, 15 to 30 km (10 to 20 mile) distance and in the least prevalent wind direction.	Semimonthly when animals are on pasture, monthly at other times	Gamma isotopic[5] and I-131 analysis semimonthly when animals are on pasture: monthly at other times
Due to the lack of milking animals which satisfy these requirements, the milk pathway is currently not included as part of the Callaway Plant Radiological Environmental Monitoring Program. Should the Annual Land Use Census identify the existence of milking animals in locations which satisfy these requirements, then the program will be revised to include this pathway.			
b. Fish	One sample of each commercially and recreationally important species in vicinity of plant discharge area. One sample of same species in areas not influenced by plant discharge.	Sample in season, or semiannually if they are not seasonal	Gamma isotopic analysis[5] on edible portions
c. Food Products	One sample of each principal class of food products from any area that is irrigated by water in which liquid plant wastes have been discharged.	At time of harvest[10]	Gamma isotopic analysis[5] on edible portion
As there are no areas irrigated by water in which liquid plant wastes have been discharged within 50 miles downstream of the discharge point, this sample type is not currently included as part of the Callaway Plant Radiological Environmental Monitoring Program. Should the annual Land Use Census identify irrigation water intakes within 10 river miles downstream of the discharge point, the program will be revised to include this sample type.			

TABLE 16.11-7 (Sheet 4)

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF REPRESENTATIVE SAMPLES AND SAMPLE LOCATIONS [1]	SAMPLING AND COLLECTION FREQUENCY	TYPE AND FREQUENCY OF ANALYSIS
c. Food Products	Samples of three different kinds of broad leaf vegetation if available grown nearest each of two different offsite locations of highest predicted annual average ground level D/Q if milk sampling is not performed	Monthly when available	Gamma isotopic [5] and I-131 analysis
	One sample of each of the similar broad leaf vegetation grown 15 to 30 km (10 to 20 mile) distant in the least prevalent wind direction if milk sampling is not performed	Monthly when available	Gamma isotopic [5] and I-131 analysis

TABLE NOTATIONS

1. Specific parameters of distance and direction sector from the centerline of one unit, and additional description where pertinent, shall be provided for each and every sample location in Table 16.11-7 in a table and figure(s) in the appropriate plant procedures. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailability, malfunction of automatic sampling equipment, and other legitimate reasons. If specimens are unobtainable due to sampling equipment malfunction, every effort shall be made to complete corrective action prior to the end of the next sampling period. All deviations from the sampling schedule shall be documented in the Annual Radiological Environmental Operating Report pursuant to Technical Specification 5.6.2.

   It is recognized that, at times, it may not be possible or practicable to continue to obtain samples of the media of choice at the most desired location or time. In these instances suitable specific alternative media and locations may be chosen for the particular pathway in question and appropriate substitutions made within 30 days in the Radiological Environmental Monitoring Program. Submit in the next Annual Radiological Environmental Operating Report documentation for a change including the revised figure(s) and table reflecting the new location(s) with supporting information identifying the cause of the unavailability of samples for that pathway and justifying the selection of the new location(s) for obtaining samples.

   The selection of sample locations should consider accessibility of sample site, availability of power, wind direction frequency, sector population, equipment security, and the presence of potentially adverse environmental conditions (such as unusually dusty conditions, etc.).

2. One or more instruments, such as a pressurized ion chamber, for measuring and recording dose rate continuously may be used in place of, or in addition to, integrating dosimeters. For the purposes of this table, a thermoluminescent dosimeter (TLD) is considered to be one phosphor; two or more phosphors in a packet are considered as two or more dosimeters. Film badges shall not be used as dosimeters for measuring direct radiation. The number of direct radiation monitoring stations may be reduced according to geographical limitations; e.g., at an ocean site, some sectors will be over water so that the number of dosimeters may be reduced accordingly. The frequency of analysis or readout for TLD systems will depend upon the characteristics of the specific system used and should be selected to obtain optimum dose information with minimal fading.

3. Deleted.

TABLE 16.11-7 (Sheet 5)

4. Airborne particulate sample filters shall be analyzed for gross beta radioactivity 24 hours or more after sampling to allow for radon and thoron daughter decay. If gross beta activity in air particulate samples is greater than an established baseline activity level, gamma isotopic analysis shall be performed on the individual samples.

5. Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.

6. The "upstream sample" shall be taken at a distance beyond significant influence of the discharge. The "downstream" sample shall be taken in an area near the downstream edge of the mixing zone.

7. In this program, composite sample aliquots shall be collected at time intervals that are very short (e.g., hourly) relative to the compositing period (e.g., monthly) in order to assure obtaining a representative sample.

8. Groundwater samples shall be taken when this source is tapped for drinking or irrigation purposes in areas where the hydraulic gradient or recharge properties are suitable for contamination.

9. The dose shall be calculated for the maximum organ and age group, using the methodology and parameters in the ODCM.

10. If harvest occurs more than once a year, sampling shall be performed during each discrete harvest. If harvest occurs continuously, sampling shall be monthly. Attention shall be paid to including samples of tuberous and root food products.

TABLE 16.11-8 REPORTING LEVELS FOR RADIOACTIVITY CONCENTRATIONS IN ENVIRONMENTAL SAMPLES

REPORTING LEVELS

ANALYSIS	WATER (pCi/ℓ)[a]	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)[b]	MILK (pCi/ℓ)[a]	FOOD PRODUCTS pCi/kg, wet)[b]
H-3	20,000*				
Mn-54	1,000		30,000		
Fe-59	400		10,000		
Co-58	1,000		30,000		
Co-60	300		10,000		
Zn-65	300		20,000		
Zr-Nb-95**	400				
I-131	2	0.9		3	100
Cs-134	30	10	1,000	60	1,000
Cs-137	50	20	2,000	70	2,000
Ba-La-140**	200			300	

(a) Multiply the values in this table by 1E-9 to convert to units of μCi/ml.
(b) Multiply the values in this table by 1E-9 to convert to units of μCi/g.

* For drinking water samples. This is 40 CFR Part 141 value. For surface water samples, a value of 30,000 pCi/ℓ may be used.

** Total activity, parent plus daughter activity.

TABLE 16.11-9 DETECTION CAPABILITITES FOR ENVIRONMENTAL SAMPLE ANALYSIS

LOWER LIMIT OF DETECTION (LLD) (1), (2), (3)

ANALYSIS	SURFACE WATER (pCi/ℓ)[a]	DRINKING WATER (pCi/ℓ)[a]	AIRBORNE PARTICULATE OR GASES (pCi/m^3)	FISH (pCi/kg, wet)[b]	MILK (pCi/ℓ)[a]	FOOD PRODUCTS (pCi/kg, wet)[b]	SEDIMENT (pCi/kg, dry)[b]
Gross Beta	4	4	0.01				
H-3	3000	2000					
Mn-54	15	15		130			
Fe-59	30	30		260			
Co-58,60	15	15		130			
Zn-65	30	30		260			
Zr-Nb-95*	15	15					
I-131	1000	1	0.07		1	60	
Cs-134	15	15	0.05	130	15	60	150
Cs-137	18	18	0.06	150	18	80	180
Ba-La-140*	15	15			15		

(a) Multiply the values in this table by 1E-9 to convert to units of μCi/ml.
(b) Multiply the values in this table by 1E-9 to convert to units of μCi/g.

* Total activity, parent plus daughter activity.

TABLE 16.11-9 (Sheet 2)

TABLE NOTATIONS

1. This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable, together with those of the listed nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report.

2. Required detection capabilities for thermoluminescent dosimeters used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13, Revision 1, July 1977.

3. The LLD is defined, for purposes of these specifications, as the smallest concentration of radioactive 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:

$$LLD = \frac{4.66 S_b}{E \times V \times 2.22E6 \times Y \times \exp(-\lambda \Delta t)}$$

   Where:

   LLD = the "a priori" lower limit of detection (microCuries per unit mass or volume),

   S_b = the standard deviation of the background counting rate or of the counting rate of a blank sample as appropriate (counts per minute),

   E = the counting efficiency (counts per disintegration),

   V = the sample size (units of mass or volume),

   2.22E6 = the number of disintegrations per minute per microCurie,

   Y = the fractional radiochemical yield, when applicable,

   λ = the radioactive decay constant for the particular radionuclide (sec^{-1}), and

   Δt = the elapsed time between the end of the sample collection period, and the time of counting (sec).

   Typical values of E, V, Y, and Δt should be used in the calculation.

It should be recognized that the LLD is defined as a "a priori" (before the fact) limit representing the capability of a measurement system and not as an "a posteriori" (after the fact) limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLD's will be achieved under routine conditions.