



April 29, 2016

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Washington, DC 20555-0001

Subject: Peach Bottom Atomic Power Station Units 1, 2 and 3

Independent Spent Fuel Storage Installation (ISFSI)  
Facility Operation License DPR-12, DPR-44 and DPR-56  
NRC Docket 50-171, 50-277 and 50-278 and ISFSI Docket 72-29

Annual Radioactive Effluent Release Report 58  
January 1, 2015 through December 31, 2015

Enclosed is the Annual Radioactive Effluent Release Report 58, January 1, 2015 through December 31, 2015 for Peach Bottom Atomic Power Station, Units 1, 2 and 3.

This report is being submitted in compliance with 10 CFR 50.36a(2) and the Technical Specifications of Operating Licenses DPR-44 and DPR-56 and to fulfill the requirements of Offsite Dose Calculation Manual Specifications (ODCMS) 3.10.2. Additionally, this report is submitted to satisfy the annual effluent reporting requirements for the ISFSI required by the ODCM.

There was a revision to both the ODCM and ODCMS during the 2015 reporting period.

There are no commitments contained in this letter.

If you have any questions or require additional information, please do not hesitate to contact Dr. Amber Donley at 717-456-3056.

Sincerely,

A handwritten signature in black ink, appearing to read "Pat J. Navin", written over a horizontal line.

Patrick Navin, Plant Manager  
Peach Bottom Atomic Power Station

PDN/SMO/GRS/MRP/ASD/asd

Enclosure (1)

cc: USNRC Region I, Regional Administrator (Daniel H. Dorman)  
USNRC Senior Resident Inspector, PBAPS (Justin Heinly)  
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CCN 16-39

IE48  
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**PEACH BOTTOM ATOMIC POWER STATION  
Unit Numbers 2 and 3  
Docket Numbers 50-277 and 50-278  
Unit Number 1  
Docket Number 50-171  
PBAPS Independent Spent Fuel Storage Installation  
Docket Number 72-29**

**RADIOACTIVE EFFLUENT RELEASE REPORT**

**NO. 58**

**JANUARY 1, 2015 THROUGH DECEMBER 31, 2015**

Submitted to  
The United States Nuclear Regulatory Commission  
Pursuant to  
Facility Operating Licenses DPR-44 and DPR-56

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

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Technical Concurrence (for accuracy of information):

<u>Siddhan O'Dwyer / S.O. Dwyer</u>	<u>4-14-16</u>
Manager, Site Chemistry, Environmental and Radwaste	Date

## INTRODUCTION

In accordance with the Reporting Requirements of Technical Specification 5.6.3 applicable during the reporting period, this report summarizes the Effluent Release Data for Peach Bottom Atomic Power Station (PBAPS) Units 2 and 3 for the period January 1, 2015 through December 31, 2015. The notations E+ and E- are used to denote positive and negative exponents to the base 10, respectively.

The release of radioactive materials during the reporting period was within the Offsite Dose Calculation Manual Specification (ODCMS) limits.

There were two (2) unplanned releases of liquid radioactive material. One release was from a tube leak on the Residual Heat Removal (RHR) heat exchanger (which was fixed as of October 16, 2015) that allowed low activity torus water to leak to the river. The other is from groundwater tritium contamination ('tritium plume'). These releases were far below regulatory limits.

There was one (1) unplanned release of gaseous radioactive material during the Unit 3 20<sup>th</sup> Refueling Outage on September 27, 2015. This was due to positive air pressure in the Turbine Building while the wall was removed to support Unit 3 Feedwater Heater outage work activities. Details of this release are included in this report. This release was far below regulatory limits.

The maximum calculated organ dose (bone) from iodines (I-131, I-133 and I-135), tritium (H-3), carbon-14 (C-14) and particulates to any individual due to gaseous effluents was 5.52E-01 mrem, which was approximately 1.84E+00% of the annual limit. The maximum calculated air dose in the Unrestricted Area due to noble gas effluents was 2.68E-01 mrad (gamma) and 1.83E-01 mrad (beta), which was 1.34E+00% and 4.58E-01%, respectively, of the annual limits.

In 2015, there were no direct gaseous or liquid releases or discharges from Unit 1 to the environment. However, a total volume of 424.6 gallons of Unit 1 water, with an average tritium concentration of 3.09E-03  $\mu\text{Ci/mL}$ , were transferred and released through the Unit 2 and Unit 3 licenses. The total activity released was 4.97E+03  $\mu\text{Ci}$ . This activity produced a projected maximum dose to the child liver of 3.60E-06 mrem (9.0E-04% of the limit) and an adult total body dose of 2.59E-06 mrem (2.2E-03% of the limit).

There were no gaseous or liquid radioactive releases from the Independent Spent Fuel Storage Installation, NRC Docket No. 72-29 (ISFSI).

There was a revision made to RW-AA-100 "Process Control Program for Radioactive Waste" in 2015.

There was a revision made to the ODCM and Appendix A of ODCM during the 2015 reporting period.

Exelon Nuclear common procedures, which provide consistent expectations and standards for Radioactive Effluents Controls Program (RECP), were used to generate this report. They are:

- CY-AA-170-000, Radioactive Effluent and Environmental Monitoring Program
- CY-AA-170-100, Radiological Environmental Monitoring Program
- CY-AA-170-200, Radioactive Effluent Controls Program
- CY-AA-170-300, Offsite Dose Calculation Manual Administration
- CY-AA-170-2000, Annual Radioactive Effluent Release Report
- CY-AA-170-2100, Estimated Errors of Effluent Measurement
- CY-AA-170-3100, Offsite Dose Calculation Manual Revisions
- CY-AA-170-2300, Determination of Carbon-14 in Gaseous Effluents



Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

## **ATTACHMENT 1: SUPPLEMENTAL INFORMATION**

## Regulatory Limits

**Table 1. Noble Gas Dose Rate and Dose Limits**

Maximum Value	Units	Limit Classification	Specification
500	mrem/ y	annual total body dose rate	ODCM Specification 3.8.C.1.a
3000	mrem/ y	annual skin dose rate	ODCM Specification 3.8.C.1.a
10	mrads	gamma radiation air dose per quarter	ODCM Specification 3.8.C.2.a
20	mrads	beta radiation in air dose per quarter	ODCM Specification 3.8.C.2.b
20	mrads	gamma radiation in air dose per year	ODCM Specification 3.8.C.2.c
40	mrads	beta radiation in air dose per year	ODCM Specification 3.8.C.2.d

**Table 2. Iodines, Tritium and Particulates (with half-lives > 8 days) Dose Rate and Dose Limits**

Maximum Value	Units	Limit Classification	Specification
1500	mrem/ y	annual dose rate limit to any organ	ODCM Specification 3.8.C.1.b
15	mrem	annual dose limit to any organ per quarter	ODCM Specification 3.8.C.3.a
30	mrem	dose limit to any organ per year	ODCM Specification 3.8.C.3.b

**Table 3. Liquid Effluent Activity Concentration and Dose Rate Limits**

Maximum Value	Units	Limit Classification	Specification
≤ 10 times 10 CFR 20, Appendix B, Table 2, Column 2	μCi/ mL	Activity Concentration in all liquid releases	ODCM Specification 3.8.B.1.a
2E-04	μCi/ mL	total activity concentration for all dissolved and entrained noble gases	ODCM Specification 3.8.B.1.b
3.0	mrem	total body dose limit per quarter	ODCM Specification 3.8.B.2.a
10	mrem	total body dose limit per year	ODCM Specification 3.8.B.2.a
6.0	mrem	dose limit per quarter to any organ	ODCM Specification 3.8.B.2.b
20	mrem	dose limit per year to any organ	ODCM Specification 3.8.B.2.b

### Maximum Permissible Concentrations

Gaseous dose rates, rather than effluent concentrations, are used to calculate permissible release rates for gaseous releases. The maximum permissible dose rates for gaseous releases are defined in ODCMS 3.8.C.1.a and 3.8.C.1.b.

Per ODCMS 3.8.B.1, the Effluent Concentrations Limits (ECL) specified in 10 CFR 20, Appendix B, Table 2, Column 2 and multiplied by 10, for identified nuclides, are used to calculate permissible release rates and concentrations for liquid release.

The total activity concentration for all dissolved or entrained noble gases is limited to ≤2E-04 μCi/ mL (ODCMS 3.8.B.1.b).

### Average Energy

The PBAPS ODCM limits the dose-equivalent rates due to the release of noble gases to less than or equal to 500 mrem/ year to the total body and less than or equal to 3000 mrem/ year to the skin. Therefore, the average beta and gamma energies of the radionuclide mixture in releases of fission and activation gases as described in Regulatory Guide 1.21, Revision 1, "Measuring, Evaluation, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants," are not applicable to PBAPS.

## **Measures and Approximations of Total Radioactivity**

### **Fission and Activation Gases**

The method used for gamma isotopic analysis is the Canberra Genie™ System with a gas Marinelli beaker. Grab samples are taken and analyzed weekly to determine the isotopic mixture of noble gas activity released for the week. Airborne effluent gaseous activity was continuously monitored and recorded in accordance with ODCMS Table 4.8.C.1. The data from the noble gas radiation monitor were analyzed to report noble gas effluent activities. When no activity was identified in the grab isotopic analysis, the entire release must be assumed to be the radionuclide most-limiting dose factors for the release pathway (i.e. krypton-88 (Kr-88) for all ground-level releases, Kr-88 for elevated gamma dose and Kr-87 for elevated beta dose; see ODCM IV.B and NUREG-0133<sup>1</sup>).

The activity released is listed as "unidentified" in the Attachment 2 Tables. If activity was found in the grab isotopic analysis, the isotopic mixture for the Noble Gas Monitor was determined from that isotopic mixture.

### **Iodines**

The method used is the Canberra Genie™ System with a charcoal cartridge. Iodine activity was continuously sampled and analyzed in accordance with ODCMS Table 4.8.C.1.

### **Particulates**

The method used is the Canberra Genie™ System with a particulate filter (47 mm diameter). Particulate activity was continuously sampled and analyzed in accordance with ODCM Table 4.8.C.1.

Composite particulate air samples were submitted to an offsite vendor laboratory for analyses of strontium-89 (Sr-89), strontium-90 (Sr-90), nickel-63 (Ni-63) and gross alpha.

### **Carbon-14**

The amount of C-14 released was estimated using the guidance from the Electric Power Research Institute (EPRI) Technical Report 1021106, "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents". The C-14 was released primarily through the stack (9.70E+01%) with a small amount (3.00E+00%) through the plant vents. The C-14 in liquid effluents is not a significant dose pathway, as determined from studies. The resulting annual dose to the maximum conservative receptor is 5.49E-01 mrem, with the limiting receptor as the child bone.

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<sup>1</sup> <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0133/sr0133.pdf>, accessed 9 April 2014.

### **Liquid Effluents**

Gamma isotopic activity concentrations are determined on each batch of liquid effluent prior to release using the Canberra Genie™ System in accordance with ODCMS Table 4.8.B.1. The total activity of a released batch is determined by multiplying each nuclide's concentration by the total volume discharged.

Composite liquid radwaste samples are analyzed for tritium on-site and submitted to an offsite vendor laboratory for analyses of iron-55 (Fe-55), phosphorus-32 (P-32), Sr-89, Sr-90, Ni-63, and gross alpha.

### **Decommissioned Unit 1 Liquid Radioactive Waste Processing**

In 2015, there were no direct gaseous or liquid releases or discharges from Unit 1 to the environment. Approximately 117.3 gallons of tritiated water from Unit 1 Sump was drummed and moved to Unit 2 & 3 in 2015. Drums of tritiated water, collected between 2013 and 2015, were released through the B Laundry Drain Tank (B LDT) through the Unit 2 & 3 license. A total volume of 424.6 gallons of water (83.3 gallons from 2015, 268.3 gallons from 2014, 73 gallons from 2013), with an average tritium concentration of  $3.09\text{E-}03 \mu\text{Ci/mL}$ , were released. The total tritium activity released was  $4.97\text{E}+03 \mu\text{Ci}$ . This activity produced a projected maximum dose to the child liver of  $3.60\text{E-}06 \text{ mrem}$  ( $9.0\text{E-}04\%$  of the limit) and an adult total body dose of  $2.59\text{E-}06 \text{ mrem}$  ( $2.2\text{E-}03\%$  of the limit).

### **Estimate of Total Error Present**

CY-AA-170-2100, "Estimated Errors of Effluent Measurements", provides the methodology to obtain an overall estimate of the error associated with radioactive effluents.

## Batch Releases

**Table 4. Quarterly Liquid Batch Release Statistics**

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Number of Batch Releases	8	11	4	20
Total Time for Batch Releases (minutes)	7.97E+02	8.41E+02	4.45E+02	2.06E+03
Maximum time period for batch release (minutes)	1.65E+02	1.50E+02	1.50E+02	1.50E+02
Average time period for batch release (minutes)	9.96E+01	7.65E+01	1.11E+02	1.03E+02
Minimum time period for batch release (minutes)	6.70E+01	3.40E+01	7.00E+01	3.00E+01
Average Stream Flow (ft <sup>3</sup> /s) <sup>2, 3</sup>	2.79E+04	5.08E+04	2.34E+04	2.36E+04
Dilution volume (liters)	3.02E+09	3.82E+09	1.59E+09	9.03E+09

**Table 5. Quarterly Gaseous Batch Release Statistics**

	First Quarter	Second Quarter	Third Quarter	Fourth Quarter
Number of batch releases:	0	0	1	0
Total Time for batch releases (minutes)	0	0	1465	0
Maximum time period for batch release (minutes):	0	0	1465	0
Average time period for batch release (minutes)	0	0	1465	0
Minimum time period for batch release (minutes)	0	0	1465	0

<sup>2</sup> Average Stream Flow is not used for dose calculation.

<sup>3</sup> USGS National Water Information System, Site Name: "Susquehanna River at Marietta, PA", Site Number: 01576000. Data accessed 21 March 2016.

### **Average Stream Flow**

The river flow is not used for dose calculations. The actual flow rate of Circulation Water (the water that is circulated within the plant for cooling) is determined for each liquid effluent release because this Circulation Water provides dilution and therefore reduces the projected dose.

### **Abnormal or Unplanned Releases**

'Abnormal' releases are those releases that are not defined as 'normal' releases in the Licensee's ODCM. While attempts are made to ensure radioactivity is not released offsite without processing, monitoring of systems with a potential for release is continuously performed. Source terms used for dose calculations utilize direct sampling and the maximum concentrations of nuclides to ensure that the most conservative and bounding estimates are used. Methodologies used calculate conservative dose uses conservative mathematical models to describe intake and exposure pathways. Therefore, reported doses for these abnormal releases are calculated conservatively.

### **Liquid Releases**

#### *Groundwater Tritium Plume*

During 2015, during the sampling and analysis of the Radiological Ground Water Protection Program (RGPP), tritium was measured at several locations around the site. The ground water that has detectable tritium has been determined to flow into the Plant intake and eventually flow into the normal Discharge Canal. Details of this program can be found in the Peach Bottom Annual Radiological Environmental Operating Report (AREOR) as an appendix. No other nuclides were detected in monitoring wells.

#### **Analysis of Release**

It was assumed from the maximum flow rates measured<sup>4</sup> that ground water flowed to the discharge canal at a steady rate of 3.17E+02 gpm, carrying with it some of the tritium underneath the plant. The conservative maximum dose for the entire year from this continuous release is calculated to be 6.41E-05 mrem (whole-body) and 6.41E-05 mrem (any organ, except bone<sup>5</sup> which is 0.00E+00 mrem)<sup>6</sup>. This dose contribution projection is well below the limit specified in the ODCM.

#### *Heat Exchanger Leakage*

During the 2015 calendar year, a small leak continued in the Unit 3 B Residual Heat Removal (RHR) Heat Exchanger, until it was repaired on October 6<sup>th</sup> 2015. The dose model assumes that contaminated water leaks from the heat exchanger, regardless of operating pressure to ensure conservatism in calculated dose. As an additional precaution, installed radiation monitoring

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<sup>4</sup> "Estimated Mass Flux Of Tritiated Groundwater To The Conowingo Reservoir And Rock Run Creek, Peach Bottom Atomic Power Station, Delta, Pennsylvania", November 2011, Conestoga-Rovers & Associates.

<sup>5</sup> Tritium dose factor for bone is 0.00E+00; therefore no hypothetical dose is calculated.

<sup>6</sup> These doses are identical because the dose factors are identical for the same nuclide and pathway.

instrumentation can indicate an inadvertent release of radioactive material should the heat exchanger leak rate increase.

#### Analysis of Release

It was assumed that the water released to the discharge canal for all of 2015 contributed a conservative maximum  $1.30\text{E-}04$  mrem Total Body dose (receptor adult), and a conservative maximum  $3.30\text{E-}04$  mrem for the conservative maximum organ, adult GI-LLI, dose. This dose contribution was well below the limits specified in the ODCM.

Samples were analyzed for all the parameters of radioactive effluent releases. Composite liquid TORUS water samples were counted for tritium and submitted to an offsite vendor laboratory for analyses of Fe-55, P-32, Sr-89, Sr-90, Ni-63 and gross alpha. The dose contributions and isotope quantities from the releases were added to this Radioactive Effluent Release Report for the applicable reporting periods.

#### Gaseous Releases

##### *Unit 3 Equipment Ground Hatch Opening*

A hole was cut into the Turbine Building wall to permit the movement of seawans and feedwater heaters in and out of the plant during the twentieth refueling outage on Unit 3 (P3R20). During the first day the wall was removed, the plant ventilation was not maintained at negative pressure (IR #02561720). The wall was removed on September 27, 2015, and positive air flow was noticed by Radiation Protection personnel. This was immediately reported, operations restored negative pressure, and particulate air samples were analyzed for radioactivity. The maximum concentration of Co-60 was found to be  $2.45\text{E-}12$   $\mu\text{Ci/cc}$  and positive air flow of 36960 CFM was estimated for a period of  $2.44\text{E+}01$  hours. The conservative dose rate ( $1.78\text{E-}04$  mrem/ year) and conservative dose ( $4.37\text{E-}06$  mrem Ground-Plane) calculated for this release was well-below the limits in the ODCM. No other nuclides were identified.

#### **Changes to the ODCM**

There was a revision to both the ODCM and the ODCM Specifications (Appendix A). The ODCM Rev 15 and ODCM App A Rev 14 updated all the required "methodology and parameters" such that the ODCM actively reflects the current REMP. The corrective action process (CAP) was utilized to track the changes to the ODCM and App A via IR #2504386 and the Change Packet was sent under transmittal #D307153. The latest revision can be found in Attachment B of this report.



### **Minimum Detectable Concentrations**

If a radionuclide was not detected, "<LLD" was reported as the activity. Samples were analyzed with techniques that achieved the required Lower Limits of Detection (LLD) as specified in ODCMS Table 4.8.B.1, "Radioactive Liquid Waste Sampling and Analysis" (for liquids) or ODCMS Table 4.8.C.1, "Radioactive Gaseous Waste Sampling and Analysis from Main Stack and Vent Stack" (for gases). In all cases, the LLD requirements were satisfied.

### **Violations**

There were no effluent release violations for the 2015 reporting period.

### **Dose Assessment**

#### **Introduction**

A dose assessment for PBAPS was conducted from measured radioactive effluent source terms and environmental data to verify that PBAPS continues to demonstrate compliance with the limits as well as the requirement of maintaining the doses "as low as is reasonably achievable" as stated in 10 CFR 50, Appendix I.<sup>7</sup>

The radioactive source term used for both liquids and gases are the current radioactive source terms given in this report, Attachment 2, "Effluent Summary".

#### **Liquid Dose Assessment**

##### *Hydrologic Conditions and Receptor Locations of Interest*

PBAPS is located on the Conowingo Pond formed in the Susquehanna River by the Conowingo Dam. For 2015, the average river flow was measured<sup>8</sup> to be approximately  $3.07\text{E}+04 \text{ ft}^3/\text{s}$ . Of these three separate flow regimes that were used in the original Appendix I submittal, the most-limiting of them ( $<1.50\text{E}+04 \text{ ft}^3/\text{s}$ ) was used to calculate a dose assessment for this report because this would provide a bounding extreme for all PBAPS liquid effluents. Therefore, although the actual average stream flow for the year was more than double the limiting case, this report will provide an upper limit for the most-limiting dose.

The annual average dilution factor<sup>9</sup> at the Conowingo Intake is  $5.40\text{E}+00$  and the assumption for the reconcentration factor<sup>10</sup> is  $1.16\text{E}+00$ . The PBAPS shorewidth factor<sup>11</sup> of  $2.00\text{E}-01$  was also used.

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<sup>7</sup> <http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-appi.html>, accessed 9 April 2014.

<sup>8</sup> USGS National Water Information Service; Monitoring Site 01576000, Susquehanna River at Marietta, PA; <http://waterdata.usgs.gov/nwis>. Accessed 6 Mar 2015.

<sup>9</sup> From original ODCM.

<sup>10</sup> From original ODCM.

<sup>11</sup> RG 1.109, Table A-2.

**Table 6. Consumption and Usage Rate Assumptions**

Pathway	Adult	Teenager	Child	Infant	Units
Eating Fish <sup>12</sup>	2.10E+01	1.60E+01	6.90E+00	0.00E+00	kg/ y
Drinking Water <sup>13</sup>	7.30E+02	5.10E+02	5.10E+02	5.10E+02	L/ y
Swimming <sup>14</sup>	2.80E+02	2.80E+02	0.00E+00	0.00E+00	h/ y
Boating <sup>14</sup>	1.20E+02	1.20E+02	6.70E+01	0.00E+00	h/ y
Shoreline Recreation <sup>14</sup>	3.25E+02	3.25E+02	1.40E+01	0.00E+00	h/ y
Fishing from Conowingo Dam <sup>14</sup>	3.25E+02	3.25E+02	0.00E+00	0.00E+00	h/ y

No invertebrate intake was examined because invertebrate ingestion pathways are not considered to be significant in this area close to PBAPS.

#### *Liquid Effluent Dose Assessment Conclusion*

The calculated limiting Total Body dose was 3.58E-04 mrem and the limiting organ dose was 5.12E-04 mrem for the limiting receptor of adult Liver.

Therefore, PBAPS liquid radioactive effluent controls continue to demonstrate compliance with 10 CFR 50, Appendix I objectives for the purposes of keeping doses to members of the public "as low as is reasonably achievable". These limiting or maximum calculated doses are a small fraction of the limits in Appendix I.

#### **Gaseous Dose Assessment**

The gaseous dose assessment calculates the conservative dose at the limiting receptor locations from the land-use census data, the 2015 meteorology and the 2015 source term to demonstrate compliance with 10 CFR 50, Appendix I. The maximum 2015 meteorology data corresponds to real resident pathway at 900 m NW and WNW, a resident/garden pathway at 1200 m SSE, and a milk pathway at 4900 m N.

Tables 7 and 8 utilized CY-PB-170-210, "Gaseous Dose and Dose Rate Calculation," to calculate the doses for elevated and ground releases. The first input utilized the highest X/Q sectors for both stack and ground (the results of the first row in both tables), while the second input utilized the highest D/Q sectors (the second row). The ground-level dose is the most influential due to the higher D/Q values than those assumed in the ODCM, but these locations do not have a cow-milk pathway. According to the 2015 Land-use census, the milk location with the highest D/Q (2.26E-09, 1500 m SW of vents), which is a value more comparable to that listed in the ODCM. The values listed in Tables 7 and 8 are conservative, as the calculation assumes the pathway exists for each location, demonstrating compliance, as the doses are less than the 10 CFR 50, Appendix I limits.

<sup>12</sup> RG 1.109, Table A-2.

<sup>13</sup> All locations except Chester Water Authority from RG 1.109, Section A-2. Chester Water Authority uses 10% of the RG 1.109 value because it is assumed to have 10% sourced from Conowingo Pond.

<sup>14</sup> From PBAPS Environmental Report, Supplement No. 3, Page 19. Boating data derived from a ratio of Adult:Child rates as listed in RG 1.109, Table A-2.

**Table 7. Conservative Maximum Elevated Release Dose from 2015 Source Term and 2015 Meteorology**

Distance (m)	Direction	2015 X/Q undepleted undecayed (s/m <sup>3</sup> )	2015 D/Q (1/m <sup>2</sup> )	Total Body Dose (mrem)	Skin Dose (mrem)	Beta Air Dose (mrad)	Gamma Air Dose (mrad)	Particulate and Iodines, H-3 and C-14 (mrem)	Limiting Receptor
4900	N	5.19E-08	3.31E-10	9.26E-04	2.07E-03	1.11E-03	9.63E-04	2.55E-02	Thyroid
900	WNW	9.50E-09	8.39E-10	9.26E-04	1.24E-03	2.03E-04	9.63E-04	6.46E-02	Thyroid

**Table 8. Ground-Level Dose from 2015 Source Term and 2015 Meteorology**

Distance (m)	Direction	2015 X/Q undepleted undecayed (s/m <sup>3</sup> )	2015 D/Q (1/m <sup>2</sup> )	Total Body Dose (mrem)	Skin Dose (mrem)	Beta Air Dose (mrad)	Gamma Air Dose (mrad)	Particulate and Iodines, H-3 and C-14 (mrem)	Limiting Receptor
900	NW	1.44E-06	8.41E-09	3.32E-01	5.98E-01	2.33E-01	3.44E-01	1.60E+00	Bone
1200	SSE	1.23E-06	9.88E-09	2.84E-01	5.11E-01	1.99E-01	2.93E-01	1.88E+00	Bone

#### *Gaseous Radioactive Effluent Dose Assessment Conclusion*

The conservative maximum dose was 5.52E-01 mrem with the maximum receptor as the child bone and this is due to the incorporation of carbon-14 in the calculation. Without C-14, the maximum dose is 1.13E-02 mrem to the infant thyroid. The noble gas limiting air doses were 2.68E-01 mrad (gamma) and 1.83E-01 mrad (beta). Noble gas plume conservative dose was 2.59E-01 mrem for the year (Total Body) and 4.68E-01 mrem (Skin Dose) for the year.

All doses are projected to be much less than the limits, as expected. Again, these dose models incorporate several factors of conservatism including a source term that, by procedure, will use the most dose-limiting noble gas nuclide when no fission gas can be identified by grab sample but activity is detected from the effluent radiation monitor.

Exelon Nuclear uses a more-detailed C-14 dose projection from the Electric Power Research Institute, Technical Report 1021106. Details for the assumptions used in this calculation may be found there.<sup>15</sup>

Therefore, PBAPS gaseous radioactive effluent controls continue to demonstrate compliance with 10 CFR 50, Appendix I objectives for the purposes of keeping doses to members of the public "as low as is reasonably achievable". These limiting or maximum calculated doses are a small fraction of the limits in Appendix I.

<sup>15</sup> For PBAPS uses specific Boiling Water Reactor assumptions because the fraction of C-14 that is in the CO<sub>2</sub> form will vary based on general plant design. This is important because the major dose pathway is through photosynthesis and, therefore, only the oxide form is relevant.

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

## **ATTACHMENT 2: EFFLUENT SUMMARY**

## Gaseous Effluents - Summation of All Releases

Period: January 1, 2015 through December 31, 2015

Unit: Peach Bottom

A. Fission & Activation Gases	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Est. Total Error %
1. Total Release	Ci	1.56E+02	1.59E+02	1.03E+02	1.93E+02	3.51E+01
2. Average release For the Period	uCi/ s	2.01E+01	2.02E+01	1.30E+01	2.43E+01	
3. Gamma Air Dose	mrads	7.23E-02	7.09E-02	3.97E-02	8.82E-02	
4. Beta Air Dose	mrads	4.95E-02	4.86E-02	2.76E-02	6.04E-02	
5. Percent of ODCM limit						
Gamma Air Dose	%	7.23E-01	7.09E-01	3.97E-01	8.82E-01	
Beta Air Dose	%	2.48E-01	2.43E-01	1.38E-01	3.02E-01	

### B. Iodines

1. Total I-131	Ci	2.45E-04	3.81E-04	4.25E-04	8.49E-05	1.76E+01
2. Average release For the Period	uCi/ s	3.14E-05	4.85E-05	5.35E-05	1.07E-05	
3. Percent of ODCM limit	%	*	*	*	*	

### C. Particulate

1. Particulates with T <sub>1/2</sub> > 8 days	Ci	1.67E-04	6.81E-04	1.86E-03	1.32E-04	1.94E+01
2. Average release For the Period	uCi/ s	2.14E-05	8.66E-05	2.34E-04	1.67E-05	
3. Percent of ODCM limit	%	*	*	*	*	

### D. Tritium

1. Total Release	Ci	9.55E+00	1.63E+01	2.17E+01	3.28E+00	1.11E+01
2. Average release For the Period	uCi/ s	1.23E+00	2.07E+00	2.73E+00	4.12E-01	
3. Percent of ODCM limit	%	*	*	*	*	

### E. Gross Alpha

1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	4.00E+02
2. Average release For the Period	uCi/ s	<LLD	<LLD	<LLD	<LLD	
3. Percent of ODCM limit	%	*	*	*	*	

### F. Carbon-14

1. Total Release	Ci	1.25E+01	1.36E+01	1.33E+01	1.32E+01	
2. Average release For the Period	uCi/ s	1.61E+00	1.73E+00	1.67E+00	1.66E+00	

### G. Iodine-131, 133 and 135, Tritium, Carbon-14 & Particulate

1. Organ Dose*	mrem	1.35E-01	1.43E-01	1.36E-01	1.35E-01	
2. Percent ODCM limit	%	8.97E-01	9.56E-01	9.07E-01	9.00E-01	

\*C-14 contributes most significantly; therefore the quarterly dose to the child bone is reported

# **Gaseous Effluents Release Point: Elevated (Main Offgas Stack)**

Period: January 1, 2015 through December 31, 2015

Unit: Peach Bottom

Nuclides Released		Continuous Mode				Batch Mode			
1. Fission Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	6.77E+00	1.07E+00	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	1.50E+00	6.75E+00	1.05E+01	7.65E+00	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	5.38E+00	1.86E+00	1.59E+00	9.23E-01	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	3.61E-02	7.88E+00	<LLD	<LLD	<LLD	<LLD	<LLD
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Unidentified	Ci	1.63E+01	1.32E+01	9.37E+00	2.18E+01	<LLD	<LLD	<LLD	<LLD
Total For Period	Ci	2.31E+01	2.86E+01	3.04E+01	3.03E+01	<LLD	<LLD	<LLD	<LLD
2. Iodines									
I-131	Ci	4.10E-05	4.75E-05	7.01E-05	7.35E-05	<LLD	<LLD	<LLD	<LLD
I-133	Ci	7.17E-05	1.24E-04	1.74E-04	1.65E-04	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total For Period	Ci	1.13E-04	1.71E-04	2.44E-04	2.38E-04	<LLD	<LLD	<LLD	<LLD
3. Particulates									
Sr-89	Ci	4.55E-05	3.73E-05	5.72E-05	3.69E-05	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	4.43E-06	5.99E-06	6.83E-06	5.69E-06	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cr-51	Ci	<LLD	<LLD	7.33E-06	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	1.32E-06	1.10E-05	4.37E-06	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	1.08E-06	3.21E-06	1.29E-06	<LLD	<LLD	<LLD	<LLD
Co-60	Ci	8.53E-06	2.18E-05	6.18E-05	3.74E-05	<LLD	<LLD	<LLD	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ag-110m	Ci	<LLD	<LLD	<LLD	5.70E-07	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	1.01E-05	1.17E-05	9.23E-06	<LLD	<LLD	<LLD	<LLD
Total For Period	Ci	5.85E-05	7.76E-05	1.59E-04	9.54E-05	<LLD	<LLD	<LLD	<LLD
4. Tritium									
H-3	Ci	3.85E-01	7.41E-01	3.12E+00	2.89E-01	<LLD	<LLD	<LLD	<LLD
5. Gross Alpha									
Gross Alpha	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
6. Carbon-14									
C-14	Ci	8.43E+00	8.98E+00	8.53E+00	8.46E+00	<LLD	<LLD	<LLD	<LLD

# **Gaseous Effluents Release Point: Ground-Level (Units 2 and 3 Reactor Building Exhaust Vents and Abnormal Releases)**

Period: January 1, 2015 through December 31, 2015

Unit: Peach Bottom

Nuclides Released		Continuous Mode				Batch Mode			
1. Fission Gases	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	4.52E+00	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Unidentified	Ci	1.33E+02	1.26E+02	7.28E+01	1.63E+02	<LLD	<LLD	<LLD	<LLD
Total For Period	Ci	1.33E+02	1.30E+02	7.28E+01	1.63E+02	<LLD	<LLD	<LLD	<LLD
2. Iodines									
I-131	Ci	2.03E-04	3.34E-04	3.55E-04	1.15E-05	<LLD	<LLD	<LLD	<LLD
I-133	Ci	1.05E-03	2.07E-03	2.19E-03	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total For Period	Ci	1.25E-03	2.41E-03	2.54E-03	1.15E-05	<LLD	<LLD	<LLD	<LLD
3. Particulates									
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	1.74E-05	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cr-51	Ci	<LLD	2.02E-05	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	2.73E-05	2.08E-04	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	2.38E-05	1.36E-04	<LLD	<LLD	<LLD	<LLD	<LLD
Co-60	Ci	1.08E-04	5.14E-04	1.35E-03	3.70E-05	<LLD	<LLD	3.76E-06	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	2.80E-04	9.11E-04	<LLD	<LLD	<LLD	<LLD	<LLD
Total For Period	Ci	1.08E-04	6.03E-04	1.70E-03	3.70E-05	<LLD	<LLD	3.76E-06	<LLD
4. Tritium									
H-3	Ci	9.16E+00	1.55E+01	1.86E+01	2.99E+00	<LLD	<LLD	<LLD	<LLD
5. Gross Alpha									
Gross Alpha	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
6. Carbon-14									
C-14	Ci	4.11E+00	4.65E+00	4.76E+00	4.76E+00	<LLD	<LLD	<LLD	<LLD

## Liquid Effluents - Summation of All Releases

Period: January 1, 2015 to December 31, 2015

Unit: Peach Bottom

A. Fission & Activation Gases	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Est. Total Error %
1. Total Release (not including tritium, gases & alpha)	Ci	1.49E-03	7.67E-03	2.20E-03	1.17E-03	2.11E+01
2. Average diluted concentration for the Period	µCi/ mL	2.375E-12	1.14E-11	3.26E-12	1.71E-12	
3. Percent of applicable limit						
Total Body Dose	%	8.37E-04	3.20E-03	2.18E-03	6.32E-03	
Organ Dose	%	6.03E-04	2.44E-03	8.94E-04	2.80E-03	

B. Tritium						Est. Total Error %
1. Total Release	Ci	2.03E+00	3.70E+00	1.86E+00	3.63E+00	6.40E+00
2. Average diluted concentration for the Period	µCi/ mL	3.23E-09	5.51E-09	2.75E-09	5.30E-09	
3. Percent of applicable limit	%	3.23E-05	5.51E-05	2.75E-05	5.30E-05	

(10x 10CFR20 Limit of 1.00E-03 uCi/ mL; ODCMS 3.8.B.1.a)

C. Dissolved & Entrained Gases						Est. Total Error %
1. Total Release	Ci	8.66E-06	<LLD	1.06E-06	3.28E-05	2.11E+01
2. Average diluted concentration for the Period	µCi/ mL	1.38E-14	<LLD	1.57E-15	4.80E-14	
3. Percent of ODCM limit	%	*	*	*	*	

D. Gross Alpha Activity						Est. Total Error %
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	2.30E+01

E. Volume of Waste Released (prior to dilution)	Liters	1.56E+08	1.57E+08	1.59E+08	1.60E+08
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F. Volume of Dilution Water Used During Period	Liters	6.29E+11	6.71E+11	6.76E+11	6.84E+11
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\*No ECL values for Xe isotopes in 10 CFR 20 Appendix B Table 2, therefore a percentage of the limit cannot be calculated.



## Liquid Effluents Release Points – Liquid Radwaste, RHR Leaks and Groundwater

Period: January 1, 2015 through December 31, 2015

Unit: Peach Bottom

Nuclides Released		Continuous Mode				Batch Mode			
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Quarter 1	Quarter 2	Quarter 3	Quarter 4
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	3.45E-05	1.10E-05	3.38E-07	1.21E-06	<LLD	8.83E-05
I-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	1.01E-05	<LLD	<LLD	<LLD	<LLD
Co-60	Ci	1.24E-03	6.93E-03	1.94E-03	4.46E-04	<LLD	5.34E-07	<LLD	1.16E-05
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	2.78E-04	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	2.31E-04	4.57E-04	2.27E-04	4.11E-05	<LLD	5.21E-07	<LLD	<LLD
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-55	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	2.55E-05	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	2.94E-04
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	2.58E-04
Ru-105	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	6.08E-06
H-3	Ci	1.57E+00	3.42E+00	1.58E+00	1.46E+00	4.56E-01	2.80E-01	2.74E-01	2.17E+00
P-32	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Total for Period	Ci	1.58E+00	3.43E+00	1.59E+00	1.46E+00	4.56E-01	2.80E-01	2.74E-01	2.17E+00
Xe-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	8.66E-06	<LLD	1.06E-06	2.40E-05
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	<LLD	8.82E-06

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

### **ATTACHMENT 3: SOLID WASTE AND IRRADIATED FUEL SHIPMENTS**

## Solid Waste Shipped

### 1. Type of Waste

	units	2015	Est. error %
<b>A: Spent Resin, Filters, Sludges, Evaporator Bottoms, etc</b>	m <sup>3</sup>	1.18E+02	
	Ci	8.33E+02	2.50E+01
<b>B: Dry Compressible Waste, Contaminated Equipment, etc.</b>	m <sup>3</sup>	2.24E+03	
	Ci	1.89E+01	2.50E+01
<b>C: Irradiated Components, Control Rods, etc.</b>	m <sup>3</sup>	0.00E+00	
	Ci	0.00E+00	N/A
<b>D: Other (Oil, SBLC)</b>	m <sup>3</sup>	3.56E+01	
	Ci	3.41E-02	2.50E+01

### 2. Estimate of Major Nuclide Composition (by type of waste)

#### a. Spent-Resin, Filters, Sludges, Evaporator Bottoms, etc.

Nuclide	Abundance % (no cutoff)	Activity (Ci)
H-3	3.00E-02	2.46E-01
C-14	1.26E-01	1.05E+00
Cl-36	0.00E+00	4.80E-07
Ar-39	0.00E+00	2.54E-07
Cr-51	7.00E-02	5.83E-01
Mn-53	0.00E+00	6.72E-09
Mn-54	5.84E-01	4.87E+00
Fe-55	3.26E+01	2.72E+02
Fe-59	2.30E-02	1.90E-01
Co-58	1.90E-02	1.55E-01
Co-60	5.88E+01	4.90E+02
Ni-59	1.00E-02	8.29E-02
Ni-63	2.91E+00	2.43E+01
Zn-65	5.39E-01	4.49E+00
Sr-89	0.00E+00	1.57E-05
Sr-90	4.58E-01	3.81E+00
Nb-94	0.00E+00	2.35E-07
Nb-95	0.00E+00	4.61E-07
Mo-93	0.00E+00	3.70E-07
Mo-99	0.00E+00	1.67E-48
Tc-99	4.00E-03	3.50E-02
Ag-110m	1.10E-02	8.85E-02
Sn-121m	1.00E-03	4.92E-03

Nuclide	Abundance % (no cutoff)	Activity (Ci)
Sb-124	0.00E+00	2.26E-03
Sb-125	0.00E+00	2.26E-03
I-129	0.00E+00	1.88E-03
I-131	0.00E+00	1.56E-24
Cs-134	1.31E-01	1.09E+00
Cs-137	3.59E+00	2.99E+01
Ba-140	0.00E+00	9.01E-44
La-140	0.00E+00	7.63E-44
Ce-141	0.00E+00	3.08E-11
Ce-144	2.60E-02	2.17E-01
Sm-151	0.00E+00	1.49E-07
Eu-152	0.00E+00	3.21E-05
Eu-154	0.00E+00	3.82E-06
Eu-155	0.00E+00	1.38E-07
Tb-158	0.00E+00	5.28E-09
Ho-166m	0.00E+00	9.12E-08
Pu-238	1.00E-03	7.72E-03
Pu-239	0.00E+00	1.22E-03
Pu-241	6.50E-02	5.40E-01
Am-241	0.00E+00	1.99E-03
Cm-242	0.00E+00	1.08E-05
Cm-243	0.00E+00	4.13E-05
Cm-244	1.00E-03	7.54E-03

*b. Dry, Compressible Waste, Contaminated Equipment, etc.*

Nuclide	Abundance % (no cutoff)	Activity (Ci)	Nuclide	Abundance % (no cutoff)	Activity (Ci)
H-3	1.16E+00	2.19E-01	Ag-110m	3.52E-01	6.66E-02
C-14	1.32E-01	2.49E-02	I-129	1.21E-01	2.29E-02
Cr-51	2.74E+00	5.18E-01	Sb-124	0.00E+00	0.00E+00
Mn-54	2.37E+00	4.48E-01	Cs-134	7.60E-02	1.43E-02
Fe-55	2.13E+01	4.03E+00	Cs-137	4.33E+00	8.20E-01
Fe-59	9.69E-01	1.83E-01	Ce-141	0.00E+00	1.45E-06
Co-58	5.16E-01	9.77E-02	Ce-144	5.11E-01	9.68E-02
Co-60	5.70E+01	1.08E+01	Pu-238	0.00E+00	1.41E-05
Ni-59	4.30E-02	8.04E-03	Pu-239	0.00E+00	1.68E-06
Ni-63	3.33E+00	6.31E-01	Pu-241	2.10E-02	4.00E-03
Zn-65	4.78E+00	9.05E-01	Am-241	4.00E-03	6.94E-04
Sr-89	0.00E+00	5.04E-06	Cm-242	0.00E+00	1.25E-06
Sr-90	5.30E-02	9.95E-03	Cm-243	0.00E+00	2.26E-05
Nb-94	0.00E+00	6.24E-06	Pb-214	0.00E+00	4.80E-22
Tc-99	2.09E-01	3.95E-02	Bi-214	0.00E+00	1.28E-27

*c. Irradiated Components, Control Rods, etc.*

There were no shipments of irradiated components or control rods during the reporting period of 2015.

*d. Other: Oil*

Nuclide	Abundance % (no cutoff)	Activity (Ci)
H-3	9.13E+01	3.12E-02
C-14	1.19E+00	4.08E-04
Fe-55	0.00E+00	0.00E+00
Co-60	4.00E-02	1.40E-05
Ni-63	1.66E+00	5.67E-04
Sr-90	0.00E+00	0.00E+00
Tc-99	2.81E+00	9.58E-04
I-129	2.98E+00	1.02E-03
Cs-137	1.00E-02	3.56E-06
Ce-144	4.00E-02	1.52E-05

### **3. Solid Waste Disposition**

Number of shipments	Mode of Transportation	Destination
68	Hittman Transport Services	Energy Solutions (Oak Ridge, TN)
19	Hittman Transport Services	Energy Solutions (Kingston, TN)
19	Hittman Transport Services	Energy Solutions - Clive CWF
7	Hittman Transport Services	Energy Solutions - Clive BWF
1	TLI Freight Services	Alaron Nuclear Services (Wampum, PA)
3	Hittman Transport Services	Waste Control Specialist - CWF
1	Visionary Solutions, LLC	Waste Control Specialist - CWF

### **Irradiated Fuel Shipments**

No shipment of irradiated fuel was made during the reporting period of 2015.

### **Changes to Process Control Program (PCP)**

A change was made to the Radioactive Waste Process Control Program during the reporting period of 2015. A new revision of RW-AA-100, "Process Control Program for Radioactive Wastes," was approved in June of 2015. The changes clarified the definition of blending, classification of controlling nuclides, concentration averaging, homogenous waste, mixable waste, and nuclides of concern; updated the references to NRC-2011-0022; and added station specific Updated Final Safety Analysis Report (UFSAR) references. The revised procedure can be found in Appendix C.

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

#### **ATTACHMENT 4: RADIOLOGICAL IMPACT ON MAN**

### Radiological Impact on Man

Effluent	Applicable Organ	Estimated Dose	Age Group	Location		% of Applicable Limit	Limit	Unit
				Distance (meters)	Direction (toward)			
Noble Gas	Gamma - Air Dose	2.68E-01	All	1.10E+03	SSE	1.34E+00	2.00E+01	mrads
Noble Gas	Beta - Air Dose	1.83E-01	All	1.10E+03	SSE	4.58E-01	4.00E+01	mrads
Noble Gas	Total Body (gamma)	2.59E-01	All	1.10E+03	SSE	2.59E+00	1.00E+01	mrem
Noble Gas	Skin (Beta)	4.68E-01	All	1.10E+03	SSE	1.56E+00	3.00E+01	mrem
Gaseous Iodine, Particulate, Carbon-14 & Tritium	Bone	5.52E-01	Child	1.10E+03	SSE	1.83E+00	3.00E+01	mrem
Gaseous Iodine, Particulate & Tritium	Thyroid	1.13E-02	Infant	1.10E+03	SSE	3.77E-02	3.00E+01	mrem
Liquid	Total Body (gamma)	3.95E-04	Child	Site Boundary		6.59E-03	6.00E+00	mrem
Liquid	Liver	5.69E-04	Child			2.85E-03	2.00E+01	mrem
Direct Radiation	Total Body	0.00E+00	All	1.15E+03	SSE	0.00E+00	2.20E+01	mrem

### 40 CFR 190 Doses

40 CFR Part 190 Compliance								
Total Dose	Total Body	2.59E-01	All	1.15E+03	SSE	1.04E+00	2.50E+01	mrem
Total Dose	Thyroid	1.13E-02	All	1.15E+03	SSE	1.51E-02	7.50E+01	mrem
Total Dose	Bone	5.52E-01	All	1.15E+03	SSE	2.20E+00	2.50E+01	mrem
Total Dose	Total Body	2.59E-01	All	1.15E+03	SSE	8.65E+00	3.00E+00	mrem
Total Dose	Bone	5.52E-01	All	1.15E+03	SSE	1.83E+01	3.00E+00	mrem
Total Dose	Thyroid	2.79E-01	All	1.15E+03	SSE	5.08E-01	5.50E+01	mrem

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

## **ATTACHMENT 5: METEOROLOGICAL DATA**



Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Extremely Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	2	0	0	0	2
NNE	0	4	1	0	0	0	5
NE	0	2	0	0	0	0	2
ENE	3	0	0	0	0	0	3
E	0	6	0	0	0	0	6
ESE	0	7	0	0	0	0	7
SE	0	3	1	0	0	0	4
SSE	0	1	2	0	0	0	3
S	0	1	3	0	0	0	4
SSW	0	0	0	0	0	0	0
SW	0	0	0	1	0	0	1
WSW	0	0	1	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	1	0	0	1
NNW	0	1	1	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	3	25	11	2	0	0	41

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 2

Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Moderately Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	4	0	0	0	0	4
NNE	0	8	4	0	0	0	12
NE	5	1	0	0	0	0	6
ENE	3	0	0	0	0	0	3
E	1	0	0	0	0	0	1
ESE	0	6	0	0	0	0	6
SE	0	1	0	0	0	0	1
SSE	0	0	2	0	0	0	2
S	0	0	5	1	0	0	6
SSW	0	2	0	0	0	0	2
SW	0	0	3	1	0	0	4
WSW	0	0	4	0	0	0	4
W	0	2	8	1	0	0	11
WNW	0	0	10	2	0	0	12
NW	0	0	9	16	6	0	31
NNW	0	0	8	11	1	0	20
Variable	0	0	0	0	0	0	0
Total	9	24	53	32	7	0	125

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 2  
Hours of missing stability measurements in all stability classes: 2

Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Slightly Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	3	2	0	0	0	5
NNE	1	4	1	0	0	0	6
NE	2	4	0	0	0	0	6
ENE	2	0	0	0	0	0	2
E	1	1	0	0	0	0	2
ESE	0	0	0	0	0	0	0
SE	0	2	2	0	0	0	4
SSE	0	0	0	0	0	0	0
S	0	3	2	1	0	0	6
SSW	0	2	0	0	0	0	2
SW	0	0	2	1	0	0	3
WSW	0	0	3	1	0	0	4
W	0	3	7	0	0	0	10
WNW	0	2	9	9	0	0	20
NW	0	2	12	13	0	0	27
NNW	0	6	16	9	1	0	32
Variable	0	0	0	0	0	0	0
Total	6	32	56	34	1	0	129

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 6  
Hours of missing stability measurements in all stability classes: 2

Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Neutral - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	7	35	30	0	0	0	72
NNE	9	35	3	0	0	0	47
NE	20	20	0	0	0	0	40
ENE	20	9	0	0	0	0	29
E	18	4	0	0	0	0	22
ESE	10	7	0	0	0	0	17
SE	10	32	5	0	0	0	47
SSE	20	44	24	0	0	0	88
S	6	27	19	0	0	0	52
SSW	2	8	7	0	0	0	17
SW	3	10	7	0	0	0	20
WSW	6	6	10	0	0	0	22
W	6	19	30	2	0	0	57
WNW	6	30	77	20	1	0	134
NW	3	35	100	91	11	0	240
NNW	4	59	70	37	1	0	171
Variable	1	0	0	0	0	0	1
Total	151	380	382	150	13	0	1076

Hours of calm in this stability class: 1  
Hours of missing wind measurements in this stability class: 58  
Hours of missing stability measurements in all stability classes: 2

Peach Bottom Atomic Power Station

Period of Record: January - March 2015

Stability Class - Slightly Stable - 150Ft-33Ft Delta-T (F)

Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	10	0	0	0	0	0	10
NNE	11	1	0	0	0	0	12
NE	11	1	0	0	0	0	12
ENE	8	0	0	0	0	0	8
E	27	1	0	0	0	0	28
ESE	33	5	0	0	0	0	38
SE	18	14	1	0	0	0	33
SSE	20	19	0	0	0	0	39
S	12	7	0	0	0	0	19
SSW	6	16	0	0	0	0	22
SW	11	20	0	0	0	0	31
WSW	14	37	1	0	0	0	52
W	21	28	5	0	0	0	54
WNW	22	33	13	0	0	0	68
NW	11	25	12	0	0	0	48
NNW	9	5	2	0	0	0	16
Variable	8	0	0	0	0	0	8
Total	252	212	34	0	0	0	498

Hours of calm in this stability class: 10

Hours of missing wind measurements in this stability class: 11

Hours of missing stability measurements in all stability classes: 2

Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Moderately Stable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	0	0	0	0	0	2
NNE	5	0	0	0	0	0	5
NE	3	0	0	0	0	0	3
ENE	5	0	0	0	0	0	5
E	11	0	0	0	0	0	11
ESE	5	0	0	0	0	0	5
SE	8	0	0	0	0	0	8
SSE	1	1	0	0	0	0	2
S	4	0	0	0	0	0	4
SSW	4	0	0	0	0	0	4
SW	11	4	0	0	0	0	15
WSW	12	16	0	0	0	0	28
W	10	1	0	0	0	0	11
WNW	6	0	0	0	0	0	6
NW	6	2	0	0	0	0	8
NNW	4	3	0	0	0	0	7
Variable	2	0	0	0	0	0	2
Total	99	27	0	0	0	0	126

Hours of calm in this stability class: 2  
Hours of missing wind measurements in this stability class: 8  
Hours of missing stability measurements in all stability classes: 2

Peach Bottom Atomic Power Station

Period of Record: January - March 2015

Stability Class - Extremely Stable - 150Ft-33Ft Delta-T (F)

Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	0	0	0	0	0	4
NNE	4	0	0	0	0	0	4
NE	1	0	0	0	0	0	1
ENE	0	0	0	0	0	0	0
E	2	0	0	0	0	0	2
ESE	4	0	0	0	0	0	4
SE	0	0	0	0	0	0	0
SSE	2	0	0	0	0	0	2
S	1	0	0	0	0	0	1
SSW	1	0	0	0	0	0	1
SW	3	1	0	0	0	0	4
WSW	8	5	0	0	0	0	13
W	7	1	0	0	0	0	8
WNW	4	0	0	0	0	0	4
NW	4	0	0	0	0	0	4
NNW	1	0	0	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	46	7	0	0	0	0	53

Hours of calm in this stability class: 7

Hours of missing wind measurements in this stability class: 5

Hours of missing stability measurements in all stability classes: 2

Peach Bottom Atomic Power Station

Period of Record: January - March 2015

Stability Class - Extremely Unstable - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	1	0	0	0	1
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	0	1	0	0	0	1

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 1



Peach Bottom Atomic Power Station

Period of Record: January - March 2015

Stability Class - Moderately Unstable - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	1	0	0	0	0	1
ESE	0	0	1	0	0	0	1
SE	0	0	1	1	0	0	2
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	2	2	1	0	0	5

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 1

Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Slightly Unstable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	1	0	0	0	2
NNE	0	3	2	0	0	0	5
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	2	0	0	0	2
SE	0	1	5	1	0	0	7
SSE	0	0	1	1	0	0	2
S	0	0	0	3	0	0	3
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	2	0	0	2
W	0	0	0	0	0	0	0
WNW	0	0	0	2	5	2	9
NW	0	1	1	0	0	3	5
NNW	0	0	1	0	0	0	1
Variable	0	0	0	0	0	0	0
Total	0	6	13	9	5	5	38

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 1

Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Neutral - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	14	35	41	6	1	99
NNE	0	15	24	5	0	0	44
NE	5	12	30	7	0	0	54
ENE	1	11	16	0	0	0	28
E	7	6	5	1	0	0	19
ESE	2	6	12	2	0	0	22
SE	2	9	26	9	0	0	46
SSE	0	12	32	15	1	0	60
S	1	21	44	28	3	0	97
SSW	1	8	13	5	0	0	27
SW	5	7	10	13	6	0	41
WSW	2	4	8	19	1	0	34
W	2	7	21	36	13	1	80
WNW	0	7	31	66	81	40	225
NW	1	14	45	94	100	48	302
NNW	1	26	56	61	18	8	170
Variable	0	0	0	0	0	0	0
Total	32	179	408	402	229	98	1348

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 1  
Hours of missing stability measurements in all stability classes: 1

Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Slightly Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	6	2	3	0	0	12
NNE	3	3	1	0	0	0	7
NE	3	14	4	1	0	0	22
ENE	1	6	1	0	0	0	8
E	1	4	3	0	0	0	8
ESE	1	2	9	0	0	0	12
SE	0	15	16	0	0	0	31
SSE	0	14	25	10	0	0	49
S	5	23	37	11	0	0	76
SSW	2	6	23	8	0	0	39
SW	3	14	21	14	0	0	52
WSW	5	9	17	20	3	0	54
W	1	8	5	24	4	1	43
WNW	2	10	21	18	8	1	60
NW	2	6	19	29	9	0	65
NNW	2	7	15	6	0	0	30
Variable	0	0	0	0	0	0	0
Total	32	147	219	144	24	2	568

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 1

Peach Bottom Atomic Power Station

Period of Record: January - March 2015  
Stability Class - Moderately Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	2	1	0	0	0	3
NNE	0	2	2	0	0	0	4
NE	1	3	2	0	0	0	6
ENE	0	2	0	0	0	0	2
E	1	2	2	0	0	0	5
ESE	1	0	3	0	0	0	4
SE	2	8	0	0	0	0	10
SSE	1	4	6	0	0	0	11
S	2	4	1	0	0	0	7
SSW	1	5	7	0	0	0	13
SW	1	6	10	2	0	0	19
WSW	0	8	10	5	2	0	25
W	0	7	7	7	0	0	21
WNW	0	3	9	0	0	0	12
NW	0	2	7	1	0	0	10
NNW	0	0	3	0	0	0	3
Variable	0	0	0	0	0	0	0
Total	10	58	70	15	2	0	155

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 1

Peach Bottom Atomic Power Station

Period of Record: January - March 2015

Stability Class - Extremely Stable - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	1	4	0	0	0	5
SSE	0	2	4	0	0	0	6
S	0	0	0	0	0	0	0
SSW	0	0	4	0	0	0	4
SW	0	3	6	2	0	0	11
WSW	0	0	4	4	1	0	9
W	0	0	0	0	0	0	0
WNW	0	3	1	0	0	0	4
NW	0	0	4	0	0	0	4
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	9	27	6	1	0	43

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 1

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Extremely Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	4	1	0	0	0	6
NNE	1	9	0	0	0	0	10
NE	5	10	0	0	0	0	15
ENE	10	3	0	0	0	0	13
E	12	10	0	0	0	0	22
ESE	0	29	2	0	0	0	31
SE	0	13	6	0	0	0	19
SSE	0	6	7	1	0	0	14
S	0	3	19	10	0	0	32
SSW	0	0	1	1	0	0	2
SW	0	0	0	4	0	0	4
WSW	0	0	0	1	0	0	1
W	0	1	1	1	0	0	3
WNW	0	0	1	1	0	0	2
NW	0	2	1	4	0	0	7
NNW	0	3	4	1	0	0	8
Variable	0	0	0	0	0	0	0
Total	29	93	43	24	0	0	189

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 298

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Moderately Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	12	2	0	0	0	15
NNE	3	6	0	0	0	0	9
NE	4	2	0	0	0	0	6
ENE	4	1	0	0	0	0	5
E	2	4	0	0	0	0	6
ESE	2	3	0	0	0	0	5
SE	0	7	2	0	0	0	9
SSE	0	9	4	0	0	0	13
S	0	10	10	3	0	0	23
SSW	0	3	2	3	0	0	8
SW	0	0	1	1	0	0	2
WSW	0	3	2	2	0	0	7
W	0	5	5	2	0	0	12
WNW	0	2	3	1	0	0	6
NW	0	2	3	10	1	0	16
NNW	2	8	18	2	0	0	30
Variable	0	0	0	0	0	0	0
Total	18	77	52	24	1	0	172

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 298



Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Slightly Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	5	2	0	0	0	8
NNE	2	2	1	0	0	0	5
NE	2	0	0	0	0	0	2
ENE	5	3	0	0	0	0	8
E	1	2	0	0	0	0	3
ESE	0	0	0	0	0	0	0
SE	1	2	1	0	0	0	4
SSE	0	3	1	0	0	0	4
S	0	4	5	4	0	0	13
SSW	0	4	1	0	0	0	5
SW	0	1	1	0	0	0	2
WSW	0	4	0	0	0	0	4
W	1	3	3	2	0	0	9
WNW	0	3	4	2	0	0	9
NW	0	5	4	3	1	0	13
NNW	2	4	7	0	0	0	13
Variable	0	0	0	0	0	0	0
Total	15	45	30	11	1	0	102

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 298

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Neutral - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	15	21	5	0	0	0	41
NNE	21	16	0	0	0	0	37
NE	24	1	0	0	0	0	25
ENE	18	16	0	0	0	0	34
E	13	12	4	0	0	0	29
ESE	8	8	2	0	0	0	18
SE	11	28	3	0	0	0	42
SSE	5	49	17	0	0	0	71
S	8	44	22	14	0	0	88
SSW	4	10	3	0	0	0	17
SW	1	8	2	1	0	0	12
WSW	3	13	13	0	0	0	29
W	4	22	18	1	0	0	45
WNW	4	14	14	3	0	0	35
NW	7	16	50	7	0	0	80
NNW	8	26	31	2	0	0	67
Variable	1	0	0	0	0	0	1
Total	155	304	184	28	0	0	671

Hours of calm in this stability class: 1  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 298

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Slightly Stable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	20	7	0	0	0	0	27
NNE	22	9	0	0	0	0	31
NE	22	3	0	0	0	0	25
ENE	15	2	0	0	0	0	17
E	22	3	0	0	0	0	25
ESE	15	2	0	0	0	0	17
SE	25	23	0	0	0	0	48
SSE	23	35	4	0	0	0	62
S	19	42	16	1	0	0	78
SSW	12	9	2	0	0	0	23
SW	12	8	2	0	0	0	22
WSW	7	20	2	0	0	0	29
W	11	22	7	1	0	0	41
WNW	12	38	8	0	0	0	58
NW	15	26	9	0	0	0	50
NNW	7	18	0	0	0	0	25
Variable	2	0	0	0	0	0	2
Total	261	267	50	2	0	0	580

Hours of calm in this stability class: 10  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 298

Peach Bottom Atomic Power Station

Period of Record: April - June 2015

Stability Class - Moderately Stable - 150Ft-33Ft Delta-T (F)

Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	0	0	0	0	0	1
NNE	1	0	0	0	0	0	1
NE	2	0	0	0	0	0	2
ENE	1	0	0	0	0	0	1
E	5	0	0	0	0	0	5
ESE	10	0	0	0	0	0	10
SE	4	0	0	0	0	0	4
SSE	5	0	0	0	0	0	5
S	3	0	0	0	0	0	3
SSW	3	1	0	0	0	0	4
SW	7	5	0	0	0	0	12
WSW	13	9	0	0	0	0	22
W	6	7	0	0	0	0	13
WNW	7	1	0	0	0	0	8
NW	6	3	0	0	0	0	9
NNW	4	3	0	0	0	0	7
Variable	1	0	0	0	0	0	1
Total	79	29	0	0	0	0	108

Hours of calm in this stability class: 5

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 298

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Extremely Stable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	9	0	0	0	0	0	9
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	2	0	0	0	0	0	2
SSW	0	0	0	0	0	0	0
SW	1	1	0	0	0	0	2
WSW	5	3	0	0	0	0	8
W	3	9	0	0	0	0	12
WNW	5	3	0	0	0	0	8
NW	3	0	0	0	0	0	3
NNW	0	0	0	0	0	0	0
Variable	1	0	0	0	0	0	1
Total	29	16	0	0	0	0	45

Hours of calm in this stability class: 3  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 298

Peach Bottom Atomic Power Station

Period of Record: April - June 2015

Stability Class - Extremely Unstable - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	1	0	0	0	1
NNE	0	2	1	0	0	0	3
NE	0	4	2	0	0	0	6
ENE	0	1	2	0	0	0	3
E	0	7	2	0	0	0	9
ESE	0	2	10	4	1	0	17
SE	0	0	1	2	0	0	3
SSE	0	0	0	1	0	0	1
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	16	19	7	1	0	43

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 303

Peach Bottom Atomic Power Station

Period of Record: April - June 2015

Stability Class - Moderately Unstable - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	2	0	0	0	0	2
NE	0	0	0	1	0	0	1
ENE	0	1	2	0	0	0	3
E	0	3	0	0	0	0	3
ESE	0	2	5	1	0	0	8
SE	0	0	1	1	0	0	2
SSE	0	0	0	0	0	0	0
S	0	0	1	1	2	0	4
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	4	0	4
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	8	9	4	6	0	27

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 303

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Slightly Unstable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	2	0	0	0	3
NNE	0	0	1	0	0	0	1
NE	0	0	0	0	0	0	0
ENE	0	0	0	1	0	0	1
E	0	3	3	0	0	0	6
ESE	0	2	7	0	1	0	10
SE	0	1	4	5	0	0	10
SSE	0	1	4	5	0	0	10
S	0	0	7	13	6	0	26
SSW	0	0	1	0	1	0	2
SW	0	0	0	0	5	0	5
WSW	0	0	0	0	0	0	0
W	0	0	0	1	3	0	4
WNW	0	1	0	0	6	2	9
NW	0	0	0	3	2	1	6
NNW	0	0	2	1	0	0	3
Variable	0	0	0	0	0	0	0
Total	0	9	31	29	24	3	96

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 303



Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Neutral - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	11	18	7	1	0	41
NNE	3	8	13	0	0	0	24
NE	4	16	27	6	0	0	53
ENE	1	17	43	4	0	0	65
E	2	10	20	8	6	0	46
ESE	4	12	24	19	7	3	69
SE	2	16	38	9	0	0	65
SSE	0	10	28	16	1	0	55
S	0	16	53	35	27	1	132
SSW	1	8	27	6	2	0	44
SW	0	5	8	6	4	1	24
WSW	1	4	17	12	6	0	40
W	0	8	20	16	16	2	62
WNW	0	13	7	31	12	1	64
NW	1	10	16	54	24	8	113
NNW	1	18	44	20	5	0	88
Variable	0	0	0	0	0	0	0
Total	24	182	403	249	111	16	985

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 303

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Slightly Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	6	9	6	0	0	22
NNE	1	8	5	2	0	0	16
NE	1	5	11	2	1	0	20
ENE	2	10	7	0	0	0	19
E	2	4	6	2	5	0	19
ESE	3	6	2	3	3	0	17
SE	1	7	17	1	0	0	26
SSE	1	11	26	9	0	0	47
S	1	21	48	36	8	0	114
SSW	0	14	34	9	0	0	57
SW	2	11	12	7	4	0	36
WSW	0	9	16	12	0	0	37
W	1	5	4	20	2	1	33
WNW	1	3	6	23	6	0	39
NW	3	13	17	22	5	0	60
NNW	2	6	16	13	0	0	37
Variable	0	0	0	0	0	0	0
Total	22	139	236	167	34	1	599

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 303

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Moderately Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	4	3	0	0	0	7
NNE	1	3	0	0	0	0	4
NE	0	0	0	0	0	0	0
ENE	1	0	0	0	0	0	1
E	0	1	0	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	1	5	0	0	0	6
S	1	5	7	0	0	0	13
SSW	0	3	10	0	0	0	13
SW	1	2	6	5	1	0	15
WSW	1	1	2	1	0	0	5
W	0	1	2	2	0	0	5
WNW	2	2	1	0	0	0	5
NW	0	8	11	3	0	0	22
NNW	0	4	5	3	0	0	12
Variable	0	0	0	0	0	0	0
Total	7	35	52	14	1	0	109

Hours of calm in this stability class: 1  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 303

Peach Bottom Atomic Power Station

Period of Record: April - June 2015  
Stability Class - Extremely Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	1	0	0	0	0	1
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	1	3	0	0	0	4
SSW	0	1	1	1	0	0	3
SW	0	2	0	0	0	0	2
WSW	0	1	0	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	7	1	0	0	8
NNW	1	1	0	0	0	0	2
Variable	0	0	0	0	0	0	0
Total	1	7	11	2	0	0	21

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 303

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Extremely Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	19	11	4	0	0	0	34
NNE	14	16	0	0	0	0	30
NE	7	1	0	0	0	0	8
ENE	9	0	0	0	0	0	9
E	5	4	0	0	0	0	9
ESE	5	7	0	0	0	0	12
SE	4	12	2	0	0	0	18
SSE	7	14	4	0	0	0	25
S	2	28	16	0	0	0	46
SSW	0	5	2	0	0	0	7
SW	0	1	0	0	0	0	1
WSW	1	0	0	0	0	0	1
W	0	1	0	0	0	0	1
WNW	2	3	0	0	0	0	5
NW	2	6	0	0	0	0	8
NNW	5	18	2	0	0	0	25
Variable	0	0	0	0	0	0	0
Total	82	127	30	0	0	0	239

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 14  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Moderately Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	7	2	0	0	0	13
NNE	9	3	0	0	0	0	12
NE	13	0	0	0	0	0	13
ENE	8	0	0	0	0	0	8
E	1	0	0	0	0	0	1
ESE	2	0	0	0	0	0	2
SE	1	4	0	0	0	0	5
SSE	3	15	1	0	0	0	19
S	1	13	5	0	0	0	19
SSW	0	6	1	0	0	0	7
SW	1	1	0	0	0	0	2
WSW	0	0	1	0	0	0	1
W	1	4	0	0	0	0	5
WNW	0	1	0	0	0	0	1
NW	1	8	4	0	0	0	13
NNW	6	22	6	0	0	0	34
Variable	0	0	0	0	0	0	0
Total	51	84	20	0	0	0	155

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 10  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Slightly Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	4	0	0	0	0	6
NNE	5	3	0	0	0	0	8
NE	2	0	0	0	0	0	2
ENE	3	0	0	0	0	0	3
E	2	0	0	0	0	0	2
ESE	2	0	0	0	0	0	2
SE	1	1	2	0	0	0	4
SSE	0	5	1	0	0	0	6
S	1	4	0	0	0	0	5
SSW	1	0	0	0	0	0	1
SW	1	2	0	0	0	0	3
WSW	0	2	2	0	0	0	4
W	0	2	1	0	0	0	3
WNW	1	5	1	0	0	0	7
NW	1	6	1	0	0	0	8
NNW	3	9	3	0	0	0	15
Variable	0	0	0	0	0	0	0
Total	25	43	11	0	0	0	79

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 3  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Neutral - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	14	11	11	0	0	0	36
NNE	19	4	0	0	0	0	23
NE	19	0	0	0	0	0	19
ENE	10	0	0	0	0	0	10
E	9	0	0	0	0	0	9
ESE	5	3	0	0	0	0	8
SE	16	19	8	0	0	0	43
SSE	11	63	29	0	0	0	103
S	10	34	4	0	0	0	48
SSW	11	15	1	0	0	0	27
SW	4	14	3	0	0	0	21
WSW	5	18	5	0	0	0	28
W	7	8	5	0	0	0	20
WNW	11	18	3	0	0	0	32
NW	22	20	9	0	0	0	51
NNW	15	25	34	0	0	0	74
Variable	0	0	0	0	0	0	0
Total	188	252	112	0	0	0	552

Hours of calm in this stability class: 22  
Hours of missing wind measurements in this stability class: 24  
Hours of missing stability measurements in all stability classes: 6



Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Slightly Stable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	27	12	1	0	0	0	40
NNE	30	8	0	0	0	0	38
NE	11	1	0	0	0	0	12
ENE	13	0	0	0	0	0	13
E	3	0	0	0	0	0	3
ESE	7	1	0	0	0	0	8
SE	16	8	2	0	0	0	26
SSE	30	29	0	0	0	0	59
S	21	27	4	0	0	0	52
SSW	21	4	2	0	0	0	27
SW	17	7	0	0	0	0	24
WSW	18	20	2	0	0	0	40
W	28	20	4	0	0	0	52
WNW	37	33	1	0	0	0	71
NW	28	14	5	0	0	0	47
NNW	23	9	7	0	0	0	39
Variable	1	0	0	0	0	0	1
Total	331	193	28	0	0	0	552

Hours of calm in this stability class: 53  
Hours of missing wind measurements in this stability class: 74  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Moderately Stable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	0	0	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	4	0	0	0	0	0	4
SSE	1	0	0	0	0	0	1
S	5	3	0	0	0	0	8
SSW	13	2	0	0	0	0	15
SW	27	3	0	0	0	0	30
WSW	28	16	2	0	0	0	46
W	25	9	0	0	0	0	34
WNW	20	6	0	0	0	0	26
NW	10	3	0	0	0	0	13
NNW	5	0	0	0	0	0	5
Variable	0	0	0	0	0	0	0
Total	140	42	2	0	0	0	184

Hours of calm in this stability class: 24  
Hours of missing wind measurements in this stability class: 40  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Extremely Stable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	25	16	0	0	0	0	41
WSW	48	24	0	0	0	0	72
W	19	8	0	0	0	0	27
WNW	3	1	0	0	0	0	4
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	95	49	0	0	0	0	144

Hours of calm in this stability class: 1  
Hours of missing wind measurements in this stability class: 32  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015

Stability Class - Extremely Unstable - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	0	1	0	0	0	1
NE	0	1	1	0	0	0	2
ENE	0	4	6	0	0	0	10
E	0	5	0	3	0	0	8
ESE	0	5	2	0	0	0	7
SE	0	0	2	1	0	0	3
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	15	12	4	0	0	31

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015

Stability Class - Moderately Unstable - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	1	1	0	0	0	2
ENE	1	4	1	1	0	0	7
E	0	4	0	2	0	0	6
ESE	0	4	1	0	0	0	5
SE	0	1	3	1	0	0	5
SSE	0	1	1	0	0	0	2
S	0	0	1	1	0	0	2
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	1	15	8	5	0	0	29

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Slightly Unstable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	1	4	3	0	0	8
NNE	0	4	4	0	0	0	8
NE	0	7	3	0	0	0	10
ENE	0	2	5	0	0	0	7
E	0	4	1	1	0	0	6
ESE	1	5	0	0	0	0	6
SE	0	7	9	0	0	0	16
SSE	0	2	6	0	0	0	8
S	0	4	16	6	0	0	26
SSW	0	2	4	0	0	0	6
SW	0	1	0	0	0	0	1
WSW	0	0	0	0	0	0	0
W	0	0	1	0	0	0	1
WNW	0	0	4	0	0	0	4
NW	0	2	3	0	0	0	5
NNW	0	1	3	0	0	0	4
Variable	0	0	0	0	0	0	0
Total	1	42	63	10	0	0	116

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015

Stability Class - Neutral - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	9	9	11	1	0	32
NNE	6	16	17	0	0	0	39
NE	10	17	15	1	0	0	43
ENE	12	26	16	1	0	0	55
E	9	8	12	7	0	0	36
ESE	8	20	12	9	1	0	50
SE	3	20	33	31	2	0	89
SSE	4	22	31	17	0	0	74
S	1	20	58	14	0	0	93
SSW	0	15	20	6	0	0	41
SW	2	16	19	2	0	0	39
WSW	4	4	17	7	0	0	32
W	3	8	19	12	0	0	42
WNW	1	9	15	9	0	0	34
NW	2	37	56	25	3	0	123
NNW	2	34	40	29	2	0	107
Variable	1	0	0	0	0	0	1
Total	70	281	389	181	9	0	930

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015

Stability Class - Slightly Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	13	9	6	0	0	32
NNE	4	10	21	3	0	0	38
NE	5	9	14	2	0	0	30
ENE	5	8	13	5	0	0	31
E	2	5	9	8	1	1	26
ESE	3	7	6	3	0	0	19
SE	2	18	21	2	0	0	43
SSE	2	8	28	4	0	0	42
S	4	19	59	21	2	0	105
SSW	9	11	41	5	1	0	67
SW	6	32	20	4	0	0	62
WSW	3	11	19	5	1	0	39
W	1	12	14	13	3	0	43
WNW	0	10	9	9	0	0	28
NW	1	14	38	40	3	0	96
NNW	2	11	20	12	0	0	45
Variable	0	0	0	0	0	0	0
Total	53	198	341	142	11	1	746

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 6



Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Moderately Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	9	11	2	0	0	24
NNE	1	2	4	0	0	0	7
NE	2	1	0	0	0	0	3
ENE	1	1	0	0	0	0	2
E	0	0	0	0	0	0	0
ESE	4	0	0	0	0	0	4
SE	1	5	1	0	0	0	7
SSE	3	10	2	0	0	0	15
S	5	12	2	1	0	0	20
SSW	1	8	4	4	0	0	17
SW	3	4	7	6	0	0	20
WSW	4	5	5	7	1	0	22
W	2	3	7	2	2	0	16
WNW	1	8	8	2	0	0	19
NW	0	7	22	14	0	0	43
NNW	1	8	16	0	0	0	25
Variable	0	0	0	0	0	0	0
Total	31	83	89	38	3	0	244

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: July - September 2015  
Stability Class - Extremely Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	6	3	0	0	0	13
NNE	2	3	3	0	0	0	8
NE	0	1	0	0	0	0	1
ENE	1	0	0	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	1	0	0	0	0	0	1
SSE	0	0	0	0	0	0	0
S	5	2	0	0	0	0	7
SSW	0	2	0	0	0	0	2
SW	3	5	4	0	0	0	12
WSW	1	3	7	0	0	0	11
W	4	5	0	0	0	0	9
WNW	1	5	8	0	0	0	14
NW	5	7	6	0	0	0	18
NNW	0	6	3	0	0	0	9
Variable	0	0	0	0	0	0	0
Total	27	45	34	0	0	0	106

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 6

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Extremely Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	3	0	0	0	0	3
NNE	2	8	1	0	0	0	11
NE	7	4	0	0	0	0	11
ENE	6	2	0	0	0	0	8
E	4	8	0	0	0	0	12
ESE	1	8	0	0	0	0	9
SE	0	4	1	0	0	0	5
SSE	1	0	2	0	0	0	3
S	0	0	0	0	0	0	0
SSW	0	1	1	0	0	0	2
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	21	38	5	0	0	0	64

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Moderately Unstable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	4	2	0	0	0	7
NNE	1	6	0	0	0	0	7
NE	1	0	0	0	0	0	1
ENE	2	2	0	0	0	0	4
E	3	0	0	0	0	0	3
ESE	3	3	0	0	0	0	6
SE	0	3	0	0	0	0	3
SSE	0	1	1	0	0	0	2
S	0	1	3	0	0	0	4
SSW	0	1	5	0	0	0	6
SW	0	2	1	0	0	0	3
WSW	0	0	5	0	0	0	5
W	0	2	0	1	0	0	3
WNW	0	4	0	4	0	0	8
NW	0	4	6	3	0	0	13
NNW	1	4	14	5	0	0	24
Variable	0	0	0	0	0	0	0
Total	12	37	37	13	0	0	99

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015

Stability Class - Slightly Unstable - 150Ft-33Ft Delta-T (F)

Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	4	1	0	0	0	5
NNE	0	0	0	0	0	0	0
NE	3	2	0	0	0	0	5
ENE	1	0	0	0	0	0	1
E	1	0	0	0	0	0	1
ESE	1	2	0	0	0	0	3
SE	1	2	0	0	0	0	3
SSE	0	0	1	0	0	0	1
S	0	2	1	0	0	0	3
SSW	1	1	2	0	0	0	4
SW	0	2	3	0	0	0	5
WSW	0	2	1	0	0	0	3
W	0	2	1	1	0	0	4
WNW	0	0	2	3	0	0	5
NW	0	4	7	2	0	0	13
NNW	0	6	22	1	0	0	29
Variable	0	0	0	0	0	0	0
Total	8	29	41	7	0	0	85

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Neutral - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	8	33	22	1	0	0	64
NNE	6	55	5	0	0	0	66
NE	16	17	0	0	0	0	33
ENE	24	11	0	0	0	0	35
E	8	8	0	0	0	0	16
ESE	9	22	1	0	0	0	32
SE	11	23	19	0	0	0	53
SSE	10	42	12	2	0	0	66
S	10	47	6	5	0	0	68
SSW	5	23	13	2	0	0	43
SW	2	5	7	0	0	0	14
WSW	4	6	8	0	0	0	18
W	3	14	21	2	0	0	40
WNW	1	27	38	7	0	0	73
NW	6	33	49	3	0	0	91
NNW	4	37	47	4	0	0	92
Variable	0	0	0	0	0	0	0
Total	127	403	248	26	0	0	804

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Slightly Stable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	11	5	2	0	0	0	18
NNE	19	34	11	0	0	0	64
NE	20	6	0	0	0	0	26
ENE	43	3	0	0	0	0	46
E	24	4	0	0	0	0	28
ESE	28	14	0	0	0	0	42
SE	29	13	4	0	0	0	46
SSE	19	23	3	0	0	0	45
S	19	23	1	0	0	0	43
SSW	17	14	1	0	0	0	32
SW	13	11	0	0	0	0	24
WSW	7	33	3	0	0	0	43
W	13	53	9	0	0	0	75
WNW	17	54	6	1	0	0	78
NW	9	28	6	1	0	0	44
NNW	16	23	4	0	0	0	43
Variable	0	0	0	0	0	0	0
Total	304	341	50	2	0	0	697

Hours of calm in this stability class: 10  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Moderately Stable - 150Ft-33Ft Delta-T (F)  
Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	9	1	0	0	0	0	10
NNE	10	0	0	0	0	0	10
NE	2	0	0	0	0	0	2
ENE	11	0	0	0	0	0	11
E	14	0	0	0	0	0	14
ESE	18	1	0	0	0	0	19
SE	8	1	0	0	0	0	9
SSE	2	1	0	0	0	0	3
S	4	0	0	0	0	0	4
SSW	11	0	0	0	0	0	11
SW	17	4	0	0	0	0	21
WSW	28	14	2	0	0	0	44
W	28	20	0	0	0	0	48
WNW	13	3	0	0	0	0	16
NW	9	2	0	0	0	0	11
NNW	9	2	0	0	0	0	11
Variable	0	0	0	0	0	0	0
Total	193	49	2	0	0	0	244

Hours of calm in this stability class: 11  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33



Peach Bottom Atomic Power Station

Period of Record: October - December 2015

Stability Class - Extremely Stable - 150Ft-33Ft Delta-T (F)

Winds Measured at 33 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	4	0	0	0	0	0	4
NNE	0	0	0	0	0	0	0
NE	1	0	0	0	0	0	1
ENE	3	0	0	0	0	0	3
E	8	0	0	0	0	0	8
ESE	8	1	0	0	0	0	9
SE	1	0	0	0	0	0	1
SSE	2	0	0	0	0	0	2
S	2	0	0	0	0	0	2
SSW	3	0	0	0	0	0	3
SW	8	3	0	0	0	0	11
WSW	38	26	0	0	0	0	64
W	20	4	0	0	0	0	24
WNW	11	0	0	0	0	0	11
NW	8	0	0	0	0	0	8
NNW	5	0	0	0	0	0	5
Variable	0	0	0	0	0	0	0
Total	122	34	0	0	0	0	156

Hours of calm in this stability class: 5

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015

Stability Class - Extremely Unstable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	3	1	1	0	0	5
ESE	0	0	2	0	0	0	2
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	3	3	1	0	0	7

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015

Stability Class - Moderately Unstable - 316Ft-33Ft Delta-T (F)

Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	0	1	0	0	0	1
NNE	0	0	0	0	0	0	0
NE	0	2	0	0	0	0	2
ENE	0	0	1	0	0	0	1
E	0	0	0	0	0	0	0
ESE	0	1	2	1	0	0	4
SE	0	0	0	0	0	0	0
SSE	0	0	0	0	0	0	0
S	0	0	0	0	0	0	0
SSW	0	0	0	0	0	0	0
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	0	3	4	1	0	0	8

Hours of calm in this stability class: 0

Hours of missing wind measurements in this stability class: 0

Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Slightly Unstable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	0	2	2	1	0	0	5
NNE	1	1	2	0	0	0	4
NE	0	0	5	0	0	0	5
ENE	0	1	1	0	0	0	2
E	0	1	2	0	0	0	3
ESE	0	1	3	0	0	0	4
SE	0	3	3	0	0	0	6
SSE	0	1	0	0	0	0	1
S	0	0	0	0	0	0	0
SSW	0	0	0	2	0	0	2
SW	0	0	0	0	0	0	0
WSW	0	0	0	0	0	0	0
W	0	0	0	0	0	0	0
WNW	0	0	0	0	1	0	1
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Variable	0	0	0	0	0	0	0
Total	1	10	18	3	1	0	33

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Neutral - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	3	13	25	21	2	0	64
NNE	1	4	9	21	16	0	51
NE	5	4	21	21	23	2	76
ENE	3	12	19	13	0	0	47
E	8	10	16	14	6	0	54
ESE	2	4	8	14	3	2	33
SE	0	6	29	28	4	0	67
SSE	0	4	27	15	2	1	49
S	1	6	38	15	2	1	63
SSW	0	7	28	16	6	1	58
SW	0	5	14	6	0	0	25
WSW	0	8	7	14	2	0	31
W	0	1	16	14	29	4	64
WNW	1	2	21	33	28	0	85
NW	1	14	49	81	24	1	170
NNW	1	17	25	28	4	0	75
Variable	0	0	0	0	0	0	0
Total	26	117	352	354	151	12	1012

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 1  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Slightly Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	2	5	12	4	0	0	23
NNE	4	3	4	0	0	0	11
NE	3	2	16	2	0	0	23
ENE	1	12	8	0	0	0	21
E	4	6	17	4	1	0	32
ESE	6	13	14	10	1	0	44
SE	6	11	18	6	0	0	41
SSE	4	12	30	12	1	0	59
S	4	24	34	14	2	0	78
SSW	1	9	34	11	0	0	55
SW	0	13	19	11	1	0	44
WSW	1	5	9	13	1	0	29
W	1	2	12	53	7	1	76
WNW	1	3	11	46	7	0	68
NW	6	12	18	42	3	0	81
NNW	2	5	21	12	0	0	40
Variable	0	0	0	0	0	0	0
Total	46	137	277	240	24	1	725

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015

Stability Class - Moderately Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	4	1	0	0	0	6
NNE	3	2	1	0	0	0	6
NE	1	1	2	1	0	0	5
ENE	1	9	1	0	0	0	11
E	3	5	1	0	0	0	9
ESE	1	3	3	0	0	0	7
SE	2	8	4	0	0	0	14
SSE	1	3	13	1	0	0	18
S	3	11	10	0	0	0	24
SSW	5	16	14	4	0	0	39
SW	2	17	5	6	0	0	30
WSW	3	2	9	4	1	0	19
W	2	5	5	10	0	0	22
WNW	5	1	8	6	0	0	20
NW	3	2	8	0	0	0	13
NNW	2	10	12	2	0	0	26
Variable	0	0	0	0	0	0	0
Total	38	99	97	34	1	0	269

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33

Peach Bottom Atomic Power Station

Period of Record: October - December 2015  
Stability Class - Extremely Stable - 316Ft-33Ft Delta-T (F)  
Winds Measured at 320 Feet

Wind Direction	Wind Speed (in mph)						Total
	1-3	4-7	8-12	13-18	19-24	> 24	
N	1	2	1	0	0	0	4
NNE	1	1	1	0	0	0	3
NE	1	0	0	0	0	0	1
ENE	2	2	0	0	0	0	4
E	0	1	0	0	0	0	1
ESE	0	0	0	0	0	0	0
SE	1	0	0	0	0	0	1
SSE	1	0	0	0	0	0	1
S	2	4	1	0	0	0	7
SSW	1	8	5	0	0	0	14
SW	1	7	2	0	0	0	10
WSW	3	4	6	0	0	0	13
W	2	5	7	0	0	0	14
WNW	2	9	5	0	0	0	16
NW	5	2	4	0	0	0	11
NNW	4	5	11	0	0	0	20
Variable	0	0	0	0	0	0	0
Total	27	50	43	0	0	0	120

Hours of calm in this stability class: 0  
Hours of missing wind measurements in this stability class: 0  
Hours of missing stability measurements in all stability classes: 33



**APPENDIX A: ERRATA DATA SECTION**  
**(No Errata Data to report during 2015)**

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

## **APPENDIX B: ATTACHED REVISION OF THE ODCM AND ODCMS**

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

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Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

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Offsite Dose Calculation Manual  
Revision 15

Peach Bottom Atomic Power Station  
Units 2 and 3

Exelon Generation Company, LLC  
Docket Nos. 50-277 & 50-278

PORC Approval: ma 5/7h 03/26/2015 15-31  
PORC Chairman/ Date/ PORC Meeting#

Implemented: PD [Signature]  
Plant Manager

| August 2015

Offsite Dose Calculation Manual  
Revision 15 |

Peach Bottom Atomic Power Station  
Units 2 and 3

Exelon Generation Company, LLC  
Docket Nos. 50-277 & 50-278 |

PORC Approval: \_\_\_\_\_  
PORC Chairman/ Date/ PORC Meeting#

Implemented: \_\_\_\_\_  
Plant Manager

August 2015 |

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## I. Purpose

The purpose of the Offsite Dose Calculation Manual is to establish methodologies and procedures for calculating doses to individuals in areas at and beyond the SITE BOUNDARY due to radioactive effluents from Peach Bottom Atomic Power Station. The results of these calculations are required to determine compliance with the requirements of Specification 5.5.4, "Radioactive Effluent Controls Program" of Appendix A to Operating Licenses DPR-44 and DPR-56, "Technical Specifications for Peach Bottom Atomic Power Station Units No. 2 and 3". The Radioactive Effluents Control Program is located in Appendix A of this Offsite Dose Calculation Manual and contains Offsite Dose Calculation Manual Specifications (ODCMS) and their associated Bases which implement the requirements of Technical Specification 5.5.4.

## II. Setpoint Determination for Liquid & Gaseous Monitors

### II.A Liquid Radwaste Activity Monitor Setpoint

A sketch of the Liquid Radwaste System is presented in Figure 4. Each tank of radioactive waste is sampled prior to release. A small liquid volume of this sample is analyzed for gross gamma activity in a NaI well counter. This NaI well counter activity is then converted to an equivalent liquid radwaste monitor reading.

$$\text{CPS (R/W Monitor)} = [\text{Net CPM/ml (well)} \times \text{Eff W/RW}] + \text{Background CPS}$$

Where:

$$\text{CPS (R/W Monitor)} = \text{liquid radwaste gross activity monitor reading in CPS}$$

$$\text{Net CPM/ml (well)} = \text{gross gamma activity for the radwaste sample tank [determined by the well counter]}$$

$$\text{Eff W/RW} = \text{conversion factor between well counter and liquid radwaste gross activity monitor [determined by calibrating both detectors with the same liquid radioactive source]}$$

$$\text{Background CPS} = \text{background reading of the liquid radwaste gross activity monitor in CPS}$$

Exceeding the expected response would indicate that an incorrect sample had been obtained for that release and the release is automatically stopped.

The alarm and trip pot setpoints for the liquid radwaste activity monitor are determined from a calibration curve for the alarm pot and trip pot. The alarm pot setting includes a factor of 1.25 to allow for analysis error, pot setting error, instrument error and calibration error. The trip pot setting includes a factor of 1.35 to allow for analysis error, pot setting error, instrument error and calibration error.

## II.B Liquid Radwaste Release Flowrate Setpoint Determination

The trip pot setpoint for the liquid radwaste release flowrate is determined by multiplying the liquid radwaste flowrate (from Section III.A) by 1.2 and using this value on the appropriate calibration curve for the discharge flow meter to be used. The Peach Bottom radwaste system has two flow monitors - high flow (5 to 300 gpm) and low flow (0.8 to 15 gpm). The factor of 1.2 allows for pot setting error and instrument error. The flow rate determination includes a margin of assurance which includes consideration of this error such that the instantaneous release limit of 10 CFR 20 is not exceeded.

## II.C Setpoint Determination for Gaseous Radwaste

A sketch of the Offgas Radwaste Treatment System is presented in Figure 1. Sketches of the Ventilation Treatment Systems for Units 2 and 3 are presented in Figures 2 and 3 respectively. The high and high-high alarm setpoints for the main stack radiation monitor, Unit 2 roof vent radiation monitor and Unit 3 roof vent radiation monitor are determined as follows:

High Alarm - the high alarm setpoint is set at approximately 3 x background.



High-High Alarm - the high-high alarm setpoint is set at a release rate from this vent of approximately 30% of the instantaneous release limit as specified in ODCMS 3.8.C.1.a for the most restrictive case (skin or total body) on an unidentified basis. To determine these setpoints, solve the gaseous effluent dose rate equations in section IV.A of the ODCM to determine what main stack release rate and roof vent release rate will produce a dose rate of 150 mrem/yr to the total body (30% of the limit of 500 mrem/yr) and a dose rate of 900 mrem/yr to the skin (30% of the limit of 3000 mrem/yr) from each release point. Using the highest (most restrictive) release rate for each release point determine monitor response required to produce this release rate assuming a normal vent flow rate and pressure correction factor. Set the high-high alarm for approximately this monitor response.

#### II.D. Setpoint Determination for Gaseous Radwaste

##### Flow Monitors

The alarm setpoint for the main stack flow monitor is as follows:

Low Flow Alarm - 10,000 CFM. - This setting ensures that the main stack minimum dilution flow as specified in ODCMS 3.8.C.4.a is maintained.

The alarm setpoints for the roof vent flow monitors are as follows:

Low Flow Alarm -  $1.5 \times 10^5$  cfm

High Flow Alarm -  $5.4 \times 10^5$  cfm

#### III. Liquid Pathway Dose Calculations

##### III.A Liquid Radwaste Release Flow Rate Determination

Peach Bottom Atomic Power Station Units 2 and 3 have one common discharge point for liquid releases. The following calculation assures that the radwaste release limits are met.

The flow rate of liquid radwaste released from the site to areas at and beyond the SITE BOUNDARY shall be such that the concentration of radioactive material after dilution shall be limited to 10 times the concentration specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than noble gases and  $2\text{E-}4$   $\mu\text{Ci/ml}$  total activity concentration for all noble gases as specified in ODCMS 3.8.B.1. This

methodology is consistent with the additional guidance the NRC provided to the industry during the implementation of the updated 10 CFR 20 which changed the criterion for controlling release rate based on Effective Concentration (EC) values in the updated 10 CFR 20 as opposed to the Maximum Permissible Concentration (MPC) values in the former 10 CFR 20.

Each tank of radioactive waste is sampled prior to release and is quantitatively analyzed for identifiable gamma emitters as specified in Table 4.8.B.1 of the ODCMS. While non-gamma emitters are not specifically addressed, the conservatisms inherent in the calculation of the maximum permissible release rate are more than adequate to account for them. From this gamma isotopic analysis the maximum permissible release flow rate is determined as follows:

Determine a Dilution Factor by:

$$\text{Dilution Factor} = \sum_i \frac{\mu\text{Ci} / \text{ml}_i}{10 \times \text{ECL}_i} \quad 1$$

$\mu\text{Ci} / \text{ml}_i$  = the activity of each identified gamma emitter in  $\mu\text{Ci}/\text{ml}$

$\text{ECL}_i$  = The effluent concentration specified in 10 CFR 20, Appendix B, Table 2, Column 2 for radionuclides other than noble gases or  $2 \times 10^{-4} \mu\text{Ci}/\text{ml}$  for noble gases.

Determine the Maximum Permissible Release Rate with this Dilution Factor by:

$$\text{Release Rate (gpm)} = \frac{A \times 2.0 \times 10^5}{B \times C \times \text{Dilution Factor}}$$

A = The number of circulating water pumps running which will provide dilution

$2.0 \times 10^5$  = the flow rate in gpm for each circulating water pump running

B = margin of assurance which includes consideration of the maximum error in the activity setpoint, the maximum error in the flow setpoint, and possible loss of 5 out of the 6 possible circulating water pumps during a release. The value used for B is 10.0.

C = concentration gradient factor. The value used for C is 5.0 for discharge canal water levels less than 104' and 3.0 for canal water levels greater than 104'. This just adds another factor of conservatism.

### III.B ODCMS 4.8.B.2.1

Dose contributions from liquid effluents released to areas at and beyond the SITE BOUNDARY shall be calculated using the equation below. This dose calculation uses those appropriate radionuclides listed in Table III.A.1. These radionuclides account for virtually 100 percent of the total body dose and organ dose from liquid effluents.

The dose for each age group and each organ should be calculated to determine the maximum total body dose and organ dose for each quarter and the year, as appropriate. Cumulative dose files for quarterly and yearly doses should be maintained separately and the maximum total body and organ dose reported in each case. **CM-1** NRC URI 88-33-01, T00353.

$$D_{\tau} = \sum_i \left[ A_{i\tau} \sum_{\ell=1}^m \Delta t_{\ell} C_{i\ell} F_{\ell} \right]$$

where:

$D_{\tau}$  = The cumulative dose commitment to the total body or any organ,  $\tau$ , from liquid effluents for the total

time period  $\sum_{\ell=1}^m \Delta t_{\ell}$ , in mrem.

- $\Delta t_{\ell}$  = The length of the  $\ell$ th time period over which  $C_{i\ell}$  and  $F_{\ell}$  are averaged for the liquid release, in hours.
- $C_{i\ell}$  = The average concentration of radionuclide,  $i$ , in undiluted liquid effluent during time period  $\Delta t_{\ell}$  from any liquid release, (determined by the effluent sampling analysis program, ODCMS Table 4.8.B.1), in  $\mu\text{Ci/ml}$ .
- $A_{i\tau}$  = The site related ingestion dose commitment factor to the total body or organ,  $\tau$ , for each radionuclide listed in Table III.A.1, in mrem-ml per hr- $\mu\text{Ci}$ . See Site Specific Data.\*\*
- $F_{\ell}$  = The near field average dilution factor for  $C_{i\ell}$  during any liquid effluent release. Defined as the ratio of the maximum undiluted liquid waste flow during release to the average flow through the discharge pathway.

### III.C ODCMS 4.8.B.4.1

Projected dose contributions from liquid effluents shall be calculated using the methodology described in section III.B.

\*\* See Note 1 in Bases

TABLE III.A.1

LIQUID EFFLUENT INGESTION DOSE FACTORS  
(DECAY CORRECTED)

$A_{it}$  DOSE FACTOR (MREM-ML PER HR- $\mu$ Ci)

<u>RADIO- NUCLIDE</u>	<u>TOTAL BODY</u>		
	<u>ADULT</u>	<u>TEEN</u>	<u>CHILD</u>
H-3	2.13E+00	1.53E+00	2.70E+00
NA-24	1.65E+02	1.70E+02	1.98E+02
P-32	5.93E+04	6.49E+04	8.33E+04
CR-51	1.49E+00	1.53E+00	1.69E+00
MN-54	9.82E+02	1.00E+03	1.08E+03
FE-55	1.31E+02	1.40E+02	1.96E+02
FE-59	1.14E+03	1.17E+03	1.36E+03
CO-57	4.55E+01	4.71E+01	5.78E+01
CO-58	2.59E+02	2.62E+02	3.17E+02
CO-60	7.40E+02	7.48E+02	9.07E+02
ZN-65	3.87E+04	3.95E+04	4.16E+04
SR-89	8.83E+02	9.45E+02	1.48E+03
SR-90	1.88E+05	1.56E+05	1.72E+05
Y-91M	5.85E-13	6.14E-13	9.35E-14
Y-93	1.27E-03	1.34E-03	2.16E-03
NB-95	1.52E+02	1.56E+02	1.68E+02
NB-95M	no data	no data	no data
ZR-95	1.77E-01	1.72E-01	3.48E-01
ZR-97	1.56E-03	1.56E-03	3.43E-03
MO-99	2.91E+01	3.01E+01	5.53E+01

TC-99M	3.33E-02	3.33E-02	4.93E-02
RU-103	3.57E+00	3.60E+00	5.97E+00
RU-105	1.73E-01	1.78E-01	3.16E-01
AG-110M	2.13E+00	2.04E+00	4.23E+00
SN-113	no data	no data	no data
TE-129M	2.01E+03	2.17E+03	2.79E+03
TE-131M	4.57E+02	4.81E+02	5.74E+02
TE-132	1.40E+03	1.44E+03	1.65E+03
SB-124	6.33E+02	6.54E+02	7.54E+02
SB-125	2.15E+02	2.51E+02	3.08E+02
I-131	1.86E+02	1.79E+02	2.36E+02
I-133	1.97E+01	2.03E+01	3.20E+01
I-135	2.04E+00	2.06E+00	3.12E+00
CS-134	6.74E+05	3.88E+05	1.49E+05
CS-136	9.79E+04	9.15E+04	7.30E+04
CS-137	3.98E+05	2.20E+05	8.49E+04
CS-138	2.65E-09	2.78E-09	3.25E-09
BA-139	5.01E-07	5.17E-07	1.18E-06
BA-140	3.66E+01	3.62E+01	7.42E+01
LA-140	1.92E-02	1.97E-02	2.78E-02
LA-142	2.46E-08	2.52E-08	3.59E-08
CE-141	1.45E-02	1.46E-02	3.86E-02
CE-143	1.68E-03	1.69E-03	4.44E-03

NOTE: The listed dose factors are for radionuclides that may be detected in liquid effluents and have significant dose consequences. The factors are decayed for one day to account for the time between effluent release and ingestion of fish by the maximum exposed individual.

TABLE III.A.1  
LIQUID EFFLUENT INGESTION DOSE FACTORS  
(DECAY CORRECTED)

$A_{it}$  DOSE FACTOR (MREM-ML PER HR- $\mu$ Ci)

LIVER

<u>RADIO- NUCLIDE</u>	<u>ADULT</u>	<u>TEEN</u>	<u>CHILD</u>
H-3	2.13E+00	1.53E+00	2.70E+00
NA-24	1.65E+02	1.70E+02	1.98E+02
P-32	9.55E+04	1.04E+05	1.01E+05
CR-51	no data	no data	no data
MN-54	5.15E+03	5.06E+03	4.03E+03
FE-55	5.62E+02	6.01E+02	6.33E+02
FE-59	2.96E+03	3.02E+03	2.73E+03
CO-57	2.74E+01	2.81E+01	2.86E+01
CO-58	1.16E+02	1.14E+02	1.04E+02
CO-60	3.35E+02	3.32E+02	3.07E+02
ZN-65	8.55E+04	8.46E+04	6.69E+04
SR-89	no data	no data	no data
SR-90	no data	no data	no data
Y-91M	no data	no data	no data
Y-93	no data	no data	no data
NB-95	2.83E+02	2.84E+02	2.35E+02
NB-95M	no data	no data	no data
ZR-95	2.61E-01	2.50E-01	3.91E-01
ZR-97	8.43E-03	3.39E-03	5.82E-03
MO-99	1.53E+02	1.58E+02	2.23E+02

TC-99M	2.61E-03	2.57E-03	2.98E-03
RU-103	no data	no data	no data
RU-105	no data	no data	no data
AG-110M	3.58E+00	3.36E+00	5.30E+00
SN-113	no data	no data	no data
TE-129M	4.74E+03	5.09E+03	5.02E+03
TE-131M	5.48E+02	5.77E+02	5.40E+02
TE-132	1.48E+03	1.53E+03	1.36E+03
SB-124	3.01E+01	3.09E+01	2.79E+01
SB-125	9.57E+01	1.17E+01	1.04E+02
I-131	3.25E+02	3.32E+02	4.16E+02
I-133	6.48E+01	6.66E+01	8.45E+01
I-135	5.52E+00	5.55E+00	1.63E+00
CS-134	8.25E+05	8.36E+05	7.06E+05
CS-136	1.36E+05	1.36E+05	1.13E+05
CS-137	6.07E+05	6.32E+05	5.75E+05
CS-138	5.34E-09	5.56E-09	5.12E-09
BA-139	1.22E-08	1.25E-08	2.17E-08
BA-140	7.00E-01	6.90E-01	1.11E+00
LA-140	7.28E-02	7.40E-02	8.25E-02
LA-142	9.89E-08	1.01E-07	1.15E-07
CE-141	1.28E-01	1.27E-01	2.60E-01
CE-143	1.52E+01	1.51E+01	3.07E+01

## NOTE:

The listed dose factors are for radionuclides that may be detected in liquid effluents and have significant dose consequences. The factors are decayed for one day to account for the time between effluent release and ingestion of fish by the maximum exposed individual.



TABLE III.A.1LIQUID EFFLUENT INGESTION DOSE FACTORS  
(DECAY CORRECTED) $A_{it}$  DOSE FACTOR (MREM-ML PER HR- $\mu$ Ci)

<u>RADIO- NUCLIDE</u>	<u>BONE</u>		
	<u>ADULT</u>	<u>TEEN</u>	<u>CHILD</u>
H-3	no data	no data	no data
NA-24	1.65E+02	1.70E+02	1.98E+02
P-32	2.38E+05	2.58E+05	3.35E+05
CR-51	no data	no data	no data
MN-54	no data	no data	no data
FE-55	8.12E+02	8.47E+02	1.19E+03
FE-59	1.26E+03	1.30E+03	1.68E+03
CO-57	no data	no data	no data
CO-58	no data	no data	no data
CO-60	no data	no data	no data
ZN-65	2.69E+04	2.43E+04	2.51E+04
SR-89	3.08E+04	3.30E+04	5.19E+04
SR-90	7.67E+05	6.31E+05	6.78E+05
Y-91M	1.51E-11	1.61E-11	2.57E-11
Y-93	4.58E-02	4.90E-02	7.77E-02
NB-95	5.08E+02	5.12E+02	6.04E+02
NB-95M	no data	no data	no data
ZR-95	8.13E-01	7.94E-01	1.78E+00
ZR-97	1.69E-02	1.71E-02	4.03E-02
MO-99	no data	no data	no data

TC-99M	9.24E-04	9.22E-04	1.52E-03
RU-103	8.30E+00	8.43E+00	1.55E+01
RU-105	4.39E-01	4.59E-01	8.71E-01
AG-110M	3.87E+00	3.55E+00	7.84E+00
SN-113	no data	no data	no data
TE-129M	1.27E+04	1.37E+04	1.80E+04
TE-131M	1.12E+03	1.21E+03	1.56E+03
TE-132	2.29E+03	2.42E+03	3.07E+03
SB-124	1.60E+03	1.68E+03	2.15E+03
SB-125	4.75E+03	1.07E+03	1.39E+03
I-131	2.28E+02	2.38E+02	4.13E+02
I-133	3.72E+01	3.92E+01	6.84E+01
I-135	2.11E+00	2.16E+00	3.66E+00
CS-134	3.47E+05	3.55E+05	4.30E+05
CS-136	3.45E+04	3.46E+04	4.10E+04
CS-137	4.44E+05	4.75E+05	6.01E+05
CS-138	2.70E-09	2.90E-09	3.68E-09
BA-139	1.71E-05	1.77E-05	4.07E-05
BA-140	5.57E+02	5.63E+02	1.27E+03
LA-140	1.44E-01	1.51E-01	2.36E-01
LA-142	2.18E-07	2.28E-07	3.94E-07
CE-141	1.89E-01	1.90E-01	5.21E-01
CE-143	2.06E-02	2.07E-02	5.66E-02

NOTE: The listed dose factors are for radionuclides that may be detected in liquid effluents and have significant dose consequences. The factors are decayed for one day to account for the time between effluent release and ingestion of fish by the maximum exposed individual.

TABLE III.A.1LIQUID EFFLUENT INGESTION DOSE FACTORS  
(DECAY CORRECTED) $A_{it}$  DOSE FACTOR (MREM-ML PER HR- $\mu$ Ci)

<u>RADIO- NUCLIDE</u>	<u>KIDNEY</u>		
	<u>ADULT</u>	<u>TEEN</u>	<u>CHILD</u>
H-3	2.13E+00	1.53E+00	2.70E+00
NA-24	1.65E+02	1.70E+02	1.98E+02
P-32	no data	no data	no data
CR-51	3.28E-01	3.35E-01	2.57E-01
MN-54	1.53E+03	1.51E+03	1.13E+03
FE-55	no data	no data	no data
FE-59	no data	no data	no data
CO-57	no data	no data	no data
CO-58	no data	no data	no data
CO-60	no data	no data	no data
ZN-65	5.72E+04	5.41E+04	4.22E+04
SR-89	no data	no data	no data
SR-90	no data	no data	no data
Y-91M	no data	no data	no data
Y-93	no data	no data	no data
NB-95	2.79E+02	2.75E+02	2.21E+02
NB-95M	no data	no data	no data
ZR-95	4.09E-01	3.68E-01	5.60E-01
ZR-97	5.14E-03	5.14E-03	8.35E-03
MO-99	3.46E+02	3.61E+02	4.77E+02

TC-99M	3.96E-02	3.83E-02	4.33E-02
RU-103	3.17E+01	2.97E+01	3.91E+01
RU-105	5.68E+00	5.78E+00	7.66E+00
AG-110M	7.04E+00	6.40E+00	9.86E+00
SN-113	no data	no data	no data
TE-129M	5.31E+04	5.74E+04	5.29E+04
TE-131M	5.55E+03	6.01E+03	5.22E+03
TE-132	1.43E+04	1.47E+04	1.27E+04
SB-124	no data	no data	no data
SB-125	no data	no data	no data
I-131	5.57E+02	5.73E+02	6.82E+02
I-133	1.12E+02	1.16E+02	1.41E+02
I-135	8.86E+00	8.77E+00	1.01E+01
CS-134	2.67E+05	2.66E+05	2.19E+05
CS-136	7.57E+04	7.42E+04	6.00E+04
CS-137	2.06E+05	2.15E+05	1.87E+05
CS-138	3.92E-09	4.10E-09	3.60E-09
BA-139	1.14E-08	1.18E-08	1.90E-08
BA-140	2.38E-01	2.34E-01	3.62E-01
LA-140	no data	no data	no data
LA-142	no data	no data	no data
CE-141	5.94E-02	5.98E-02	1.14E-01
CE-143	6.70E-03	6.77E-03	1.29E-02

## NOTE:

The listed dose factors are for radionuclides that may be detected in liquid effluents and have significant dose consequences. The factors are decayed for one day to account for the time between effluent release and ingestion of fish by the maximum exposed individual.

TABLE III.A.1LIQUID EFFLUENT INGESTION DOSE FACTORS  
(DECAY CORRECTED) $A_{1r}$  DOSE FACTOR (MREM-ML PER HR- $\mu$ Ci)

<u>RADIO- NUCLIDE</u>	<u>GI-LLI</u>		
	<u>ADULT</u>	<u>TEEN</u>	<u>CHILD</u>
H-3	2.13E+00	1.53E+00	2.70E+00
NA-24	1.65E+02	1.70E+02	1.98E+02
P-32	1.73E+05	1.41E+05	5.98E+04
CR-51	3.74E+02	2.57E+02	8.98E+01
MN-54	1.58E+04	1.04E+04	3.38E+03
FE-55	3.22E+02	2.60E+02	1.17E+02
FE-59	9.90E+03	7.15E+03	2.84E+03
CO-57	6.94E+02	5.24E+02	2.34E+02
CO-58	2.35E+03	1.56E+03	6.04E+02
CO-60	6.30E+03	4.33E+03	1.70E+03
ZN-65	5.38E+04	3.58E+04	1.18E+04
SR-89	4.94E+03	3.93E+03	2.01E+03
SR-90	2.22E+04	1.77E+04	9.13E+03
Y-91M	4.44E-11	7.58E-10	5.03E-08
Y-93	1.45E+03	1.50E+03	1.18E+03
NB-95	1.72E+06	1.21E+06	4.35E+05
NB-95M	no data	no data	no data
ZR-95	8.27E+02	5.78E+02	4.08E+02
ZR-97	1.06E+03	9.19E+02	8.81E+02
MO-99	3.54E+02	2.82E+02	1.85E+02

TC-99M	1.54E+00	1.69E+00	1.69E+00
RU-103	9.69E+02	7.04E+02	4.01E+02
RU-105	2.69E+02	3.70E+02	5.69E+02
AG-110M	1.46E+03	9.43E+02	6.30E+02
SN-113	no data	no data	no data
TE-129M	6.40E+04	5.15E+04	2.19E+04
TE-131M	5.44E+04	4.63E+04	2.19E+04
TE-132	7.02E+04	4.85E+04	1.37E+04
SB-124	4.53E+04	3.38E+04	1.35E+04
SB-125	5.93E+04	4.85E+04	2.13E+04
I-131	8.58E+01	6.57E+01	3.70E+01
I-133	5.82E+01	5.03E+01	3.40E+01
I-135	6.24E+00	6.16E+00	5.03E+00
CS-134	1.44E+04	1.04E+04	3.80E+03
CS-136	1.55E+04	1.09E+04	3.96E+03
CS-137	1.18E+04	9.00E+03	3.60E+03
CS-138	2.28E-14	2.52E-12	2.36E-09
BA-139	3.04E-05	1.58E-04	2.35E-03
BA-140	1.15E+03	8.69E+02	6.43E+02
LA-140	5.34E+03	4.25E+03	2.30E+03
LA-142	7.22E-04	3.08E-03	2.27E-02
CE-141	4.89E+02	3.63E+02	3.24E+02
CE-143	5.69E+02	4.54E+02	4.49E+02

NOTE: The listed dose factors are for radionuclides that may be detected in liquid effluents and have significant dose consequences. The factors are decayed for one day to account for the time between effluent release and ingestion of fish by the maximum exposed individual.

IV. Gaseous Pathway Dose CalculationsIV.A. ODCMS 4.8.C.1.1 and 4.8.C.1.2

The dose rate in areas at and beyond the SITE BOUNDARY due to radioactive materials released in gaseous effluents shall be determined by the expressions below:

IV.A.1 Noble Gases:

The dose rate from radioactive noble gas releases shall be determined by either of two methods. Method (a), the Gross Release Method, assumes that all noble gases released are the most limiting nuclide - Kr-88 for total body dose (vent and stack releases) and skin dose (vent releases) and Kr-87 for skin dose (stack releases). Method (b), the Isotopic Analysis Method, utilizes the results of noble gas analyses required by ODCMS 4.8.C.1.1.

## a. Gross Release Method

$$D_{TB} = V \dot{Q}_{NS} + K \left( \overline{\chi/Q} \right)_v \dot{Q}_{NV}$$

$$D_s = \left[ L_s \left( \overline{\chi/Q} \right)_s + 1.1B \right] \dot{Q}_{NS} + \left[ L_v + 1.1M \right] \left( \overline{\chi/Q} \right)_v \dot{Q}_{NV}$$

where:

The location is the site boundary, 1100m SSE from the vents. This location results in the highest calculated dose to an individual from noble gas releases.

$D_{TB}$  = total body dose rate, in mrem/yr.

$D_s$  = skin dose rate, in mrem/yr.

$V$  =  $4.72 \times 10^{-4}$  mrem/yr per  $\mu\text{Ci/sec}$ ; the constant for Kr-88 accounting for the gamma radiation from the elevated finite plume. This constant was developed using MARE program with plant specific inputs for PBAPS.

## IV.A.1.a (Cont'd)

- $\dot{Q}_{NS}$  = The gross release rate of noble gases from the stack determined by gross activity stack monitors averaged over one hour, in  $\mu\text{Ci/sec}$ .
- $K$  =  $1.47 \times 10^4$  mrem/yr per  $\mu\text{Ci/m}^3$ ; the total body dose factor due to gamma emissions for Kr-88 (Reg. Guide 1.109, Table B-1).
- $(\overline{\chi/Q})_v$  =  $1.12 \times 10^{-6}$  sec/ $\text{m}^3$ ; the highest calculated annual average relative concentration for any area at or beyond the SITE BOUNDARY for all vent releases.
- $\dot{Q}_{NV}$  = The gross release rate of noble gases in gaseous effluents from vent releases determined by gross activity vent monitors averaged over one hour, in  $\mu\text{Ci/sec}$ .
- $L_v$  =  $2.37 \times 10^3$  mrem/yr per  $\mu\text{Ci/m}^3$ ; the skin dose factor due to beta emissions for Kr-88. (Reg. Guide 1.109, Table B-1).
- $L_s$  =  $9.73 \times 10^3$  mrem/yr per  $\mu\text{Ci/m}^3$ ; the skin dose factor due to beta emissions for Kr-87. (Reg. Guide 1.109, Table B-1).
- $(\overline{\chi/Q})_s$  =  $9.97 \times 10^{-8}$  sec/ $\text{m}^3$ ; the highest calculated annual average relative concentration from the stack releases for any area at or beyond the SITE BOUNDARY.
- $B$  =  $1.74 \times 10^{-4}$  mrad/yr per  $\mu\text{Ci/sec}$ ; the constant for Kr-87 accounting for the gamma radiation from the elevated finite plume. This constant was developed using MARE program with plant specific inputs for PBAPS.
- $M$  =  $1.52 \times 10^4$  mrad/yr per  $\mu\text{Ci/m}^3$ ; the air dose factor due to gamma emissions for Kr-88. (Reg. Guide 1.109, Table B-1).
- 1.1 = Unit conversion, converts air dose to skin dose, mrem/mrad.



## IV.A.1. b. Isotopic Analysis Method

$$D_{TB} = \sum_i \left( V_i \dot{Q}_{is} + K_i \left( \overline{\chi/Q} \right)_v \dot{Q}_{iv} \right)$$

$$D_s = \sum_i \left[ \left( L_i \left( \overline{\chi/Q} \right)_s + 1.1B_i \right) \dot{Q}_{is} + \left( L_i + 1.1M_i \right) \left( \overline{\chi/Q} \right)_v \dot{Q}_{iv} \right]$$

where:

The location is the site boundary, 1100m SSE from the vents. This location results in the highest calculated dose to an individual from noble gas releases.

$D_{TB}$  = total body dose rate, in mrem/yr.

$D_s$  = skin dose rate, in mrem/yr.

$V_i$  = The constant for each identified noble gas radionuclide for the gamma radiation from the elevated finite plume. The constants were developed using the MARE program with plant specific inputs for PBAPS. Values are listed on Table IV.A.1, in mrem/yr per  $\mu\text{Ci/sec}$ .

$\dot{Q}_{is}$  = The release rate of noble gas radionuclide, i, in gaseous effluents from the stack determined by isotopic analysis averaged over one hour, in  $\mu\text{Ci/sec}$ .

$K_i$  = The total body dose factor due to gamma emissions for each identified noble gas radionuclide. Values are listed on Table IV.A.1, in mrem/yr per  $\mu\text{Ci/m}^3$ .

$\left( \overline{\chi/Q} \right)_v$  =  $1.12 \times 10^{-6} \text{ sec/m}^3$ ; the highest calculated annual average relative concentration for any area at or beyond the SITE BOUNDARY for all vent releases.

$\dot{Q}_{iv}$  = The release rate of noble gas radionuclide, i, in gaseous effluents from all vent releases determined by isotopic analysis averaged over one hour, in  $\mu\text{Ci/sec}$ .

## IV.A.1.b (Cont'd)

- $L_i$  = The skin dose factor due to beta emissions for each identified noble gas radionuclide. Values are listed on Table IV.A.1, in mrem/yr per  $\mu\text{Ci}/\text{m}^3$ .
- $(\overline{\chi/Q})_s$  =  $9.97 \times 10^{-8} \text{ sec}/\text{m}^3$ ; the highest calculated annual average relative concentration from the stack releases for any area at or beyond the SITE BOUNDARY.
- $B_i$  = The constant for each identified noble gas radionuclide accounting for the gamma radiation from the elevated finite plume. The constants were developed using MARE program with plant specific inputs for PBAPS. Values are listed on Table IV.A.1, in mrad/yr per  $\mu\text{Ci}/\text{sec}$ .
- $M_i$  = The air dose factor due to gamma emissions for each identified noble gas radionuclide. Values are listed on Table IV.A.1, in mrad/yr per  $\mu\text{Ci}/\text{m}^3$ .
- 1.1 = Unit conversion, converts air dose to skin dose, mrem/mrad.

TABLE IV.A.1 - Constants for Isotopic Analysis Method  
(corrected for decay during transit)

Radionuclide	Plume-Air Dose Factor $B_i$ (mrad/yr per $\mu\text{Ci/sec}$ )	Total Body Dose Factor $K_i$ (mrem/yr per $\mu\text{Ci/m}^3$ )	Skin Dose Factor $L_i$ (mrem/yr per $\mu\text{Ci/m}^3$ )	Gamma Air Dose Factor $M_i$ (mrad/yr per $\mu\text{Ci/m}^3$ )	Beta Air Dose Factor $N_i$ (mrad/yr per $\mu\text{Ci/m}^3$ )	Plume-Body Dose Factor $V_i$ (mrem/yr per $\mu\text{Ci/sec}$ )
Kr-85m	4.02E-05	1.17E+03	1.46E+03	1.23E+03	1.97E+03	3.76E-05
Kr-87	1.74E-04	5.92E+03	9.73E+03	6.17E+03	1.03E+04	1.66E-04
Kr-88	4.90E-04	1.47E+04	2.37E+03	1.52E+04	2.93E+03	4.72E-04
Xe-133	1.19E-05	2.94E+02	3.06E+02	3.53E+02	1.05E+03	1.11E-05
Xe-133m	1.09E-05	2.51E+02	9.94E+02	3.27E+02	1.48E+03	1.01E-05
Xe-135	6.37E-05	1.81E+03	1.86E+03	1.92E+03	2.46E+03	5.95E-05
Xe-135m	6.61E-05	2.53E+03	5.76E+02	2.72E+03	5.99E+02	6.17E-05
Xe-138	1.52E-04	6.98E+03	3.26E+03	7.28E+03	3.75E+03	1.46E-04

The values  $K_i$ ,  $L_i$ ,  $M_i$ , and  $N_i$  are taken from Reg. Guide 1.109, Table B-1. The values  $B_i$  and  $V_i$  were developed using the MARE program with plant specific inputs for PBAPS.

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IV.A.2 Iodine-131, iodine-133, tritium and radioactive materials in particulate form, other than noble gases, with half-lives greater than eight days:

The dose rate shall be determined for either of two critical organs and most restrictive age group. Child thyroid dose is limiting when iodine releases exceed 10 percent of the total release rates. The teenager lung dose is limiting when iodine is either not present or a small fraction of the total release.

When it is not clear which organ dose will be limiting, doses for both restrictive age group organs will be calculated and the limiting organ dose identified.

$$D = \sum_i P_i [W_s \dot{Q}_{is} + W_v \dot{Q}_{iv} + W_v \dot{q}_{iv}]$$

where:

The location is the site boundary, 1100m SSE from the vents.

- $D$  = dose rate to the critical organ most restrictive age group, in mrem/yr.
- $P_i$  = The dose parameter for radionuclides other than noble gases for the inhalation pathway. The dose factors are based on the critical organ, and most restrictive age group. All values are from Reg. Guide 1.109 (Tables E-5, E-8, E-9 and E-10). Values are listed on Table IV.A.2, in mrem/yr per  $\mu\text{Ci}/\text{m}^3$
- $W_s$  =  $1.03 \times 10^{-7}$  sec/ $\text{m}^3$ ; the highest calculated annual average relative concentration for any area at or beyond the SITE BOUNDARY from stack releases. (SSE boundary)
- $\dot{Q}_{is}$  = The release rate of radionuclides; i, in gaseous effluents from the stack determined by the effluent sampling and analysis program (ODCMS Table 4.8.C.1) in  $\mu\text{Ci}/\text{sec}$ .
- $W_v$  =  $4.78 \times 10^{-7}$  sec/ $\text{m}^3$ ; the highest calculated annual average relative concentration for any area at or beyond the SITE BOUNDARY for all vent releases. (SSE boundary)

## IV.A.2. (Cont'd)

$\dot{Q}_{iv}$  = The release rate of radionuclide,  $i$ , in gaseous effluents from all vent releases, determined by the effluent sampling and analysis program (ODCMS Table 4.8.C.1) in  $\mu\text{Ci/sec}$ .

$\dot{q}_{iv}$  = The release rate of radionuclide,  $i$ , in gaseous effluents from the auxiliary boiler stack releases, determined by the oil sampling and analysis program (ODCM Specification Table 4.8.C.1) in  $\mu\text{Ci/sec}$  as calculated below:

$$= \sum_i \frac{C_{iv} \times 3785 \times Z}{T}$$

where:

The location is the site boundary, 1097m SSE from the vents.

$C_{iv}$  = activity concentration measured in oil for nuclide,  $i$ , in  $\mu\text{Ci/ml}$ .

3785 = milliliters per gallon.

$Z$  = gallons of oil consumed.

$T$  = number of seconds used for release  
 Method (a) 60 second  
 Method (b) number of seconds used to burn oil for release.

TABLE IV.A.2  
PI CONSTANTS FOR CRITICAL ORGAN FOR THE  
MOST RESTRICTIVE AGE GROUP

(mrem/yr per  $\mu\text{Ci}/\text{m}^3$ )

RADIONUCLIDE	INFANT THYROID DOSE FACTOR	INFANT LUNG DOSE FACTOR	CHILD THYROID DOSE FACTOR	TEENAGER LUNG DOSE FACTOR
H-3	6.47E+02	6.47E+02	1.13E+03	1.27E+03
C-14	5.31E+03	5.31E+03	6.73E+03	4.87E+03
NA-24	1.06E+04	1.06E+04	1.61E+04	1.38E+04
P-32	no data	no data	no data	no data
Cr-51	5.75E+01	1.28E+04	8.55+01	2.10E+04
MN-54	no data	1.00E+06	no data	1.98E+06
FE-55	no data	8.69E+04	no data	1.24E+05
MN-56	no data	1.25E+04	no data	1.52E+04
CO-58	no data	7.77E+05	no data	1.34E+06
FE-59	no data	1.02E+06	no data	1.53E+06
CO-60	no data	4.51E+06	no data	8.72E+06
NI-63	no data	2.09E+05	no data	3.07E+05
CU-64	no data	9.30E+03	no data	1.11E+04
NI-65	no data	8.12E+03	no data	9.36E+03
ZN-65	no data	6.47E+05	no data	1.24E+06
ZN-69	no data	1.47E+03	no data	1.58E+03
BR-83	no data	no data	no data	no data
BR-84	no data	no data	no data	no data
BR-85	no data	no data	no data	no data
BR-86	no data	no data	no data	no data
BR-88	no data	no data	no data	no data
BR-89	no data	no data	no data	no data

SR-89	no data	2.03E+06	no data	2.42E+06
SR-90	no data	1.12E+07	no data	1.65E+07
Y-90	no data	2.69E+05	no data	2.93E+05
SR-91	no data	5.26E+04	no data	6.07E+04
Y-91M	no data	2.79E+03	no data	3.20E+03
Y-91	no data	2.45E+06	no data	2.94E+06
SR-92	no data	2.38E+04	no data	2.74E+04
Y-92	no data	2.45E+04	no data	2.68E+04
Y-93	no data	7.64E+04	no data	8.32E+04
NB-95	no data	4.79E+05	no data	7.51E+05
ZR-95	no data	1.75E+06	no data	2.69E+06
ZR-97	no data	1.10E+05	no data	1.30E+05
MO-99	no data	1.35E+05	no data	1.54E+05
TC-99M	no data	8.11E+02	no data	1.15E+03
TC-101	no data	5.84E+02	no data	6.67E+02
RU-103	no data	5.52E+05	no data	7.83E+05
RU-105	no data	1.57E+04	no data	1.82E+04
RU-106	no data	1.16E+07	no data	1.61E+07
AG-110M	no data	3.67E+06	no data	6.75E+06
TE-125M	1.62E+03	4.47E+05	1.92E+03	5.36E+05
TE-127M	4.87E+03	1.31E+06	6.07E+03	1.66E+06
TE-127	1.85E+00	1.04E+04	1.96E+00	1.12E+04
TE-129M	5.47E+03	1.68E+06	6.33E+03	1.98E+06
TE-129	6.75E-02	3.00E+03	7.14E-02	3.30E+03
I-130	1.60E+06	no data	1.85E+06	no data
I-131	1.48E+07	no data	1.62E+07	no data
TE-131M	8.93E+01	1.99E+05	9.77E+01	2.38E+05
TE-131	1.58E-02	2.06E+03	1.70E-02	2.34E+03

I-132	1.69E+05	no data	1.94E+05	no data
TE-132	2.79E+02	3.40E+05	3.18E+02	4.49E+05
I-133	3.56E+06	no data	3.85E+06	0.00E+00
CS-134	no data	7.97E+04	0.00E+00	1.46E+05
I-134	4.45E+04	no data	5.07E+04	no data
I-135	6.96E+05	no data	7.92E+05	no data
CS-136	no data	1.18E+04	no data	1.78E+04
CS-137	no data	7.13E+04	no data	1.21E+05
CS-138	no data	6.54E+01	no data	7.87E+01
BA-139	no data	5.95E+03	no data	6.46E+03
BA-140	no data	1.60E+06	no data	2.03E+06
LA-140	no data	1.68E+05	no data	2.14E+05
BA-141	no data	2.97E+03	no data	3.29E+03
CE-141	no data	5.17E+05	no data	6.14E+05
BA-142	no data	1.55E+03	no data	1.91E+03
LA-142	no data	8.22E+03	no data	1.02E+04
CE-143	no data	1.16E+05	no data	1.30E+05
PR-143	no data	4.33E+05	no data	4.83E+05
CE-144	no data	9.84E+06	no data	1.34E+07
PR-144	no data	1.61E+03	no data	1.75E+03
ND-147	no data	3.22E+05	no data	3.72E+05
W-187	no data	3.96E+04	no data	4.74E+04
NP-239	no data	5.95E+04	no data	6.49E+04



IV.B. ODCMS 4.8.C.2.1

The air dose in areas at and beyond the SITE BOUNDARY due to noble gases released in gaseous effluents shall be determined by the expressions below.

The air dose shall be determined by either of two methods. Method (a), the Gross Release Method, assumes that all noble gases released are the most limiting nuclide - Kr-88 for gamma radiation and Kr-87 for beta radiation. Method (b), the Isotopic Analysis Method, utilizes the results of noble gas analyses required by ODCMS 4.8.C.1.1.

## IV.B.1 for gamma radiation:

## a. Gross Release Method

$$D_{\gamma} = 3.17 \times 10^{-8} \left[ M \left( \overline{\chi/Q} \right)_v \tilde{Q}_v + B \tilde{Q}_s \right]$$

where:

The location is the SITE BOUNDARY 1100m SSE from the vents. This location results in the highest calculated gamma air dose from noble gas releases.

$D_{\gamma}$  = gamma air dose, in mrad.

$3.17 \times 10^{-8}$  = years per second.

$M$  =  $1.52 \times 10^4$  mrad/yr per  $\mu\text{Ci}/\text{m}^3$ ; the air dose factor due to gamma emissions for Kr-88. (Reg. Guide 1.109, Table B-1)

$\left( \overline{\chi/Q} \right)_v$  =  $1.12 \times 10^{-6}$  sec/ $\text{m}^3$ ; the highest calculated annual average relative concentration from vent releases for any area at or beyond the SITE BOUNDARY.

$\tilde{Q}_v$  = The gross release of noble gas radionuclides in gaseous effluents from all vents, determined by gross activity vent monitors, in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year as appropriate.

## IV.B.1. a (Cont'd)

$B$  =  $4.90 \times 10^{-4}$  mrad/year per  $\mu\text{Ci}/\text{sec}$ ; the constant for Kr-88 accounting for the gamma radiation from the elevated finite plume. The constant was developed using the MARE program with plant specific inputs for PBAPS.

$\tilde{Q}_s$  = The gross release of noble gas radionuclides in gaseous releases from the stack determined by gross activity stack monitor in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year as appropriate.

## b. Isotopic Analysis Method

$$D_\gamma = 3.17 \times 10^{-8} \sum_i \left[ M_i \left( \overline{\chi/Q} \right)_v \tilde{Q}_{iv} + B_i \tilde{Q}_{is} \right]$$

where:

The location is the SITE BOUNDARY, 1100m SSE from the vents. This location results in the highest calculated gamma air dose from noble gas releases.

$D_\gamma$  = gamma air dose, in mrad.

$3.17 \times 10^{-8}$  = years per second.

$M_i$  = The air dose factor due to gamma emissions for each identified noble gas radionuclide. Values are listed on Table IV.A.1, in mrad/yr per  $\mu\text{Ci}/\text{m}^3$ .

$\left( \overline{\chi/Q} \right)_v$  =  $1.12 \times 10^{-6}$  sec/ $\text{m}^3$ ; the highest calculated average relative concentration from vent releases for any area at or beyond the SITE BOUNDARY.

$\tilde{Q}_{iv}$  = The release of noble gas radionuclides,  $i$ , in gaseous effluents from all vents as determined by isotopic analysis, in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year, as appropriate.

$B_i$  = The constant for each identified noble gas radionuclide accounting for the gamma radiation for the elevated finite plume. The constants were developed using the MARE program with plant specific inputs for PBAPS. Values are listed on Table IV.A.1, in mrad/yr per  $\mu\text{Ci/sec}$ .

#### IV.B.1. b. (Cont'd)

$\tilde{Q}_{is}$  = The release of noble gas radionuclides,  $i$ , in gaseous effluents from the stack determined by isotopic analysis, in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year, as appropriate.

#### IV.B.2. for beta radiation:

##### a. Gross Release Method

$$D_\beta = 3.17 \times 10^{-8} N \left[ \left( \overline{\chi/Q} \right)_v \tilde{Q}_v + \left( \overline{\chi/Q} \right)_s \tilde{Q}_s \right]$$

where:

The location is the SITE BOUNDARY 1100m SSE from the vents. This location results in the highest calculated gamma air dose from noble gas releases.

$D_\beta$  = beta air dose, in mrad.

$3.17 \times 10^{-8}$  = years per second.

$N$  =  $1.03 \times 10^4$  mrad/yr per  $\mu\text{Ci/m}^3$ ; the air dose factor due to beta emissions for Kr-87. (Reg. Guide 1.109, Table B-1)

$\left( \overline{\chi/Q} \right)_v$  =  $1.12 \times 10^{-6}$  sec/ $\text{m}^3$ ; the highest calculated annual average relative concentration from vent releases for any area at or beyond the SITE BOUNDARY.

$\tilde{Q}_v$  = The gross release of noble gas radionuclides in gaseous effluents from all vents determined by gross activity vent monitors, in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year, as appropriate.

$(\overline{\chi/Q})_s$  =  $9.97 \times 10^{-8}$  sec/m<sup>3</sup>; the highest calculated annual average relative concentration from the stack releases for any area at or beyond the SITE BOUNDARY.

$\tilde{Q}_s$  = The gross release of noble gas radionuclides in gaseous releases from the stack determined by gross activity stack monitors, in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year, as appropriate.

IV.B.2. b. Isotopic Analysis Method

$$D_\beta = 3.17 \times 10^{-8} \sum_i N_i \left[ (\overline{\chi/Q})_v \tilde{Q}_{iv} + (\overline{\chi/Q})_s \tilde{Q}_{is} \right]$$

$3.17 \times 10^{-8}$  = years per second.

$N_i$  = The air dose factor due to beta emissions for each identified noble gas radionuclide. Values are listed on Table IV.A.1, in mrad/yr per  $\mu\text{Ci}/\text{m}^3$ .

$(\overline{\chi/Q})_v$  =  $1.12 \times 10^{-6}$  sec/m<sup>3</sup>; the highest calculated annual average relative concentration from vent releases for any area at or beyond the SITE BOUNDARY.

$\tilde{Q}_{iv}$  = The release of noble gas radionuclide, i, in gaseous effluents from all vents as determined by isotopic analysis, in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year, as appropriate.

$(\overline{\chi/Q})_s$  =  $9.97 \times 10^{-8}$  sec/m<sup>3</sup>; the highest calculated annual average relative concentration from the stack releases for any area at or beyond the SITE BOUNDARY.

$\tilde{Q}_{is}$  = The release of noble gas radionuclide, i, in gaseous effluents from the stack as determined by isotopic analysis, in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year, as appropriate.

IV.C ODCMS 4.8.C.3.1

The dose to an individual from iodine-131, iodine-133, tritium and radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to areas at and beyond the SITE BOUNDARY.

The dose shall be determined for the limiting organ. Infant thyroid doses are dominating any time that either iodine-131 release rates are more than two (2) percent of total release rates or iodine-133 exceeds 25 percent of total release rates. In these cases only iodine-131 and iodine-133 are potentially significant.

For cases where there is no detectable iodine releases, doses shall be determined for infant bone and liver. Both bone and liver doses are calculated because the controlling dose is dependent upon the presence of strontium.

When it is not clear whether thyroid, bone, or liver doses are controlling, all three shall be calculated and the limiting dose identified.

$$D = 3.17 \times 10^{-8} \sum_i F_e R_i \left[ W_s \tilde{Q}_{is} + W_v \tilde{Q}_{iv} + W_v \tilde{Q}_{lv} \right]$$

where:

Location is the critical pathway dairy 1500m SW from vents. |

$D$  = limiting dose to the critical infant organ, from the milk, or inhalation, or ground plane pathways, in mrem.

$3.17 \times 10^{-8}$  = years per second.

$F_e$  = Fraction that is elemental (0.5 for iodines and 1.0 for all other elements).

$R_i$  = The dose factor for each identified radionuclide;  $i$ , in  $m^2$  (mrem/yr) per  $\mu\text{Ci/sec}$  except tritium, which is in mrem/yr per  $\mu\text{Ci}/m^3$ . The dose factors are for the critical individual organ for the most restrictive age group, infant. Values are listed in Table IV.C.1 for the ingestion pathway, Table IV.C.2 for the inhalation pathway, and Table IV.C.3 for the ground plane pathway. See Site Specific Data.\*\*

## IV.C (Continued)

$W_s$  =  $8.78 \times 10^{-10}$  meters<sup>-2</sup>;  $(\overline{D/Q})$  for the food pathway for stack releases except tritium which uses a  $(\chi/Q)$  of  $8.78 \times 10^{-8}$  sec/m<sup>3</sup>.

$\tilde{Q}_{is}$  = The release of radionuclide,  $i$ , in gaseous effluents from the stack determined by the effluent sampling and analysis program (ODCMS Table 4.8.C.1), in  $\mu\text{Ci}$ . Releases shall be cumulative over the calendar quarter or year, as appropriate.

$W_v$  =  $1.58 \times 10^{-9}$  meters<sup>-2</sup>;  $(\overline{D/Q})$  for the food pathway for vent releases except tritium which uses a  $(\chi/Q)$  of  $1.58 \times 10^{-7}$  sec/m<sup>3</sup>.

\*\* See Note 2 and 3 in Bases

$\tilde{Q}_{iv}$  = The release of radionuclide,  $i$ , in gaseous effluents from the vents determined by the effluent sampling and analysis program (ODCMS Table 4.8.C.1) in  $\mu\text{Ci}$ . Release shall be cumulative over the calendar quarter or year, as appropriate.

$\tilde{q}_{iv}$  = The release of radionuclide,  $i$ , in gaseous effluents from the auxiliary boiler stack releases, determined by the oil sampling and analysis program (ODCMS Table 4.8.C.1) in  $\mu\text{Ci}$ . Release shall be cumulative over the calendar quarter or year, as appropriate.

TABLE IV.C.1  
Ri CONSTANTS INGESTION PATHWAY

(m<sup>2</sup> (mrem/yr) per µCi/sec)\*

Radionuclide	Infant Bone	Infant Liver	Infant Thyroid	Infant Kidney	Infant Lung	Infant GI-LLI	Infant Skin	Infant T Body
H-3	no data	1.30E+03	1.30E+03	1.30E+03	1.30E+03	1.30E+03	no data	1.30E+03
C-14	3.23E+06	6.89E+05	6.89E+05	6.89E+05	6.89E+05	6.89E+05	no data	6.89E+05
NA-24	4.48E+06	4.48E+06	4.48E+06	4.48E+06	4.48E+06	4.48E+06	no data	4.48E+06
P-32	4.74E+10	2.79E+09	no data	no data	no data	6.41E+08	no data	1.84E+09
CR-51	no data	no data	3.35E+04	7.32E+03	6.51E+04	1.50E+06	no data	5.13E+04
MN-54	no data	1.93E+07	no data	4.28E+06	no data	7.09E+06	no data	4.38E+06
FE-55	7.09E+07	4.58E+07	no data	no data	2.24E+07	5.81E+06	no data	1.22E+07
MN-56	no data	9.24E-03	no data	7.94E-03	no data	8.39E-01	no data	1.59E-03
CO-58	no data	9.57E+06	no data	no data	no data	2.39E+07	no data	2.39E+07
FE-59	7.92E+07	1.38E+08	no data	no data	4.09E+07	6.61E+07	no data	5.45E+07
CO-60	no data	4.69E+07	no data	no data	no data	1.12E+08	no data	1.11E+08
NI-63	1.88E+10	1.17E+09	no data	no data	no data	5.80E+07	no data	6.54E+08
CU-64	no data	5.42E+04	no data	9.17E+04	no data	1.11E+06	no data	2.51E+04
NI-65	1.03E+00	1.16E-01	no data	no data	no data	8.85E+00	no data	5.29E-02
ZN-65	2.69E+09	9.22E+09	no data	4.47E+09	no data	7.78E+09	no data	4.25E+09
ZN-69	3.09E+04	5.56E+04	no data	2.31E+04	no data	4.54E+06	no data	4.14E+03
BR-83	no data	no data	no data	no data	no data	no data	no data	1.20E-01
BR-84	no data	no data	no data	no data	no data	no data	no data	1.64E-23
BR-85	no data	no data	no data	no data	no data	no data	no data	no data
RB-86	no data	6.69E+09	no data	no data	no data	1.71E+08	no data	3.31E+09
RB-88	no data	5.60E-45	no data	no data	no data	5.45E-45	no data	3.07E-45
RB-89	no data	9.86E-53	no data	no data	no data	3.36E-53	no data	6.79E-53
SR-89	4.58E+09	no data	no data	no data	no data	9.42E+07	no data	1.31E+08
SR-90	6.55E+10	no data	no data	no data	no data	8.18E+08	no data	1.67E+10
Y-90	1.99E+02	no data	no data	no data	no data	2.74E+05	no data	5.33E+00
SR-91	7.94E+04	no data	no data	no data	no data	9.40E+04	no data	2.87E+03
Y-91M	1.66E-19	no data	no data	no data	no data	5.53E-16	no data	5.65E-21
Y-91	2.77E+04	no data	no data	no data	no data	1.98E+06	no data	7.37E+02
SR-92	1.36E+00	no data	no data	no data	no data	1.47E+01	no data	5.05E-02
Y-92	1.57E-04	no data	no data	no data	no data	3.01E+00	no data	4.43E-06
Y-93	6.31E-01	no data	no data	no data	no data	4.98E+03	no data	1.72E-02
NB-95	1.98E+05	8.16E+04	no data	5.85E+04	no data	6.89E+07	no data	4.72E+04
ZR-95	2.62E+03	6.40E+02	no data	6.89E+02	no data	3.19E+05	no data	4.54E+02
ZR-97	1.19E+00	2.04E-01	no data	2.05E-01	no data	1.30E+04	no data	9.31E-02
MO-99	no data	6.07E+07	no data	9.07E+07	no data	2.00E+07	no data	1.18E+07
TC-99M	8.04E+00	1.66E+01	no data	1.78E+02	8.67E+00	4.82E+03	no data	2.14E+02
TC-101	7.44E-60	9.38E-60	no data	1.11E-58	5.11E-60	1.59E-57	no data	9.28E-59
RU-103	2.97E+03	no data	no data	6.18E+03	no data	3.61E+04	no data	9.93E+02
RU-105	2.36E-03	no data	no data	1.73E-02	no data	9.38E-01	no data	7.94E-04
RU-106	9.54E+04	no data	no data	1.13E+05	no data	7.24E+05	no data	1.19E+04
AG-110M	1.87E+08	1.37E+08	no data	1.95E+08	no data	7.09E+09	no data	9.04E+07
SB-124	5.31E+07	7.81E+05	1.41E+05	no data	3.32E+07	1.64E+08	no data	1.64E+07
SB-125	5.23E+07	5.06E+05	6.55E+04	no data	3.03E+07	6.98E+07	no data	1.08E+07

TE-125M	5.68E+07	1.90E+07	1.91E+07	no data	no data	2.71E+07	no data	7.68E+06
TE-127M	1.82E+08	6.03E+07	5.26E+07	4.48E+08	no data	7.34E+07	no data	2.20E+07
TE-127	1.85E+03	6.19E+02	1.50E+03	4.51E+03	no data	3.88E+04	no data	3.97E+02
TE-129M	1.84E+08	6.32E+07	7.08E+07	4.61E+08	no data	1.10E+08	no data	2.84E+07
TE-129	7.99E-10	2.76E-10	6.70E-10	1.99E-09	no data	6.39E-08	no data	1.87E-10
I-130	1.04E+06	2.28E+06	2.56E+08	2.51E+06	no data	4.89E+05	no data	9.17E+05
I-131	7.97E+08	9.39E+08	3.08E+11	1.10E+09	no data	3.35E+07	no data	4.13E+08
TE-131M	9.87E+05	3.97E+05	8.05E+05	2.73E+06	no data	6.69E+06	no data	3.28E+05
TE-131	1.03E-32	3.79E-33	9.15E-33	2.62E-32	no data	4.14E-31	no data	2.88E-33
I-132	3.66E-01	7.43E-01	3.48E+01	8.29E-01	no data	6.02E-01	no data	2.65E-01
TE-132	6.17E+06	3.05E+06	4.51E+06	1.91E+07	no data	1.13E+07	no data	2.85E+06
I-133	1.06E+07	1.54E+07	2.81E+09	1.81E+07	no data	2.61E+06	no data	4.52E+06
CS-134	1.90E+10	3.54E+10	no data	9.11E+09	3.73E+09	9.61E+07	no data	3.57E+09
I-134	4.81E-12	9.86E-12	2.30E-10	1.10E-11	no data	1.02E-11	no data	3.51E-12
I-135	3.21E+04	6.39E+04	5.73E+06	7.12E+04	no data	2.31E+04	no data	2.33E+04
CS-136	5.80E+08	1.71E+09	no data	6.80E+08	1.39E+08	2.59E+07	no data	6.37E+08
CS-137	2.77E+10	3.24E+10	no data	8.71E+09	3.53E+09	1.01E+08	no data	2.30E+09
CS-138	2.58E-23	4.20E-23	no data	2.09E-23	3.27E-24	6.71E-23	no data	2.04E-23
BA-139	1.26E-07	8.32E-11	no data	5.00E-11	5.04E-11	7.95E-06	no data	3.63E-09
BA-140	7.09E+07	7.09E+04	no data	1.68E+04	4.35E+04	1.74E+07	no data	3.65E+06
LA-140	1.18E+01	4.67E+00	no data	no data	no data	5.49E+04	no data	1.20E+00
BA-141	1.41E-45	9.65E-49	no data	5.80E-49	5.87E-49	1.72E-44	no data	4.44E-47
CE-141	1.42E+04	8.69E+03	no data	2.68E+03	no data	4.49E+06	no data	1.02E+03
BA-142	7.43E-80	6.18E-83	no data	3.56E-83	3.74E-83	3.07E-79	no data	3.66E-81
LA-142	4.99E-11	1.83E-11	no data	no data	no data	3.11E-06	no data	4.39E-12
CE-143	1.16E+02	7.70E+04	no data	2.24E+01	no data	4.49E+05	no data	8.78E+00
PR-143	4.38E+02	1.64E+02	no data	6.09E+01	no data	2.31E+05	no data	2.17E+01
CE-144	1.14E+06	4.68E+05	no data	1.89E+05	no data	6.55E+07	no data	6.40E+04
PR-144	1.70E-53	6.59E-54	no data	2.39E-54	no data	3.07E-49	no data	8.58E-55
ND-147	2.58E+02	2.65E+02	no data	1.02E+02	no data	1.68E+05	no data	1.63E+01
W-187	1.79E+04	1.24E+04	no data	no data	no data	7.31E+05	no data	4.30E+03
NP-239	1.06E+01	9.51E-01	no data	1.90E+00	no data	2.75E+04	no data	5.37E-01
NP-237	5.33E+07	3.53E+06	no data	1.41E+07	no data	1.83E+06	no data	2.33E+06
NP-238	1.02E+02	2.56E+00	no data	5.58E+00	no data	3.42E+04	no data	1.57E+00

\* Tritium and C-14  $R_1$  values in units of mrem/yr per  $\mu\text{Ci}/\text{m}^3$  |



TABLE IV.C.2  
 Ri CONSTANTS INHALATION PATHWAY  
 (mrem/yr per  $\mu\text{Ci}/\text{m}^3$ )

Radionuclide	Infant Bone	Infant Liver	Infant Thyroid	Infant Kidney	Infant Lung	Infant GI-LLI	Infant Skin	Infant T Body
Nuclide	Bone	Liver	Thyroid	Kidney	Lung	GI-LLI	Skin	T Body
H-3	no data	6.47E+02	6.47E+02	6.47E+02	6.47E+02	6.47E+02	no data	6.47E+02
C-14	2.65E+04	5.31E+03	5.31E+03	5.31E+03	5.31E+03	5.31E+03	no data	5.31E+03
NA-24	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	1.06E+04	no data	1.06E+04
P-32	2.03E+06	1.12E+05	no data	no data	no data	1.61E+04	no data	7.74E+04
CR-51	no data	no data	5.75E+01	1.32E+01	1.28E+04	3.57E+02	no data	8.95E+01
MN-54	no data	2.53E+04	no data	4.98E+03	1.00E+06	7.06E+03	no data	4.98E+03
FE-55	1.97E+04	1.18E+04	no data	no data	8.69E+04	1.10E+03	no data	3.33E+03
MN-56	no data	1.54E+00	no data	1.10E+00	1.25E+04	7.17E+04	no data	2.21E-01
CO-58	no data	1.22E+03	no data	no data	7.77E+05	1.11E+04	no data	1.82E+03
FE-59	1.36E+04	2.35E+04	no data	no data	1.02E+06	2.48E+04	no data	9.48E+03
CO-60	no data	8.02E+03	no data	no data	4.51E+06	3.19E+04	no data	1.18E+04
NI-63	3.39E+05	2.04E+04	no data	no data	2.09E+05	2.42E+03	no data	1.16E+04
CU-64	no data	1.88E+00	no data	3.98E+00	9.30E+03	1.50E+04	no data	7.74E-01
NI-65	2.39E+00	2.84E-01	no data	no data	8.12E+03	5.01E+04	no data	1.23E-01
ZN-65	1.93E+04	6.26E+04	no data	3.25E+04	6.47E+05	5.14E+04	no data	3.11E+04
ZN-69	5.39E-02	9.67E-02	no data	4.02E+02	1.47E+03	1.32E+04	no data	7.18E-03
BR-83	no data	no data	no data	no data	no data	no data	no data	3.81E+02
BR-84	no data	no data	no data	no data	no data	no data	no data	4.00E+02
BR-85	no data	no data	no data	no data	no data	no data	no data	2.04E+01
BR-86	no data	1.90E+05	no data	no data	no data	3.04E+03	no data	8.82E+04
BR-88	no data	5.57E+02	no data	no data	no data	3.39E+02	no data	2.87E+02
BR-89	no data	3.21E+02	no data	no data	no data	6.82E+01	no data	2.06E+02
SR-89	3.98E+05	no data	no data	no data	2.03E+06	6.40E+04	no data	1.14E+04
SR-90	4.09E+07	no data	no data	no data	1.12E+07	1.31E+05	no data	2.59E+06
Y-90	3.29E+03	no data	no data	no data	2.69E+05	1.04E+05	no data	8.82E+01
SR-91	9.56E+01	no data	no data	no data	5.26E+04	7.34E+04	no data	3.46E+00
Y-91M	4.07E-01	no data	no data	no data	2.79E+03	2.35E+03	no data	1.39E-02
Y-91	5.88E+05	no data	no data	no data	2.45E+06	7.03E+04	no data	1.57E+04
SR-92	1.05E+01	no data	no data	no data	2.38E+04	1.40E+05	no data	3.91E-01
Y-92	1.64E+01	no data	no data	no data	2.45E+04	1.27E+05	no data	4.61E-01
Y-93	1.50E+02	no data	no data	no data	7.64E+04	1.67E+05	no data	4.07E+00
NB-95	1.57E+04	6.43E+03	no data	4.72E+03	4.79E+05	1.27E+04	no data	3.78E+03
ZR-95	1.15E+05	2.79E+04	no data	3.11E+04	1.75E+06	2.17E+04	no data	2.03E+04
ZR-97	1.50E+02	2.56E+01	no data	2.59E+01	1.10E+05	1.40E+05	no data	1.17E+01
MO-99	no data	1.65E+02	no data	2.65E+02	1.35E+05	4.87E+04	no data	3.23E+01
TC-99M	1.40E-03	2.88E-03	no data	3.11E-02	8.11E+02	2.03E+03	no data	3.72E-02
TC-101	6.51E-05	8.23E-05	no data	9.79E-04	5.84E+02	8.44E+02	no data	8.12E-04
RU-103	2.02E+03	no data	no data	4.24E+03	5.52E+05	1.61E+04	no data	6.79E+02
RU-105	1.22E+00	no data	no data	8.99E-01	1.57E+04	4.84E+04	no data	4.10E-01
RU-106	8.68E+04	no data	no data	1.07E+05	1.16E+07	1.64E+05	no data	1.09E+04
AG-110M	9.98E+03	7.22E+03	no data	1.09E+04	3.67E+06	3.30E+04	no data	5.00E+03
TE-125M	4.76E+03	1.99E+03	1.62E+03	no data	4.47E+05	1.29E+04	no data	6.58E+02
TE-127M	1.67E+04	6.90E+03	4.87E+03	3.75E+04	1.31E+06	2.73E+04	no data	2.07E+03
TE-127	2.23E+00	9.53E-01	1.85E+00	4.86E+00	1.04E+04	2.44E+04	no data	4.89E-01
TE-129M	1.41E+04	6.09E+03	5.47E+03	3.18E+04	1.68E+06	6.90E+04	no data	2.23E+03
TE-129	7.88E-02	3.47E-02	6.75E-02	1.75E-01	3.00E+03	2.63E+04	no data	1.88E-02
I-130	6.36E+03	1.39E+04	1.60E+06	1.53E+04	no data	1.99E+03	no data	5.57E+03

I-131	3.79E+04	4.44E+04	1.48E+07	5.18E+04	no data	1.06E+03	no data	1.96E+04
TE-131M	1.07E+02	5.50E+01	8.93E+01	2.65E+02	1.99E+05	1.19E+05	no data	3.63E+01
TE-131	1.74E-02	8.22E-03	1.58E-02	3.99E-02	2.06E+03	8.22E+03	no data	5.00E-03
I-132	1.69E+03	3.54E+03	1.69E+05	3.95E+03	no data	1.90E+03	no data	1.26E+03
TE-132	3.72E+02	2.37E+02	2.79E+02	1.04E+03	3.40E+05	4.41E+04	no data	1.76E+02
I-133	1.32E+04	1.92E+04	3.56E+06	2.24E+04	no data	2.16E+03	no data	5.60E+03
CS-134	3.96E+05	7.03E+05	no data	1.90E+05	7.97E+04	1.33E+03	no data	7.45E+04
I-134	9.21E+02	1.88E+03	4.45E+04	2.09E+03	no data	1.29E+03	no data	6.65E+02
I-135	3.86E+03	7.60E+03	6.96E+05	8.47E+03	no data	1.83E+03	no data	2.77E+03
CS-136	4.83E+04	1.35E+05	no data	5.64E+04	1.18E+04	1.43E+03	no data	5.29E+04
CS-137	5.49E+05	6.12E+05	no data	1.72E+05	7.13E+04	1.33E+03	no data	4.55E+04
CS-138	5.05E+02	7.81E+02	no data	4.10E+02	6.54E+01	8.76E+02	no data	3.98E+02
BA-139	1.48E+00	9.84E-04	no data	5.92E-04	5.95E+03	5.10E+04	no data	4.30E-02
BA-140	5.60E+04	5.60E+01	no data	1.34E+01	1.60E+06	3.84E+04	no data	2.90E+03
LA-140	5.05E+02	2.00E+02	no data	no data	1.68E+05	8.48E+04	no data	5.15E+01
BA-141	1.57E-01	1.08E-04	no data	6.50E-05	2.97E+03	4.75E+03	no data	4.97E-03
CE-141	2.77E+04	1.67E+04	no data	5.25E+03	5.17E+05	2.16E+04	no data	1.99E+03
BA-142	3.98E-02	3.30E-05	no data	1.90E-05	1.55E+03	6.93E+02	no data	1.96E-03
LA-142	1.03E+00	3.77E-01	no data	no data	8.22E+03	5.95E+04	no data	9.04E-02
CE-143	2.93E+02	1.93E+02	no data	5.64E+01	1.16E+05	4.97E+04	no data	2.21E+01
PR-143	1.40E+04	5.24E+03	no data	1.97E+03	4.33E+05	3.72E+04	no data	6.99E+02
CE-144	3.19E+06	1.21E+06	no data	5.38E+05	9.84E+06	1.48E+05	no data	1.76E+05
PR-144	4.79E-02	1.85E-02	no data	6.72E-03	1.61E+03	4.28E+03	no data	2.41E-03
ND-147	7.94E+03	8.13E+03	no data	3.15E+03	3.22E+05	3.12E+04	no data	5.00E+02
W-187	1.30E+01	9.02E+00	no data	no data	3.96E+04	3.56E+04	no data	3.11E+00
NP-239	3.71E+02	3.32E+01	no data	6.62E+01	5.95E+04	2.49E+04	no data	1.88E+01
U-232	3.60E+08	no data	no data	3.36E+07	2.09E+09	6.10E+04	no data	2.98E+007
U-233	7.62E+07	no data	no data	1.53E+07	4.98E+08	5.64E+04	no data	5.36E+06
U-234	7.31E+07	no data	no data	1.50E+07	4.89E+08	5.53E+04	no data	5.25E+06
U-235	7.01E+07	no data	no data	1.41E+07	4.59E+08	7.03E+04	no data	4.93E+06
U-236	7.01E+07	no data	no data	1.44E+07	4.69E+08	5.19E+04	no data	5.04E+06
U-237	4.55E+02	no data	no data	1.13E+03	1.28E+05	1.83E+04	no data	1.21E+02
U-238	6.71E+07	no data	no data	1.32E+07	4.28E+08	4.96E+04	no data	4.61E+06
NP-237	4.03E+09	2.39E+09	no data	1.08E+09	4.89E+08	7.14E+04	no data	1.76E+08
NP-238	3.74E+03	8.47E+02	no data	2.06E+02	1.29E+05	3.61E+04	no data	5.82E+01
PU-238	3.77E+09	2.35E+09	no data	6.50E+08	1.26E+09	6.57E+04	no data	1.78E+08
PU-239	4.10E+09	2.46E+09	no data	6.93E+08	1.19E+09	5.99E+04	no data	1.88E+08
PU-240	4.10E+09	2.45E+09	no data	6.92E+08	1.19E+09	6.10E+04	no data	1.88E+08
PU-241	1.18E+08	2.59E+07	no data	1.61E+07	1.07E+06	1.26E+03	no data	4.35E+06
PU-242	3.81E+09	2.37E+09	no data	6.68E+08	1.14E+09	5.88E+04	no data	1.81E+08
PU-244	4.44E+09	2.72E+09	no data	7.64E+08	1.31E+09	8.76E+04	no data	2.07E+08
AM-241	4.41E+09	2.73E+09	no data	1.11E+09	5.68E+08	6.69E+04	no data	1.83E+08
AM-242M	4.55E+09	2.60E+09	no data	1.12E+09	2.30E+08	8.41E+04	no data	1.89E+08
AM-243	4.34E+09	2.63E+09	no data	1.08E+09	5.39E+08	7.84E+04	no data	1.78E+08
CM-242	1.79E+08	1.21E+08	no data	2.37E+07	4.16E+08	7.14E+04	no data	7.98E+06
CM-243	3.46E+09	2.13E+09	no data	5.47E+08	5.94E+08	7.03E+04	no data	1.48E+08
CM-244	2.90E+09	1.78E+09	no data	4.49E+08	5.71E+08	6.80E+04	no data	1.24E+08
CM-245	4.51E+09	2.74E+09	no data	7.32E+08	5.49E+08	6.34E+04	no data	1.90E+08
CM-246	4.48E+09	2.74E+09	no data	7.32E+08	5.59E+08	6.23E+04	no data	1.90E+08
CM-247	4.35E+09	2.70E+09	no data	7.21E+08	5.49E+08	8.19E+04	no data	1.86E+08
CM-248	3.61E+10	2.23E+10	no data	5.94E+09	4.52E+09	1.32E+06	no data	1.54E+09
CF-252	3.32E+09	no data	no data	no data	1.92E+09	2.59E+05	no data	1.41E+08

TABLE IV.C.3  
 Ri CONSTANTS GROUND PLANE PATHWAY  
 (mrem/yr per  $\mu\text{Ci}/\text{m}^3$ )

AG-110M	3.44E+09
AM-241	6.85E+08
AM-242M	9.61E+07
AM-243	5.03E+09
BA-139	1.06E+05
BA-140	2.05E+07
BA-141	4.18E+04
BA-142	4.49E+04
BR-83	4.87E+03
BR-84	2.03E+05
BR-85	no data
C-14	no data
CE-141	1.37E+07
CE-143	2.31E+06
CE-144	6.96E+07
CF-252	4.83E+10
CM-242	6.85E+05
CM-243	7.05E+09
CM-244	7.84E+06
CM-245	3.67E+09
CM-246	3.86E+06
CM-247	8.51E+09
CM-248	2.63E+10
CO-58	3.79E+08
CO-60	2.32E+10
CR-51	4.66E+06
CS-134	6.91E+09
CS-136	1.50E+08
CS-137	1.30E+10
CS-138	3.59E+05
CU-64	6.07E+05
FE-55	no data
FE-59	2.72E+08
H-3	no data
I-130	5.51E+06
I-131	1.73E+07
I-132	1.23E+06
I-133	2.45E+06
I-134	4.46E+05
I-135	2.52E+06
LA-140	1.92E+07
LA-142	7.60E+05
MN-54	1.38E+09
MN-56	9.04E+05

MO-99	3.99E+06
NA-24	1.19E+07
NB-95	1.37E+08
ND-147	8.40E+06
NI-63	no data
NI-65	2.97E+05
NP-237	5.42E+09
NP-238	4.53E+06
NP-239	1.71E+06
P-32	no data
PR-143	no data
PR-144	1.83E+03
PU-238	4.65E+06
PU-239	3.06E+06
PU-240	5.02E+06
PU-241	1.14E+07
PU-242	4.26E+06
PU-244	3.46E+09
RB-86	8.97E+06
RB-88	3.31E+04
RB-89	1.23E+05
RU-103	1.08E+08
RU-105	6.36E+05
RU-106	4.22E+08
SB-124	5.98E+08
SB-125	2.38E+09
SR-89	2.16E+04
SR-90	no data
SR-91	2.15E+06
SR-92	7.77E+05
TC-101	2.04E+04
TC-99M	1.84E+05
TE-125M	1.55E+06
TE-127	2.98E+03
TE-127M	9.17E+04
TE-129	2.62E+04
TE-129M	1.98E+07
TE-131	2.92E+04
TE-131M	8.03E+06
TE-132	4.23E+06
U-232	9.12E+06
U-233	8.90E+09
U-234	2.45E+06
U-235	1.24E+10
U-236	8.13E+04
U-237	5.16E+07
U-238	4.26E+08
W-187	2.36E+06
Y-90	4.49E+03
Y-91	1.07E+06

Y-91M	1.00E+05
Y-92	1.80E+05
Y-93	1.83E+05
ZN-65	7.46E+08
ZN-69	no data
ZR-95	2.45E+08
ZR-97	2.96E+06

IV.D ODCMS 4.8.C.5.1

The projected doses from releases of gaseous effluents to areas at and beyond the SITE BOUNDARY shall be calculated in accordance with the following sections of this manual:

- a. gamma air dose - IV.B.1
- b. beta air dose - IV.B.2
- c. organ dose - IV.C

The projected dose calculation shall be based on expected release from plant operation. The normal release pathways result in the maximum releases from the plant. Any alternative release pathways result in lower releases and, therefore, lower doses.

IV.E Technical Requirements Manual Test Requirement (TR) 3.5.3

- IV.E.1 The recombiner hydrogen analyzers currently used at Peach Bottom are Whittaker Electrochemical type. (Analyzers 4083A and 4083B on Unit 2. Analyzers 5083A and 5083B on Unit 3.)
- IV.E.2 The calibration gas is in accordance with approved procedures.

IV.F ODCMS 4.8.C.7.1 and 4.8.C.7.2

- IV.F.1 The dose rate in areas at and beyond the SITE BOUNDARY due to radioactive materials released in gaseous effluents from the incineration of waste oil from the auxiliary boilers shall be calculated by the equation in IV.A.2.

The dose rate from radioactive particulate release shall be determined by either of two methods. Method (a), total instantaneous release assumes that the total activity contained in the waste oil is released in the first minute of incineration. Method (b) uses the activity release over the entire time of incineration.

For normal operations, it is assumed that Method (a) will be used, since the total activity from the waste oil is expected to contribute an insignificant dose compared to the annual limits. However, in the event that the activity is significantly higher than administrative or regulatory limits, then Method (b) would be used because it is more accurate in calculating the dose rate.

Since the auxiliary boiler stacks are at approximately the same height as the reactor vents and discharge from the auxiliary boilers will also be heated, the use of the reactor vent D/Q value for the calculations is considered conservative.

IV.F.2 The dose to an individual from radioactive materials in particulate form and radionuclides other than noble gases with half-lives greater than eight days in gaseous effluents released to areas at and beyond the SITE BOUNDARY from the incineration of contaminated waste oil from the auxiliary boiler stacks shall be calculated by the equation in IV.C.

V.A. ODCMS 4.8.D.1.1 and 4.8.D.1.2

V.A.1 ODCMS 4.8.D.1.1

The total gaseous and liquid cumulative dose contributions are limited by ODCMS 3.8.D.1 to 3.0 mrem for whole body and critical organ, and 55 mrem for the thyroid to preserve assumptions set forth in the 10CFR72.212 report for the TN-68 spent fuel casks that are stored on the Independent Spent Fuel Storage (ISFSI) pad. Exceeding these action levels does not necessarily result in the overall 40CFR190 or 10CFR72.104 requirements not being met. Further calculations are required to determine compliance.

#### Whole Body

The whole body dose contribution from liquid and gaseous effluents shall be determined by the following method:

$$D_{WB} = D_r + D_\gamma$$

where:

$D_{WB}$  = whole body dose from liquid and gaseous effluents, in mrem.

$D_r$  = cumulative dose commitment to the total body from liquid effluents, in mrem (Determined by ODCM Section III.B).

$D_\gamma$  = gamma air dose, in mrad (Determined by ODCM Section IV.B, with mrad equivalent to mrem).

Critical organ(except thyroid)

The critical organ(except thyroid) dose contribution from liquid and gaseous effluents shall be determined by the following method:

$$D_{co} = D_r + D_\gamma + D$$

where:

$D_{co}$  = critical organ(except thyroid) dose from liquid and gaseous effluents, in mrem.

$D_r$  = cumulative dose commitment to any organ from liquid effluents, in mrem (Determined by ODCM Section III.B).

$D_\gamma$  = gamma air dose, in mrad (Determined by ODCM Section IV.B, with mrad equivalent to mrem).

$D$  = limiting dose to the critical organ(except thyroid), in mrem (Determined by ODCM Section IV.C).

Thyroid

The thyroid dose contribution from gaseous effluents shall be determined by the following method:

$$D_{thy} = D_r + D_\gamma + D$$

where:

$D_{thy}$  = thyroid dose from gaseous effluents, in mrem.

$D_r$  = cumulative dose commitment to any organ from liquid effluents, in mrem (Determined by ODCM Section III.B).

$D_\gamma$  = gamma air dose, in mrad (Determined by ODCM Section IV.B, with mrad equivalent to mrem).

$D$  = limiting dose to the thyroid, in mrem (Determined by ODCM Section IV.C).



V.A.2 ODCMS 4.8.D.1.2

The cumulative dose from all sources(i.e. gas and liquid effluents and direct radiation) is calculated by summing the individual doses obtained in ODCMS 4.8.D.1.1 for whole body( $D_{WB}$ ), critical organ( $D_{CO}$ ) and thyroid( $D_{thy}$ ) with the dosimeter net dose(mrem).

Whole Body

The cumulative whole body dose from liquid, gas and direct radiation shall be determined by the following method:

$$D_{WB}^{Total} = D_{WB} + D_D$$

where:

$D_{WB}^{Total}$  = whole body dose equivalent from all sources, in mrem.

$D_{WB}$  = whole body dose from liquid and gaseous effluents, in mrem.

$D_D$  = Net dose from direct radiation, in mrem.

Critical Organ(except thyroid)

The cumulative critical organ(except thyroid) dose from liquid, gas and direct radiation shall be determined by the following method:

$$D_{CO}^{Total} = D_{CO} + D_D$$

where:

$D_{CO}^{Total}$  = critical organ(except thyroid) dose equivalent from all sources, in mrem.

$D_{CO}$  = critical organ(except thyroid) dose from liquid and gaseous effluents, in mrem.

$D_D$  = Net dose from direct radiation, in mrem.

Thyroid

The cumulative thyroid dose from gas and direct radiation shall be determined by the following method:

$$D_{Thy}^{Total} = D_{Thy} + D_D$$

where:

$D_{Thy}^{Total}$  = thyroid dose equivalent from all sources, in mrem.

$D_{Thy}$  = thyroid dose from gaseous effluents, in mrem.

$D_D$  = Net dose from direct radiation, in mrem. |

The dose contribution is calculated at the discharge point for liquids and in the worst sector for gases. If necessary, the dose contribution from liquid and gas may be calculated for a real individual.

VI.A ODCMS 4.8.E.1.1 and 4.8.E.1.2

The radiological environment monitoring samples shall be collected pursuant to Table VII.A.1 from the locations shown on Figures VII.A.1, VII.A.2, and VII.A.3, and shall be analyzed pursuant to the requirements of Table VII.A.1.

TABLE VII.A-1

ODCM - Peach Bottom Atomic Power Station  
Radiological Environmental Monitoring Program

Pathway	Station Code	Distance and Direction from PBAPS Vents	Collection Method and Discussion	Analyses
I.	<u>Direct Radiation</u>			
Site Boundary	1L	1,100 feet NE of site	1 set of four (4)	Gamma Dose quarterly
	1A	1,500 feet SE of site	Dosimeters from each	
	2	4,700 feet SE of site	location at least	
	1I	2,900 feet SSE of site	quarterly	
	1C	4,700 feet SSE of site	Gamma dose quarterly	
	1J	4,000 feet S of site		
	1F	2,900 feet SSW of site		
	40	8,000 feet SW of site		
	1NN	2,700 feet WSW of site	Dosimeter sites were	
	1H	3,200 feet W of site	chosen in accordance	
	1G	3,100 feet WNW of site	with Peach Bottom	
	1B	2,500 feet NW of site	ODCMS Table 4.8.E.1	
	1E	3,000 feet NNW of site	Item 1. Site Boundary	
	1K	4,700 feet SW of site	stations all sectors	
	Intermediate Distance	1P	2,200 feet ESE of site	
		15	19,300 feet N of site	
		22	12,500 feet NNE of site	
		44	26,700 feet NE of site	
		32	14,400 feet ENE of site	
		45	17,600 feet ENE of site	
		14	10,300 feet E of site	
		17	21,500 feet ESE of site	
		31A	24,100 feet SE of site	
		4K	45,900 feet SE of site	
		23	5,500 feet SSE of site	
		27	14,400 feet S of site	
		48	26,500 feet SSW of site	
			The distant and	
			special interest	
			stations provide	
			information in	
			population centers and	
			control locations.	

TABLE VII.A-1

ODCM - Peach Bottom Atomic Power Station  
Radiological Environmental Monitoring Program

Pathway	Station Code	Distance and Direction from PBAPS Vents	Collection Method and Discussion	Analyses
	3A	19,300 feet SW of site		
	49	21,500 feet WSW of site		
	50	26,400 feet W of site		
	51	21,000 feet WNW of site		
	26	22,300 feet NW of site		
	6B	30,400 feet NW of site		
	42	21,600 feet NNW of site		
Distant and Special Interest	43	26,200 feet NNE of site		
	5	24,400 feet E of site		
	16	67,100 feet E of site		
	24	57,600 feet ESE of site		
	2B	3,900 feet SSE of site		
	46	23,800 feet SSE of site		
	47	22,700 feet S of site		
	18	52,200 feet W of site		
	19 C	124,000 feet NW of site		
	1T	3,100 feet WNW of site		
II. <u>Airborne</u>				
Particulates	1Z	1,500 feet SE of site	Approximately 1 cfm continuous flow through glass fiber filter which is collected weekly.	Gross beta analysis on each weekly sample. Gamma spectrometry shall be done when gross beta exceeds ten times the yearly mean of
	1B	2,500 feet NW of site		
	1C	4,700 feet SSE of site		
	3A	19,300 feet SW of site		
	5H2 C	162,400 feet NE of site		
			These stations	

TABLE VII.A-1

ODCM - Peach Bottom Atomic Power Station  
Radiological Environmental Monitoring Program

Pathway	Station Code	Distance and Direction from PBAPS Vents	Collection Method and Discussion	Analyses
			provide for coverage of the highest annual average ground level D/Q near the site boundary, the community with the highest annual average D/Q and a control location.	control station value.  Gross beta analysis done ≥24 hr after sampling to allow for Radon and Thoron daughter decay.  Gamma Spec on quarterly composite by location.
Iodine	1Z	1,500 feet SE of site	A TEDA impregnated flow-through cartridge is connected to air sampler and is collected weekly at site filter change.	Iodine 131 weekly
	1B	2,500 feet NW of site		
	1C	4,700 feet SSE of site		
	3A	19,300 feet SW of site		
	5H2 C	162,400 feet NE of site		
III. <u>Waterborne</u>				
Surface	1LL C	1,200 feet ENE of site	Sample collected from a continuous	Gamma isotopic analysis monthly;
	1MM	5,500 feet SE of site		

TABLE VII.A-1

ODCM - Peach Bottom Atomic Power Station  
Radiological Environmental Monitoring Program

Pathway	Station Code	Distance and Direction from PBAPS Vents	Collection Method and Discussion	Analyses
			water sampler, monthly. In event sampler is inoperable, grab samples will be collected each calendar day until sampler returned to service.	H-3 on quarterly composite
Drinking	4L 6I C 13B	45,900 feet SE of site 30,500 feet NW of site 13,300 feet ESE of site	Sample collected from a continuous water sampler monthly. In event sampler is inoperable, weekly grab samples will be collected until sampler returned to service.	Gross beta and gamma isotopic monthly,  H-3 on quarterly composite
Sediment	4J	7,400 feet SE of site	A sediment sample is taken down stream of discharge semi-annually.	Gamma isotopic analysis each sample
IV. <u>Ingestion</u>				
Milk	V C J	32,600 feet W of site 5,100 feet W of site	Sample of fresh milk is collected	I-131 analyses on each sample

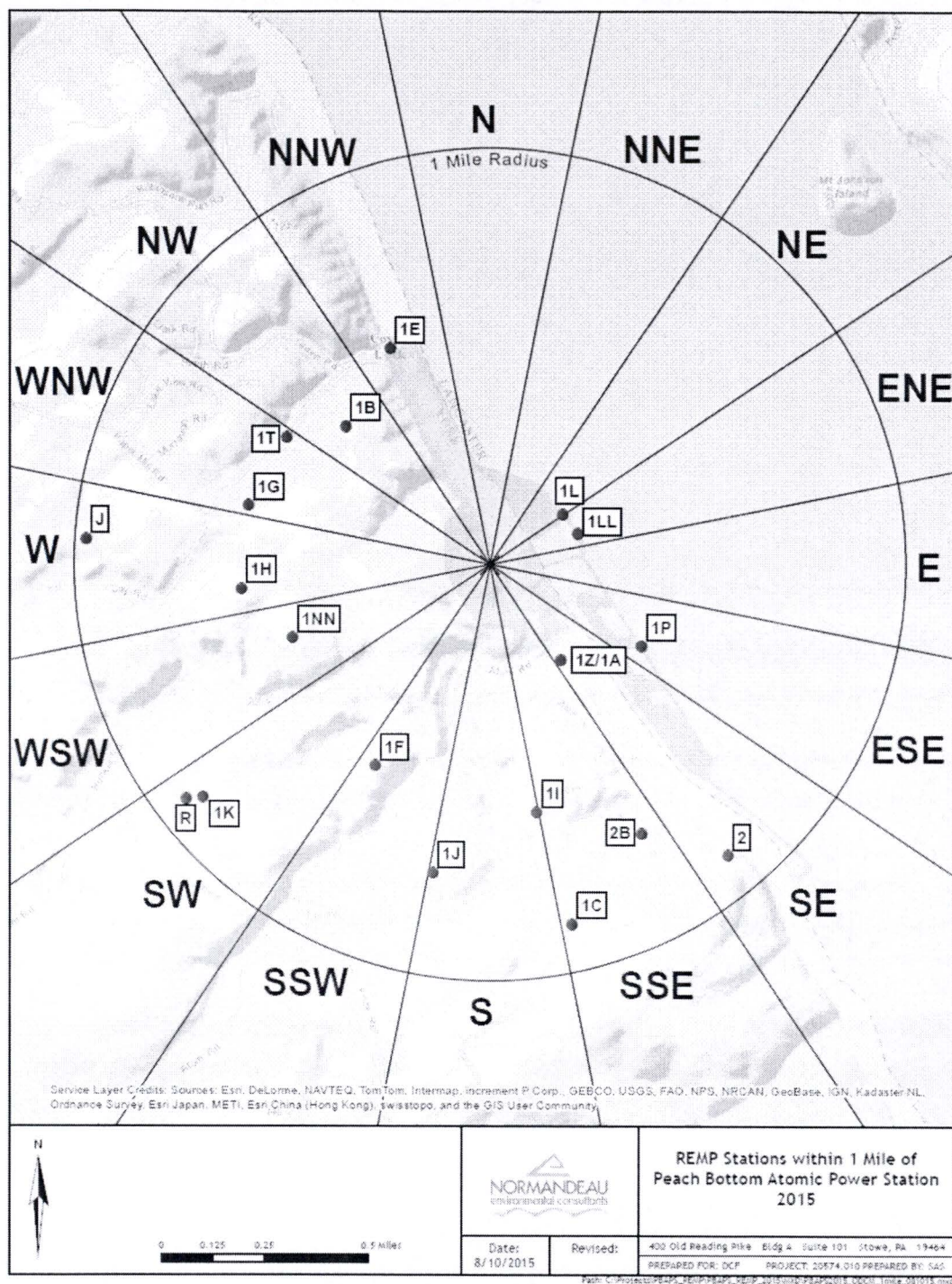
TABLE VII.A-1

ODCM - Peach Bottom Atomic Power Station  
Radiological Environmental Monitoring Program

Pathway	Station Code	Distance and Direction from PBAPS Vents	Collection Method and Discussion	Analyses
	R	4,900 feet SW of site	from each farm	
	U	11,200 feet SSW of site	biweekly when cows are on pasture (April through October), monthly at other times.	Gamma isotopic analysis or Cs-134, -137 by chemical separation quarterly
Fish	4	6,000-10,000 feet SE of site	Two species of recreationally important fish (predator and bottom feeder) sampled in season or semiannually if not seasonal.	Gamma isotopic analyses on edible portions.
	6 C	50,000-70,000 feet NNW of site		
Food Products	1C	4,700 feet SSE of site	Samples of three	Gamma isotopic and
	1B	2,500 feet NW of site	(3) different	I-131 analysis
	55 C	51,900 feet NE of site	kinds of broad leaf vegetation monthly when available if milk sampling is not performed	

C = Control Location





**FIGURE VII.A.1  
ENVIRONMENTAL SAMPLING STATIONS AT  
SITE BOUNDARY AREA TO PEACH BOTTOM**



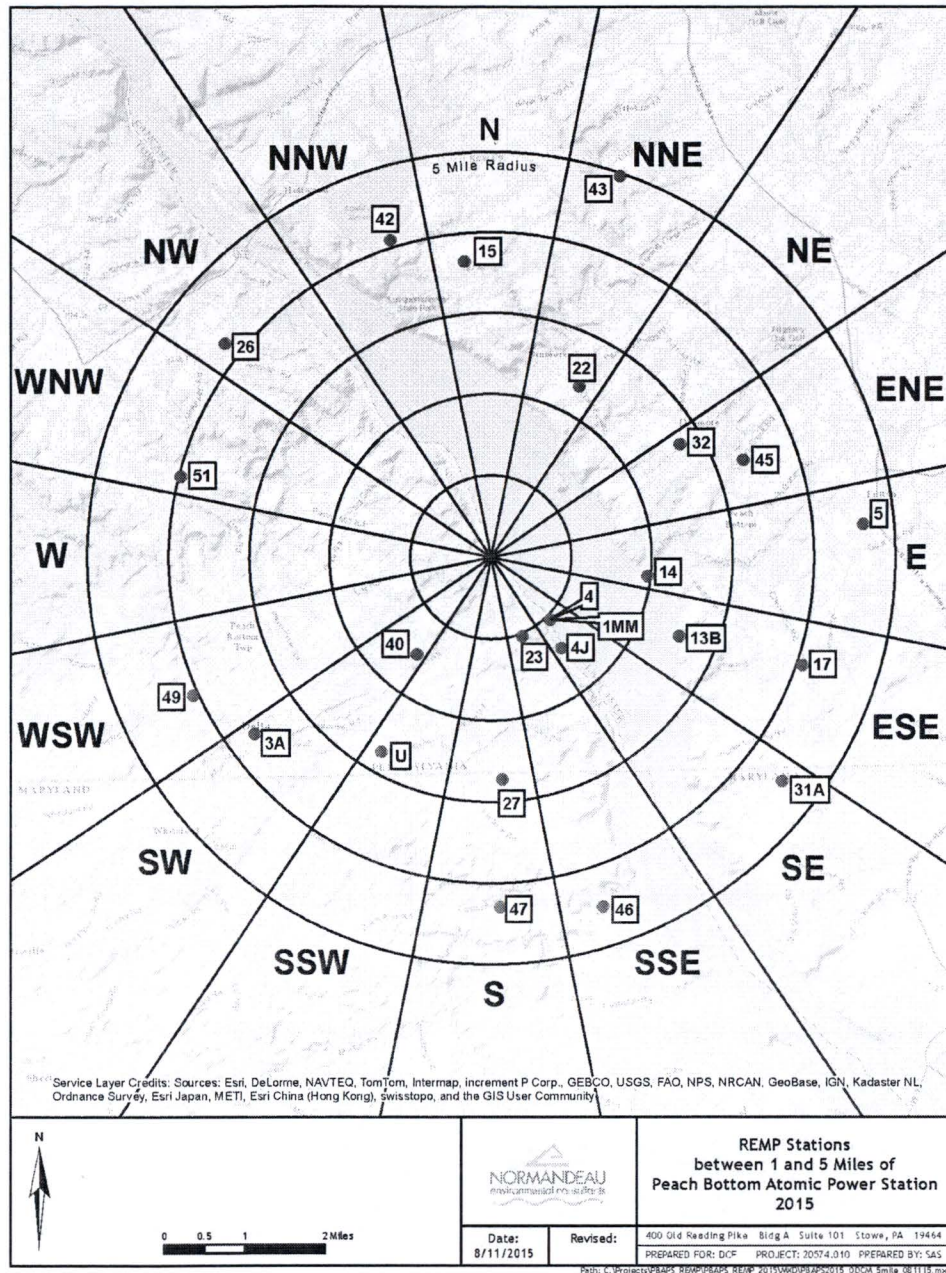


FIGURE VII.A.2  
ENVIRONMENTAL SAMPLING STATIONS AT  
INTERMEDIATE DISTANCES FROM PEACH BOTTOM SITE



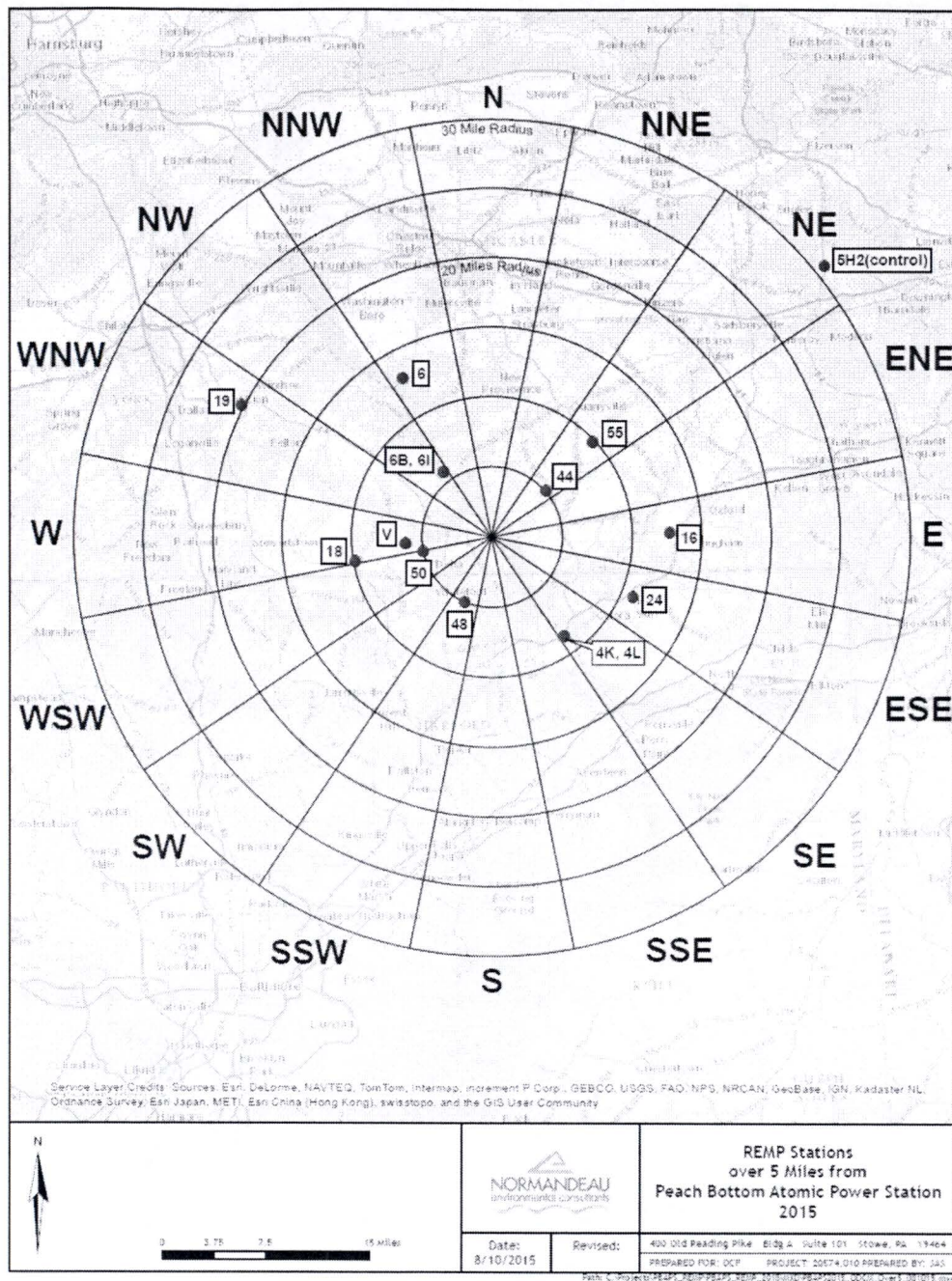


FIGURE VII.A.3  
ENVIRONMENTAL SAMPLING STATIONS AT  
REMOTE DISTANCES FROM PEACH BOTTOM SITE

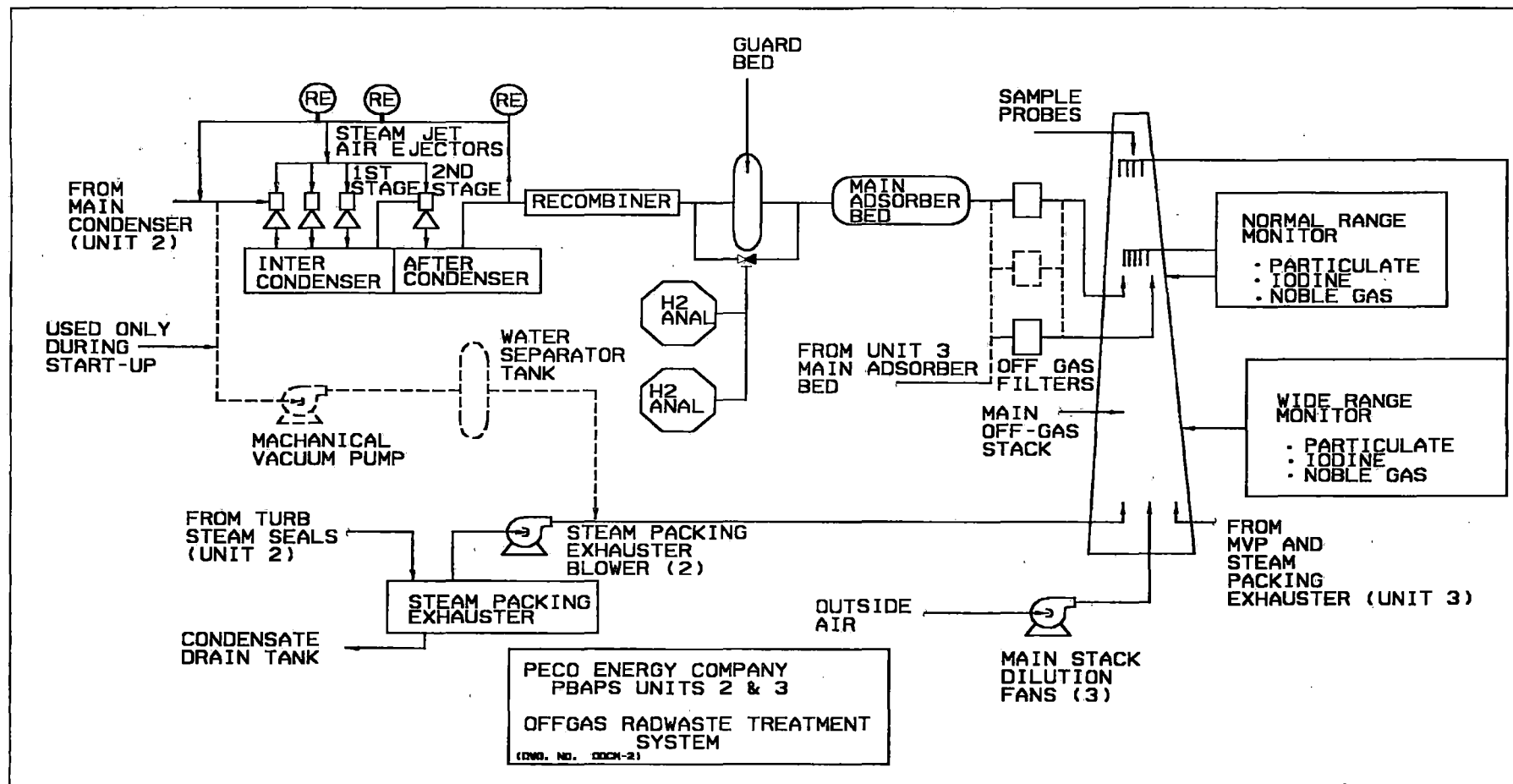


Figure 1

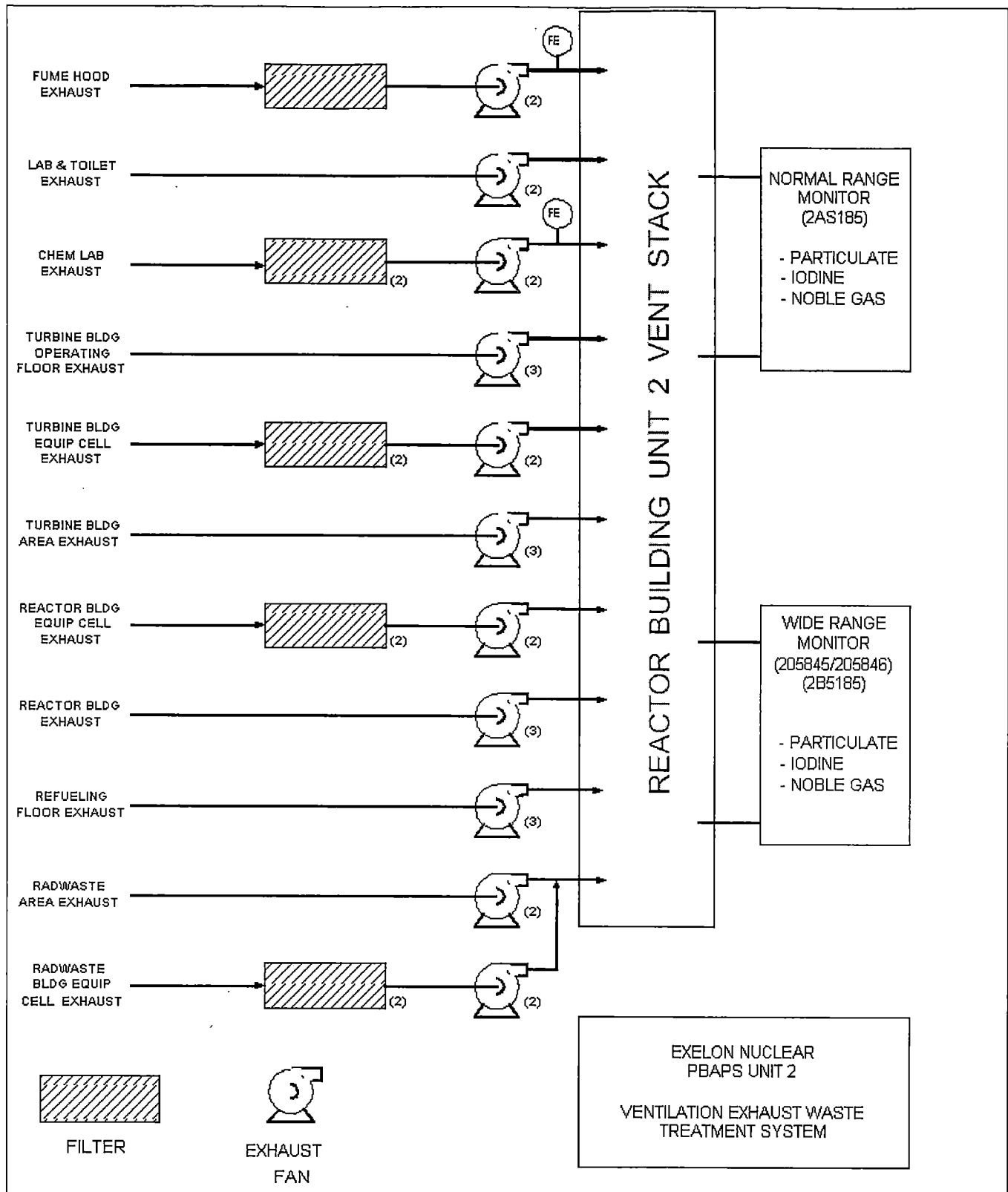


Figure 2

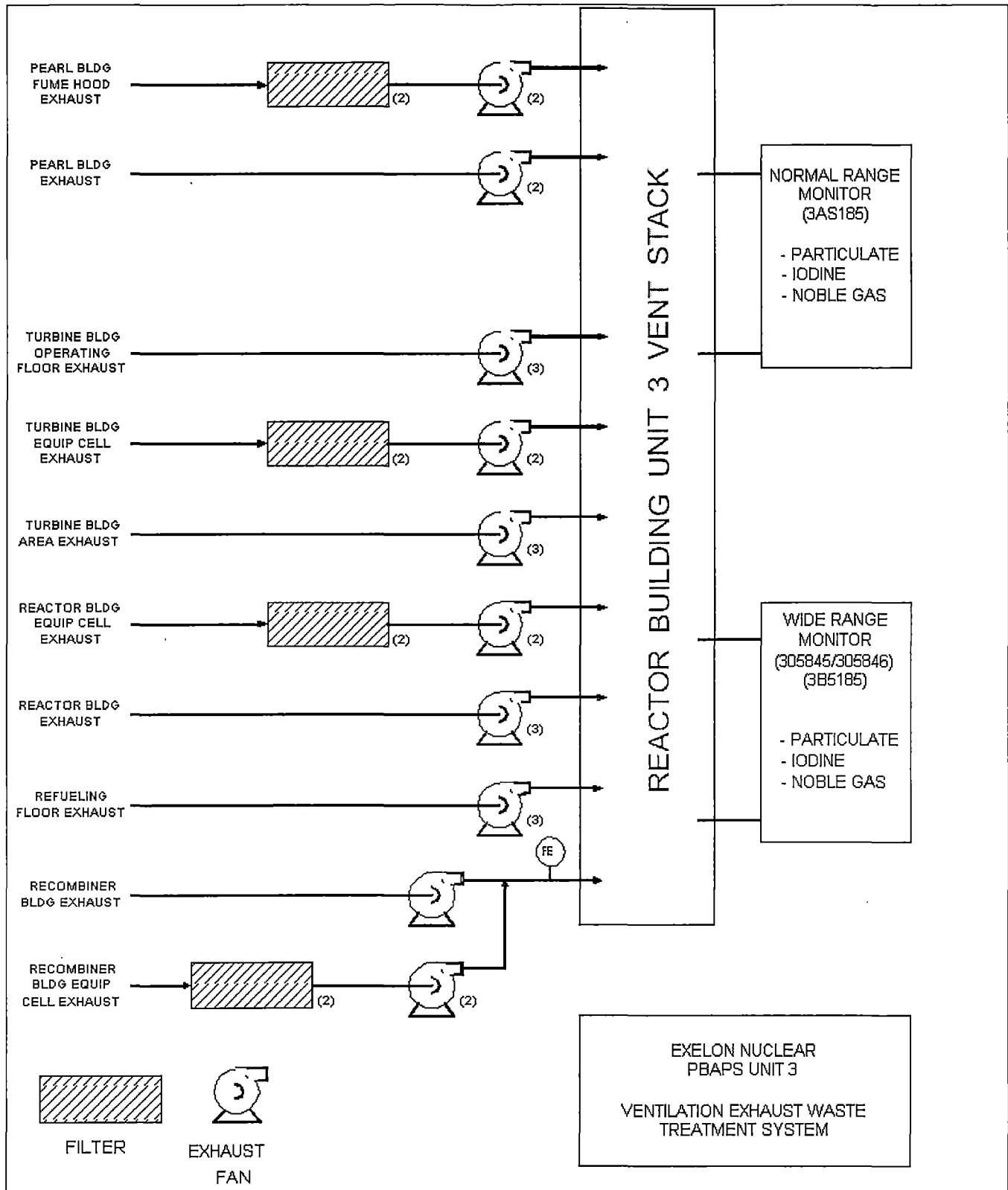
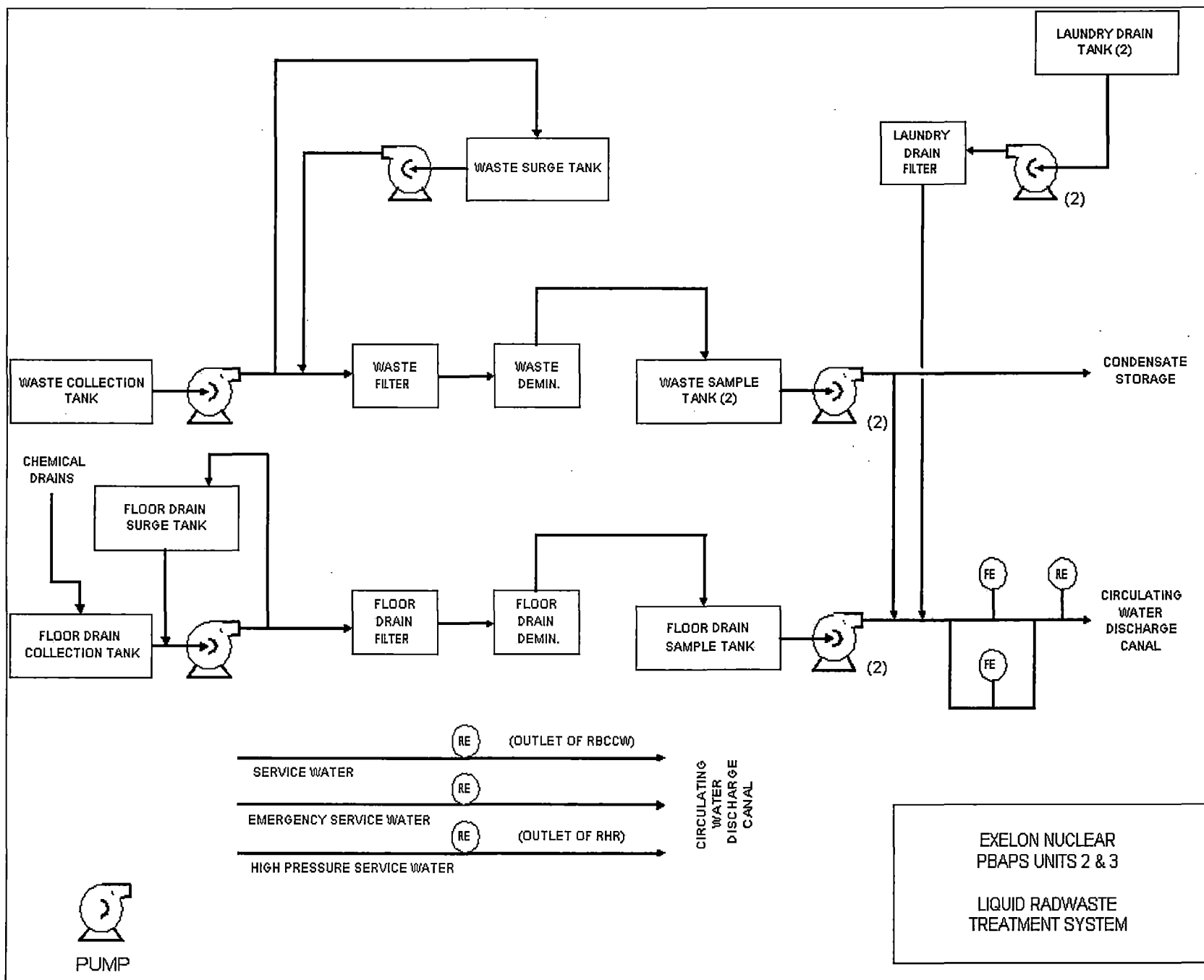


Figure 3

Figure 4



VII. BasesLiquid Effluent Release Flow Rate Determination

Non-gamma emitting radionuclides (H-3, Fe-55, Sr-89/90) are not detected by the effluent monitor and, therefore, are not directly included in the release flow rate determination. While tritium accounts for nearly all the activity released, it is not a significant contributor when determining the permissible flow rate. Examining releases over the years 2004 - 2006, the average diluted H-3 contribution to its limiting concentration in liquid effluents was 0.03%. This contribution is not expected to change significantly over time, since the concentration of H-3 in effluents can be expected to remain fairly consistent in effluent releases regardless of fuel conditions, activation product releases, and waste processing.

Based on relative abundances, other non-gamma emitting radionuclides only contributed up to nearly 3 % of the concentration limit. It is reasonable to assume that the abundances of these non-gamma will remain the same relative to other fission and/or activation products under varying conditions. Therefore, under conditions of elevated effluent radionuclide levels, the gamma-emitting radionuclides can be expected to be the main contributors to limiting conditions on liquid effluent concentrations. The maximum permissible release flow rate determination methodology presented in III.A offers an additional factor of conservatism of 30 to 50 which is more than adequate to account for the non-gamma emitting radionuclides.

Site Specific DataNOTE 1

Liquid dose factors,  $A_{it}$ , for section III.B were developed using the following site specific data. The liquid pathways involved are drinking water and fish.

$$A_{it} = (U_w / D_w + U_F \times B F_i) k_0 \times D F_i \times R C \times e^{-24 \lambda_i}$$

$U_w$  = liters per year; maximum age group usage of drinking water (Reg. Guide 1.109, Table E-5)

$D_w$  = 5.4; average annual dilution at Conowingo intake

$U_F$  = kg per year; maximum age group usage of fish (Reg. Guide 1.109, Table E-5)

$BF_i$  = bioaccumulation factor for nuclide,  $i$ , in freshwater fish. Reg. Guide 1.109, Table A-1, except P-32 which uses a value of  $3.0 \times 10^3$  pCi/kg per pCi/liter.

$k_0$  =  $1.14 \times 10^5 = (10^6 \text{ pCi}/\mu\text{Ci} \times 10^3 \text{ ml/l}) / 8760$  hr/yr) units conversion factor.

$DF_i$  = dose conversion factor for nuclide,  $i$ , for the age group in total body or organ, as applicable. Reg. Guide 1.109, Table E-11, except P-32 bone which uses a value as indicated below.

$3.0 \times 10^{-5}$  mrem/pCi

$RC$  = 1.16; reconcentration from PBAPS discharge back through PBAPS intake.

$\lambda_i$  = decay constant for nuclide  $i$ ,  $\text{hr}^{-1}$

The data for  $D_w$  and  $RC$  were derived from data published in Peach Bottom Atomic Power Station Units 2 and 3 (Docket Nos. 50-277 and 50-278) Radioactive Effluent Dose Assessment, Enclosure A, September 30, 1976. All other data except P-32 BF and DF were used as given in Reg. Guide 1.109, Revision 1, October 1977. The P-32 BF and DF were used in accordance with information supplied in Branagan, E.F., Nichols, C.R., and Willis, C.A., "The Importance of P-32 in Nuclear Reactor Liquid Effluents", NRC, 6/82. The teen and child dose factors were derived by the ratio of the adult bone dose factors in Reg. Guide 1.109 and Branagan, et al.



## NOTE 2

To develop constant R for the ingestion pathway in section IV.C, the following site specific data were used:

$$R_i^c(D/Q) = K' \frac{Q_F(U_{ap})}{\lambda_i + \lambda_w} F_m(r)(DFL_i) \left[ \frac{f_p f_s}{Y_p} + \frac{(1 - f_p f_s) e^{-\lambda_i t_h}}{Y_s} \right] e^{-\lambda_i t_f}$$

where:

- $K'$  =  $10^6$  pCi/ $\mu$ Ci; unit conversion factor
- $Q_F$  = 50 kg/day; cow's consumption rate
- $U_{ap}$  = 330 l/yr; yearly milk consumption by an infant
- $\lambda_i$  = radioactive decay constant for nuclide of interest,  $\text{sec}^{-1}$  (e.g.  $9.97 \times 10^{-7} \text{ sec}^{-1}$  for I-131)
- $\lambda_w$  =  $5.73 \times 10^{-7} \text{ sec}^{-1}$ ; decay constant for removal of activity in leaf and plant surfaces
- $F_m$  = stable element transfer coefficient for nuclide of interest, day/liter (e.g.  $6.0 \times 10^{-3}$  day/liter for I-131)
- $r$  = fraction of deposited nuclide retained in cow's feed grass, 1.0 for radioiodine; 0.2 for particulates
- $DFL_i$  = ingestion dose factor in infant for nuclide of interest, mrem/pCi (e.g.  $1.39 \times 10^{-2}$  mrem/pCi for I-131)
- $f_p$  = 0.6; the fraction of the year the cow is on pasture (average of all farms)
- $f_s$  = 0.487; the fraction of cow feed that is pasture grass while the cow is on pasture (average of all farms)
- $Y_p$  =  $0.7 \text{ kg/m}^2$ ; the agricultural productivity of pasture feed grass
- $Y_s$  =  $2.0 \text{ kg/m}^2$ ; the agricultural productivity of stored feed

- $t_f$  =  $1.73 \times 10^5$  sec (2 days); the transport time from pasture, to cow, to milk, to receptor
- $t_h$  =  $7.78 \times 10^6$  sec (90 days); the transport time from pasture, to harvest, to cow, to milk, to receptor

NOTE 3

To develop constant R for tritium for the ingestion pathway in section IV.C, the following site specific data were used:

The concentration of tritium in milk is based on the airborne concentration rather than the deposition. The following additional constants and formula are used:

$$R_{H-3}^C (\chi/Q) = K' K'' F_m Q_F U_{ap} (DFL_i) [0.75(0.5/H)]$$

where:

- $K''$  =  $10^3$  gm/kg; a constant of unit conversion
- $H$  =  $14.61$  gm/m<sup>3</sup>; absolute humidity of the atmosphere
- $0.75$  = the fraction of total feed that is water
- $0.5$  = the ratio of the specific activity of the feed grass water to the atmospheric water

NOTE 4

To develop constant R for C-14 for the ingestion pathway in section IV.C, the following site specific data were used:

$$R_{C-14}^{Milk} = K' K'' p F_m Q_F U_{ap} DFL_{C-14} [0.11/0.16]$$

where:

- $p$  = the ratio of the total annual release time (for C-14 atmospheric releases) to the total annual time during photosynthesis occurs.
- $0.11$  = the fraction of total plant mass that is natural carbon.
- $0.16$  = the concentration of natural carbon in the atmosphere, in g/m<sup>3</sup>.

The pathway is the grass-cow-milk ingestion pathway. These data were derived from data published in Peach Bottom Atomic Power Station Units 2 and 3 (Docket Nos. 50-277 and 50-278) Radioactive Effluent Dose Assessment, Enclosure A, September 30, 1976. All other data were used as given in Reg. Guide 1.109, Revision 1, October 1977.

#### ODCMS 4.8.B.2.1, Liquid Pathway Dose Calculations

The equations for calculating the doses due to the actual release rates of radioactive materials in liquid effluents were developed from 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 NUREG-0133 "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", October 1978.

#### ODCMS 4.8.C.1.1 and 4.8.C.1.2

##### Dose Rate Noble Gases

The equations for calculating the dose rate due to the actual release rates of radioactive noble gases in gaseous effluents were developed from 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, NUREG-0133 "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", August 1978, and the atmospheric dispersion model presented in Information Requested in Enclosure 2 to letter from George Lear to E. G. Bauer dated February 17, 1976, September 30, 1976. The specified equations provide for determining the dose rates in areas at and beyond the SITE BOUNDARY based upon the historical average atmospheric conditions.

The dose rate due to noble gas release as calculated by the Gross Release Method is much more conservative than the dose calculated by the Isotopic Analysis Method. Assuming the release rates given in Radioactive Effluent Dose Assessment, September 30, 1976, the values calculated by the Gross Release Method for total body dose rate and skin dose rate are 6.0 times and 5.7 times, respectively, the values calculated by the Isotopic Analysis Method.

Dose Rate I-131, I-133, Tritium and Radioactive Material  
in Particulate Form.

The model Technical Specification LCO of NUREG-0133 for all radionuclides and radioactive materials in particulate form and radionuclides other than noble gases requires that the instantaneous dose rate be less than the equivalent of 1500 mrem per year.

The release data from 1994 to 1996 were evaluated and the critical organs were determined to be the child thyroid or teenager lung. The child thyroid dose rate is limiting when iodine releases exceed 10 percent of the total release rates. The teenager lung dose rate is limiting when iodine is either not present or a small fraction of the total release.

Because of good fuel performance the amount of I-131 released has decreased. The thyroid may not be the critical organ. When it is not clear which organ dose is limiting, doses for the child thyroid and teenage lung are calculated.

ODCMS 4.8.C.2.1

Dose Noble Gases

The equations for calculating the doses due to the actual release rates of radioactive noble gases in gaseous effluents were developed from 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, NUREG-0133 "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", August 1978, and the atmospheric dispersion model presented in Information Requested in Enclosure 2 to letter from George Lear to E. G. Bauer dated February 17, 1976, September 30, 1976. The specified equations provide for determining the air doses in areas at and beyond the SITE BOUNDARY based upon the historical average atmospheric conditions.

The dose due to noble gas releases as calculated by the Gross Release Method is much more conservative than the dose calculated by the Isotopic Analysis Method. Assuming the releases rates given in Radioactive Effluent Dose Assessment, September 30, 1976, the values calculated by the Gross Release Method for total body dose rate and skin dose rate are 4.3 times and 7.2 times, respectively, the values calculated by the Isotopic Analysis Method.

#### ODCMS 4.8.C.3.1

##### Dose, Iodine-131, Iodine-133, Tritium, and Radioactive Material in Particulate Form

The equation for calculating the doses due to the actual release of radioiodines, radioactive material in particulate form, and radionuclides other than noble gases with half-lives greater than 8 days were developed using 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, NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", October 1978, and the atmospheric dispersion model presented in Information Requested in Enclosure 2 to Letter from George Lear to E. G. Bauer dated February 17, 1976, September 30, 1976. These equations provide for determining the actual doses based upon the historical average atmospheric conditions.

Compliance with the 10 CFR 50 limits for radioiodines, radioactive materials in particulate form and radionuclides other than noble gases with half lives greater than eight days is to be determined by calculating the infant thyroid, infant liver and infant bone dose. These organs were determined to be the critical organs based on the release data from 1994 to 1996.

Because of a decrease in the amount of I-131 released, the thyroid may not be the critical organ. The isotopic analysis method is used to calculate dose to the infant thyroid, infant liver and infant bone.

August 2015

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APPENDIX A

RADIOACTIVE EFFLUENTS CONTROLS PROGRAM

CONTAINING

OFFSITE DOSE CALCULATION MANUAL  
SPECIFICATIONS (ODCMS) AND BASES

FOR

PEACH BOTTOM ATOMIC POWER STATION

UNITS 2 AND 3

REVISION 14

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3.10	Reporting Requirements .....	ODCM 3.10-1
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-----NOTE-----

The defined terms of this section appear in capitalized type and are applicable throughout these Offsite Dose Calculation Manual Specifications and Bases.

<u>Term</u>	<u>Definition</u>
FUNCTIONAL TESTS	A FUNCTIONAL TEST is the manual operation or initiation of a system, subsystem, or component to verify that it functions within design tolerances (e.g., the manual start of a core spray pump to verify that it runs and that it pumps the required volume of water).
OPERABLE - OPERABILITY	A system, subsystem, division, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and all necessary attendant instrumentation, controls, normal and emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, division, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).
GASEOUS RADWASTE TREATMENT SYSTEM	Any system designed and installed to reduce radioactive gaseous effluents by collecting primary coolant system off gases from the main condenser evacuation system and providing for delay or holdup for the purpose of reducing the total radioactivity prior to release to the environment.
INSTRUMENT CALIBRATION	An INSTRUMENT CALIBRATION means the adjustment of an instrument signal output so that it corresponds, within acceptable range, and accuracy, to a known value(s) of the parameter, which the instrument monitors. The INSTRUMENT CALIBRATION shall encompass the entire instrument including the sensors and alarm, interlock and/or trip functions and shall include the INSTRUMENT FUNCTIONAL TEST. The known value of the parameter shall be injected into the instrument as close to the primary sensor as practicable.



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INSTRUMENT CHECK	An INSTRUMENT CHECK is a qualitative determination of acceptable FUNCTIONALITY by observation of instrument behavior during operation. This determination shall include, where possible, comparison of the instrument with other independent instruments measuring the same variable.
INSTRUMENT FUNCTIONAL TEST	An INSTRUMENT FUNCTIONAL TEST means the injection of a simulated signal into the instrument as close to the primary sensor as practicable to verify the FUNCTIONALITY including alarm and/or trip functions and channel failure trips.
MEMBERS OF THE PUBLIC	MEMBERS OF THE PUBLIC shall include all persons who are not occupationally associated with the plant. This category does not include employees of the utility, its contractors, or vendors. Also excluded from this category are persons who enter the site to service equipment or to make deliveries. This category does include persons who use portions of the site for recreational, occupational, or other purposes not associated with the plant.
OFFSITE DOSE CALCULATION MANUAL	Contains the current methodology and parameters used in the calculation of offsite doses resulting from radioactive gaseous and liquid effluents in the calculation of gaseous and liquid effluent monitoring Alarm/Trip Setpoints, and in the conduct of the Radiological Environmental Monitoring Program.
FUNCTIONAL-FUNCTIONALITY	An attribute of SSCs that is not controlled by TS. An SSC is functional or has functionality when it is capable of performing its specified function, as set forth in the CLB. Functionality does not apply to specified safety functions, but does apply to the ability of non-TS SSCs to perform other specified functions that have a necessary support function.
PURGE - PURGING	PURGE or PURGING is the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is required to purify the confinement.

August 2015

SITE BOUNDARY

That line beyond which the land is not owned, leased, or otherwise controlled by licensee as defined in Figure 3.8.A.1.

SOURCE CHECK

A SOURCE CHECK shall be the qualitative assessment of channel response when the channel sensor is exposed to a source of increased radioactivity.

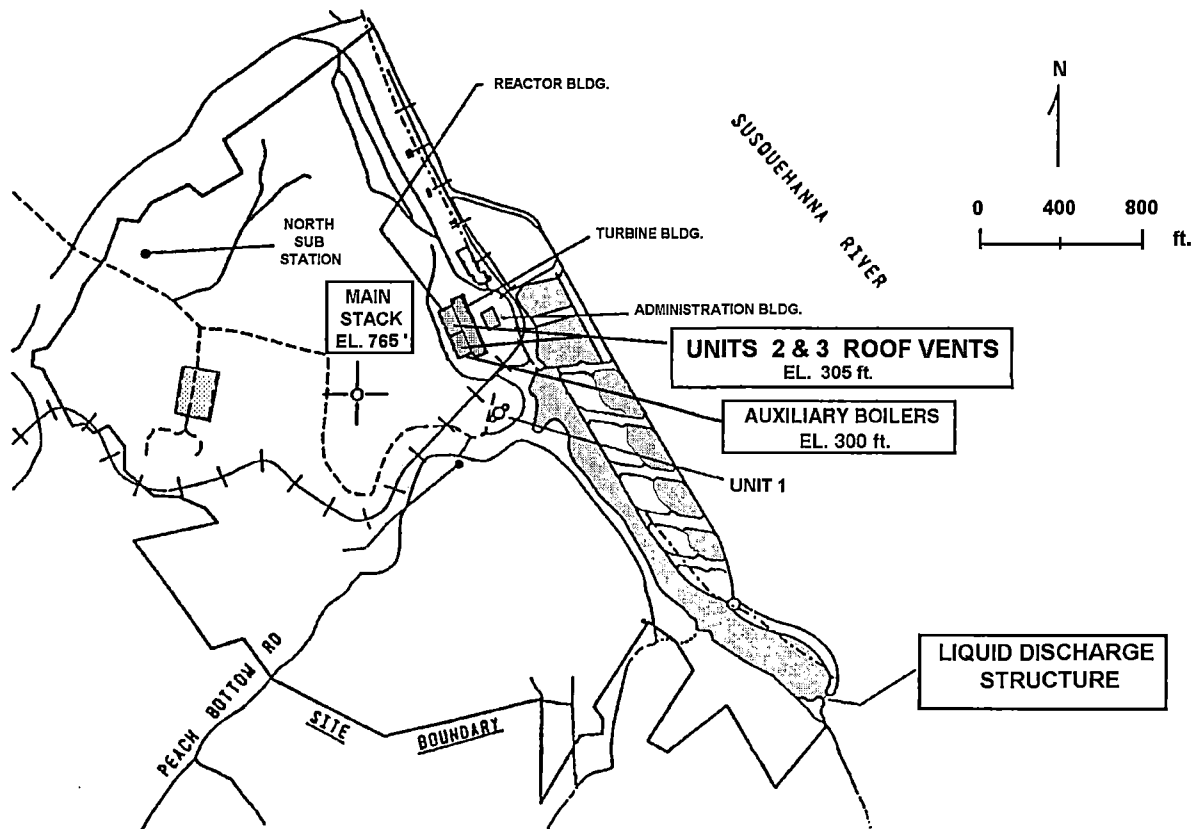


Figure 3.8.A.1

SITE BOUNDARY  
(including gaseous and liquid effluent release points)

## 3.8.B Liquid Radwaste Effluents

ODCMS 3.8.B.1 The concentration of radioactive material released to areas at or beyond the SITE BOUNDARY shall be limited to:

- a. 10 times the concentration specified in 10 CFR 20 Appendix B, Table 2, Column 2 for radionuclides other than noble gases; and
- b.  $2 \times 10^{-4} \mu\text{Ci/ml}$  total activity concentration for all dissolved or entrained noble gases.

APPLICABILITY: At all times.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Concentration of radioactive material released to areas at or beyond the SITE BOUNDARY exceeding limits.	A.1 Initiate actions to decrease the release rate of radioactive materials to restore concentration to within limits.	Immediately
	<u>OR</u>	
	A.2 Initiate actions to increase the dilution flow rate to restore concentration within limits.	Immediately
	<u>OR</u>	
	A.3 Initiate actions to decrease the release rate of radioactive materials and increase the dilution flow rate to restore concentration within limits.	Immediately

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.B.1.1 Take a sample of each batch of liquid effluent and analyze for the concentration of each significant gamma energy peak. Base the release rate on the circulating water flow rate at the time of discharge.	Prior to each release
ODCMS 4.8.B.1.2 Record radioactive concentrations and volume before dilution of each batch of liquid effluent released, the average dilution flow, and length of time over which each discharge occurred.	During each release
ODCMS 4.8.B.1.3 Perform radioactive liquid waste sampling and activity analysis.	In accordance with Table 4.8.B.1

Table 4.8.B.1 (Page 1 of 2)  
Radioactive Liquid Waste Sampling and Analysis

SAMPLE TYPE	SAMPLE FREQUENCY	SAMPLE ANALYSIS	SAMPLE LOWER LIMIT OF DETECTION (LLD) (a), (d), (e)
Waste Tank to be released	Each batch (b)	Quantitative Analysis of Identifiable Gamma Emitters	$5 \times 10^{-7} \mu\text{Ci/ml}$
		I-131	$1 \times 10^{-6} \mu\text{Ci/ml}$
Proportional Composite of Batches	31 days (c)	Fe-55	$1 \times 10^{-6} \mu\text{Ci/ml}$
		Tritium	$1 \times 10^{-5} \mu\text{Ci/ml}$
		Gross Alpha	$1 \times 10^{-7} \mu\text{Ci/ml}$
Proportional Composite of Batches	31 days (c)	Sr-89	$5 \times 10^{-8} \mu\text{Ci/ml}$
		Sr-90	$5 \times 10^{-8} \mu\text{Ci/ml}$
One Batch	31 days	Dissolved noble gases	$1 \times 10^{-5} \mu\text{Ci/ml}$

- (a) The Sample Lower Limit of Detection is defined as an 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. The values for the lower limit of detection are based on a 95% confidence level.
- (b) A batch release is the discharge of liquid wastes of a discrete volume. Prior to sampling for analysis, each batch shall be isolated and thoroughly mixed to assure representative sampling.
- (c) A composite sample is one in which the quantity of the sample is proportional to the quantity of liquid waste discharged and in which the method of sampling results in a sample representative of the liquids released.

Table 4.8.B.1 (Page 2 of 2)  
Radioactive Liquid Waste Sampling and Analysis

- (d) The principal gamma emitters for which the minimum detectable level specification will apply are exclusively 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 detected and reported. Other peaks which are measurable and identifiable, together with the above nuclides, shall also be identified and reported. Nuclides which are below the sample detectable limit for the analyses should not be reported as being present at the sample detectable limit level. When unusual circumstances result in sample detectable limits higher than required, the reasons shall be documented in the Radioactive Effluent Release Report. The values listed are believed to be attainable.
- (e) Certain mixtures of radionuclides may cause interference in the measurement of individual radionuclides at their detectable limit especially if other radionuclides are at much higher concentrations. Under these circumstances use of known ratios of radionuclides will be appropriate to calculate the levels of such radionuclides.

## 3.8.B Liquid Radwaste Effluents

ODCMS 3.8.B.2 The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive material in liquid effluent releases from the two reactors at the site to the areas at or beyond the SITE BOUNDARY shall be limited to:

- a.  $\leq 3.0$  mrem to the total body and  $\leq 10.0$  mrem to any organ during any calendar quarter; and
- b.  $\leq 6.0$  mrem to the total body and  $\leq 20.0$  mrem to any organ during any calendar year.

APPLICABILITY: At all times.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Calculated dose from the release of radioactive materials in liquid effluents exceeds required limits.	A.1 Submit a Special report to the NRC that will identify cause(s) for exceeding limits, action(s) taken to reduce releases of radioactive materials in liquid effluents, corrective action(s) taken to assure subsequent releases are within limits, results of radiological analyses of the drinking water source, and the radiological impact on the potentially affected drinking water supplies with regard to 40 CFR 141, Safe Drinking Water Act.	31 days

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.B.2.1 Determine cumulative dose contributions in accordance with the methodology and parameters in the ODCM.	31 days



## COMPENSATORY MEASURES (Continued)

## 3.8.B Liquid Radwaste Effluents

ODCMS 3.8.B.3 The following conditions shall be met:

- a. Dilution water flow rates necessary to satisfy requirements of ODCMS 3.8.B.1 shall be maintained;
- b. The gross activity monitor and the flow monitor on the waste effluent line shall be FUNCTIONAL; and
- c. The liquid effluent control monitor shall be set in accordance with methodology and parameters in the ODCM to alarm and automatically close the waste discharge valve prior to exceeding limits in ODCMS 3.8.B.1; and
- d. The service water, emergency service water, and high pressure service water effluent line radiation monitors shall be FUNCTIONAL.

APPLICABILITY: During release of radioactive wastes or with flow present in the system.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Gross activity monitor on the waste activity line inoperable.	A.1 Initiate action to restore monitor to FUNCTIONAL status.	Immediately
	<u>AND</u>	
	A.2 Analyze two independent samples of tank's contents.	Prior to release
	<u>AND</u>	
	A.3 Perform independent verification of the release rate calculations and discharge line valve line-up using at least two technically qualified members of the facility staff.	Prior to release

## COMPENSATORY MEASURES (Continued)

[illegible]

## COMPENSATORY MEASURES (Continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
E. Liquid radwaste effluents radiation monitors inoperable for > 30 days.	E.1 Explain why the inoperability was not corrected in a timely manner in the next Annual Radioactive Effluent Release Report.	In accordance with Technical Specification 5.6.3

ODCMS REQUIREMENT		FREQUENCY
ODCMS 4.8.B.3.1	Perform INSTRUMENT CHECK of liquid radwaste effluents radiation monitor.	24 hours during release
ODCMS 4.8.B.3.2	Perform INSTRUMENT CHECK of liquid effluent flow monitor.	24 hours during release
ODCMS 4.8.B.3.3	Perform INSTRUMENT FUNCTIONAL TEST of liquid radwaste effluents radiation monitor, including FUNCTIONALITY demonstration of the radwaste discharge automatic isolation valve and control room annunciation in response to alarm/trip setpoint being exceeded and an instrument INOP failure.	31 days
ODCMS 4.8.B.3.4	Perform SOURCE CHECK of liquid radwaste effluents radiation monitor.	92 days
ODCMS 4.8.B.3.5	Perform INSTRUMENT CALIBRATION of the liquid radwaste effluents radiation monitor with a known radiation source positioned in a reproducible geometry with respect to the sensor.	12 months

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.B.3.6 Perform INSTRUMENT CALIBRATION of the liquid effluents flow monitor.	12 months
ODCMS 4.8.B.3.7 Perform INSTRUMENT CHECK of service water effluent line radiation monitor.	24 hours during release
ODCMS 4.8.B.3.8 Perform INSTRUMENT FUNCTIONAL TEST of service water effluent line radiation monitor, including FUNCTIONALITY demonstration of the control room annunciation in response to alarm/trip setpoint being exceeded and an instrument INOP failure.	92 days
ODCMS 4.8.B.3.9 Perform SOURCE CHECK of service water effluent line radiation monitor.	31 days
ODCMS 4.8.B.3.10 Perform INSTRUMENT CALIBRATION of the service water effluent line radiation monitor with a known radiation source.	18 months
ODCMS 4.8.B.3.11 Perform INSTRUMENT CHECK of emergency service water effluent line radiation monitor.	24 hours during release
ODCMS 4.8.B.3.12 Perform INSTRUMENT FUNCTIONAL TEST of emergency service water effluent line radiation monitor, including FUNCTIONALITY demonstration of the control room annunciation in response to alarm/trip setpoint being exceeded and an instrument INOP failure.	92 days

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.B.3.13 Perform SOURCE CHECK of emergency service water effluent line radiation monitor.	31 days
ODCMS 4.8.B.3.14 Perform INSTRUMENT CALIBRATION of the emergency service water effluent line radiation monitor with a known radiation source.	18 months
ODCMS 4.8.B.3.15 Perform INSTRUMENT CHECK of high pressure service water effluent line radiation monitor.	24 hours during release
ODCMS 4.8.B.3.16 Perform INSTRUMENT FUNCTIONAL TEST of high pressure service water effluent line radiation monitor, including FUNCTIONALITY demonstration of the control room annunciation in response to alarm/trip setpoint being exceeded and an instrument INOP failure.	92 days
ODCMS 4.8.B.3.17 Perform SOURCE CHECK of high pressure service water effluent line radiation monitor.	31 days
ODCMS 4.8.B.3.18 Perform INSTRUMENT CALIBRATION of the high pressure service water effluent line radiation monitor with a known radiation source.	18 months

## 3.8.B Liquid Radwaste Effluents

ODCMS 3.8.B.4 Liquid effluent releases shall be processed through

one of the radwaste subsystems or combination of subsystems listed below:

- a.waste collector filter and demineralizer;
- b.floor drain filter and demineralizer;
- c.fuel pool filter demineralizer;
- d.chemical/oily waste cleanup subsystem;
- e.laundry drain filter

APPLICABILITY: Prior to all liquid effluent release(s) whenever the release(s) would cause the projected dose, when it is averaged over 31 days to exceed 0.12 mrem to the total body or 0.4 mrem to any organ (combined total from the two reactors at the site).

#### COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Liquid waste discharged without required processing.	A.1 Submit a Special Report to the NRC that includes, an explanation of why liquid radwaste was discharged without required processing, identification of any inoperable equipment or subsystems and the reason for the inoperability, the action taken to restore the inoperable equipment to FUNCTIONAL status, and the action(s) taken.	31 days

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.B.4.1 Project doses due to liquid effluent releases to areas at and beyond the SITE BOUNDARY in accordance with the methodology and parameters in the ODCM.	31 days
ODCMS 4.8.B.4.2 Demonstrate FUNCTIONALITY of the waste collector filter and demineralizer and the floor drain filter by analyzing the liquid processed through the subsystem and determining it meets the requirements of ODCMS 3.8.B.1.	92 days
ODCMS 4.8.B.4.3 Demonstrate FUNCTIONALITY of the fuel pool filter demineralizer by analyzing the liquid processed through the subsystem and determining it meets the requirements of ODCMS 3.8.B.1.	Prior to release of liquid effluents processed by this subsystem
ODCMS 4.8.B.4.4 Demonstrate FUNCTIONALITY of the chemical/oily waste cleanup subsystem by analyzing the liquid processed through the subsystem and determining it meets the requirements of ODCMS 3.8.B.1.	Prior to release of liquid effluents processed by this subsystem
ODCMS 4.8.B.4.5 Demonstrate FUNCTIONALITY of the laundry drain filter by analyzing the liquid processed through the subsystem and determining it meets the requirements of ODCMS 3.8.B.1.	Prior to release of liquid effluents processed by this subsystem

## 3.8.C Gaseous Effluents

ODCMS 3.8.C.1 The dose rate at or beyond the SITE BOUNDARY due to radioactive materials in gaseous effluents released from the two reactors at the site shall be limited to the following:

- a. For noble gases,  $\leq 500$  mrem per year to the total body and  $\leq 3000$  mrem per year to the skin; and
- b. For iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half lives  $> 8$  days,  $\leq 1500$  mrem per year to any organ.

APPLICABILITY: At all times.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Dose rates at or beyond the SITE BOUNDARY exceed limits due to radioactive material in gaseous effluents.	A.1 Initiate actions to decrease release rates to comply with limits.	Immediately

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.1.1 Verify the dose rate due to noble gases in gaseous effluents is within limits in accordance with methods and procedures of the ODCM.	In accordance with sampling and analysis program specified in Table 4.8.C.1

(continued)



## ODCMS REQUIREMENTS (Continued)

ODCMS REQUIREMENT		FREQUENCY
ODCMS 4.8.C.1.2	Obtain representative samples and verify the dose rate due to iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half lives > 8 days in gaseous effluents are within limits in accordance with the methods and procedures of the ODCM.	In accordance with sampling and analysis program specified in Table 4.8.C.1

Table 4.8.C.1 (page 1 of 2)  
Radioactive Gaseous Waste Sampling and Analysis from  
Main Stack, Vent Stacks, and Auxiliary Boiler Exhaust Stack

SAMPLE TYPE	SAMPLE FREQUENCY	SAMPLE ANALYSIS	SAMPLE LOWER LIMIT OF DETECTION (LLD) (a) (d)
Grab Sample	31 days (b)	Quantitative analysis of identifiable gamma emitters	$1 \times 10^{-4} \mu\text{Ci/cc(c)}$
Grab Sample	92 days	Tritium	$1 \times 10^{-6} \mu\text{Ci/cc}$
Charcoal Filters	7 days (c)	I-131	$1 \times 10^{-12} \mu\text{Ci/cc(c)}$
Particulate Filters	7 days (c)	Quantitative analysis of identifiable gamma emitters	$1 \times 10^{-10} \mu\text{Ci/cc(c)}$
		I-131	$1 \times 10^{-12} \mu\text{Ci/cc(c)}$
Particulate Filters (composite of weekly filters)	31 days	Gross Alpha	$1 \times 10^{-11} \mu\text{Ci/cc}$
Particulate Filters (composite of weekly filters)	31 days	Sr-89	$1 \times 10^{-11} \mu\text{Ci/cc}$
		Sr-90	$1 \times 10^{-11} \mu\text{Ci/cc}$
Noble Gas Monitor (Main Stack)	Continuously	Noble Gas Gross $\beta$ or $\gamma$	$1 \times 10^{-6} \mu\text{Ci/cc}$
Noble Gas Monitor (Roof Vents)	Continuously	Noble Gas Gross $\beta$ or $\gamma$	$1 \times 10^{-6} \mu\text{Ci/cc}$
Auxiliary Boiler Waste Oil Grab Sample	Prior to batch release for burn	Quantitative analysis of identifiable gamma emitters	$5 \times 10^{-7} \mu\text{Ci/ml}$

Table 4.8.C.1 (page 2 of 2)  
Radioactive Gaseous Waste Sampling and Analysis from  
Main Stack, Vent Stacks, and Auxiliary Boiler Exhaust Stack

- (a) The sample lower limit of detection is defined as an a priori (before the fact) limit representing the capability of measurement system and not as an a posteriori (after the fact) limit for a particular measurement. The values for the lower limit of detection are based on a 95% confidence level.
- (b) Sampling and analysis shall be performed following shutdown, startup or a thermal power change exceeding 15% of rated thermal power within 1 hour from a steady state condition unless (1) analysis shows that the dose equivalent I-131 concentration in the primary coolant has not increased more than a factor of 3, and (2) the noble gas activity monitor shows that effluent activity has not increased by more than a factor of 3.
- (c) Samples shall be changed at least once per 7 days and analyses shall be completed within 48 hours after changing. Sampling shall also be performed at least once per 24 hours for at least 3 days following each shutdown, startup or thermal power change exceeding 15% of rated thermal power in 1 hour and analyses shall be completed within 48 hours of changing. When samples collected for 24 hours are analyzed, the corresponding LLD may be increased by a factor of 10. This requirement does not apply if (1) analysis has shown that the dose equivalent I-131 concentration in the primary coolant has not increased more than a factor of 3, and (2) the noble gas monitor shows that effluent activity has not increased more than a factor of 3.
- (d) Certain mixtures of radionuclides may cause interference in the measurement of individual radionuclides at their detectable limit especially if other radionuclides are at much higher concentrations. Under these circumstances use of known ratios of radionuclides will be appropriate to calculate the levels of such radionuclides. Nuclides which are below the sample detectable limit for the analyses should not be reported as being present at the sample detectable limit level.

## 3.8.C Gaseous Effluents

ODCMS 3.8.C.2 The air dose at or beyond the SITE BOUNDARY due to noble gases in gaseous effluents released from the two reactors at the site shall be limited to the following:

- a. For gamma radiation,  $\leq 10$  mrad during any calendar quarter;
- b. For beta radiation,  $\leq 20$  mrad during any calendar quarter;
- c. For gamma radiation,  $\leq 20$  mrad during any calendar year; and
- d. For beta radiation,  $\leq 40$  mrad during any calendar year.

APPLICABILITY: At all times.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Calculated air dose at or beyond the SITE BOUNDARY from radioactive noble gases in gaseous effluents exceeds limits.	A.1 Submit a Special Report to the NRC that identifies causes for exceeding limits, corrective actions taken to reduce the releases, and corrective actions to assure that subsequent releases are within limits.	31 days

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.2.1 Determine cumulative dose contributions for noble gases in accordance with the methodology and parameters in the ODCM.	31 days

## 3.8.C Gaseous Effluents

ODCMS 3.8.C.3 The dose to a MEMBER OF THE PUBLIC at or beyond the SITE BOUNDARY from iodine-131, iodine-133, tritium and all radionuclides in particulate form, with half lives > 8 days, in gaseous effluents released from the two reactors at the site shall be limited to:

a.  $\leq 15$  mrem during any calendar quarter; and

b.  $\leq 30$  mrem during any calendar year.

APPLICABILITY: At all times.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Calculated dose from the release of iodine-131, iodine-133, tritium and radionuclides in particulate form, with half-lives > 8 days in gaseous effluents exceeds limits.	A.1 Submit a Special Report to the NRC that identifies causes for exceeding limits, corrective actions taken, and proposed corrective actions to assure that subsequent releases are within limits.	31 days

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.3.1 Determine cumulative dose contributions for iodine-131, iodine-133, tritium, and radionuclides in particulate form with half lives > 8 days in accordance with the methodology and parameters in the ODCM.	31 days

3.8.C Gaseous Effluents

ODCMS 3.8.C.4 The following conditions shall be met:

- a. Main stack dilution flow shall be  $\geq 10,000$  cfm;
- b. One vent stack noble gas monitor and one main stack noble gas monitor shall be FUNCTIONAL and set to alarm in accordance with the methodology and parameters in the ODCM;
- c. One vent stack iodine filter and one main stack iodine filter and one vent stack particulate filter and one main stack particulate filter with their respective flow rate monitors shall be FUNCTIONAL; and
- d. One vent stack flow rate monitor and one main stack flow rate monitor shall be FUNCTIONAL and set to alarm in accordance with the methodology and parameters in the ODCM.

APPLICABILITY: During release of radioactive wastes.



## COMPENSATORY MEASURES

-----NOTE-----  
Separate condition entry is allowed for each instrument.

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. One required vent stack noble gas monitor inoperable.  OR  One required main stack noble gas monitor inoperable.	A.1 Collect two independent grab samples from the affected effluent release pathway.  AND  A.2 -----NOTE----- Perform independent verification of the release rate calculations using at least two technically qualified members of the facility staff. -----  Analyze grab samples from the affected release pathway for activity.	8 hours  AND  Once per 8 hours thereafter          24 hours from time of collection

(continued)

## COMPENSATORY MEASURES (Continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
<p>B. One required vent stack iodine filter inoperable.</p> <p><u>OR</u></p> <p>One required vent stack particulate filter inoperable.</p> <p><u>OR</u></p> <p>One required main stack iodine filter inoperable.</p> <p><u>OR</u></p> <p>One required main stack particulate filter inoperable.</p>	<p>B.1 Initiate action to collect samples from the affected effluent release pathway continuously with auxiliary sampling equipment such that each sample period duration is approximately 7 days.</p> <p><u>AND</u></p> <p>B.2 Analyze collected samples.</p>	<p>Immediately</p>     <p>48 hours after end of each sampling period</p>
<p>C. One required vent stack flow rate monitor inoperable.</p> <p><u>OR</u></p> <p>One required main stack flow rate monitor inoperable.</p>	<p>C.1 Estimate flow rate from the affected effluent release pathway.</p>	<p>4 hours</p> <p><u>AND</u></p> <p>Once per 4 hours thereafter</p>
<p>D. Main off-gas stack dilution flow &lt; 10,000 cfm.</p>	<p>D.1 Initiate action to re-establish main off-gas stack flow ≥ 10,000 cfm.</p>	<p>Immediately</p>

(continued)

## COMPENSATORY MEASURES (Continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
E. One or more required radioactive gaseous effluent monitoring instrumentation channels inoperable for > 30 days.	E.1 Explain why the inoperability was not corrected in a timely manner in the next Annual Radioactive Effluent Release Report.	In accordance with Technical Specification 5.6.3

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.4.1 Perform INSTRUMENT CHECK of the vent stack and main stack noble gas radiation monitors.	24 hours
ODCMS 4.8.C.4.2 Perform INSTRUMENT CHECK of the vent stack and the main stack flow rate monitors.	24 hours
ODCMS 4.8.C.4.3 Section Removed	
ODCMS 4.8.C.4.4 Perform INSTRUMENT FUNCTIONAL TEST of the vent stack and main stack noble gas radiation monitors, including control room alarm annunciation in response to alarm setpoint being exceeded and an instrument downscale failure.	92 days
ODCMS 4.8.C.4.5 Section Removed	

ODCMS REQUIREMENT	FREQUENCY
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(Continued)

## ODCMS REQUIREMENTS (Continued)

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.4.6 Perform INSTRUMENT CALIBRATION of the vent stack and main stack noble gas radiation monitors with a known radioactive source positioned in a reproducible geometry with respect to the sensor.	18 months
ODCMS 4.8.C.4.7 Perform INSTRUMENT CALIBRATION of the vent stack and main stack flow rate monitors.	18 months
ODCMS 4.8.C.4.8 Perform INSTRUMENT CALIBRATION of the vent stack and main stack iodine and particulate sample flow rate monitors.	18 months
ODCMS 4.8.C.4.9 Section Removed	
ODCMS 4.8.C.4.10 Perform SOURCE CHECK of vent stack and main stack noble gas radiation monitors.	92 days
ODCMS 4.8.C.4.11 Not Used	

## 3.8.C Gaseous Effluents

ODCMS 3.8.C.5 Gaseous effluents shall be processed through the Gaseous Waste Treatment System described below prior to discharge:

- a. Steam jet air ejector discharge shall be processed through the recombiner, holdup pipe, off-gas filter, and off-gas stack;
- b. Mechanical vacuum pump and gland steam exhauster discharge shall be processed through the off-gas stack;
- c. Auxiliary boiler exhaust shall be processed through the auxiliary boiler stack when burning radioactive waste oil;
- d. Reactor, turbine, radwaste, and recombiner building atmospheres shall be processed through permanently or temporarily installed equipment in the appropriate building ventilation system and the vent stack, with the exception of the following unmonitored exhausts:
  1. Recirculation M-G set and reactor building cooling water equipment rooms;
  2. Control room utility and toilet rooms;
  3. Cable spread room;
  4. Emergency switchgear rooms;
  5. 125/250 VDC battery rooms and the 250 VDC battery rooms, and
  6. Administration building maintenance decontamination area.

APPLICABILITY: Prior to all gaseous release(s) whenever the release(s) would cause the projected dose, when it is averaged over 31 days to exceed 0.6 mrem to any organ (combined total from the two reactors at the site).

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Gaseous waste discharged without required processing.	A.1 Submit a Special Report to the NRC that explains the reasons gaseous radwaste was discharged without processing, identifies inoperable equipment or subsystems and the reasons for the inoperability, identifies actions taken to restore the inoperable equipment to FUNCTIONAL status, and action(s) taken.	30 days

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.5.1 Project doses due to gaseous effluent releases at and beyond the SITE BOUNDARY in accordance with the methodology and parameters in the ODCM.	31 days
ODCMS 4.8.C.5.2 Collect and analyze air samples from each building area with an unmonitored exhaust.	31 days

(continued)

## ODCMS REQUIREMENTS (Continued)

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.5.3 Demonstrate FUNCTIONALITY of required gaseous radioactive waste system equipment by analyzing the gaseous waste processed through the required equipment to determine it meets the requirements of ODCMS 3.8.C.1	92 days

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Gaseous Effluents  
3.8.C.6

### 3.8.C Gaseous Effluents

ODCMS 3.8.C.6 PURGING of the primary containment shall be:

- a. Through the Standby Gas Treatment System whenever primary containment is required to be FUNCTIONAL; and
- b. Through the Reactor Building Ventilation Exhaust System or the Standby Gas Treatment System whenever primary containment is not required to be FUNCTIONAL.

APPLICABILITY: During PURGING of the primary containment.

#### COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Requirement of ODCMS 3.8.C.6 not met.	A.1 Initiate action to suspend PURGING.	Immediately

#### ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.6.1 Verify primary containment PURGING is through required effluent release pathway of ODCMS 3.8.C.6.	Prior to PURGING primary containment



## 3.8.C Gaseous Effluents

ODCMS 3.8.C.7 Burning of radioactive waste oil shall be allowed:

- a. In accordance with the requirements of 10CFR20.2004.
- b. Through the Auxiliary Boilers (Common) with the exhaust stack of the affected auxiliary boiler as a release point for radioactive effluents.
- c. With the radioactive content of the oil determined prior to incineration.
- d. With the radioactive effluents from this pathway summed with other effluents from the site and reported to the Commission in the Radioactive Effluent Release Report.

APPLICABILITY: At all times

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Gaseous effluents discharge without required processing or Gaseous effluents exceed limits specified in 3.8.C.3	A.1 Submit a Special Report to the NRC that explains the reasons gaseous radwaste was discharged without processing, identifies inoperable equipment or subsystems and the reasons for the inoperability, identifies actions taken to restore the inoperable equipment to FUNCTIONAL status, and action(s) taken.	Immediately

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.C.7.1 Project doses due to gaseous effluent releases at or beyond the SITE BOUNDARY.	Each Batch Incinerated
ODCMS 4.8.C.7.2 Determine dose and dose rate contributions for radionuclides in particulate form with half lives > 8 days in accordance with the methodology and parameters in ODCM Section IV.F.	Each Batch Incinerated

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40 CFR 190  
3.8.D.1

3.8.D 40 CFR 190 and 10 CFR 72.104

- ODCMS 3.8.D.1 The annual dose equivalent to a real individual who is located beyond the SITE BOUNDARY from all uranium fuel cycle sources within 8 kilometers shall be:
- a.  $\leq 25$  mrem to the total body;
  - b.  $\leq 75$  mrem to the thyroid.
  - c.  $\leq 25$  mrem to any other critical organ; and
  - d.  $\leq 3.0$  mrem contribution from liquid and gaseous effluents for whole body and critical organ doses.
  - e.  $\leq 55$  mrem contribution from gaseous effluents for thyroid dose.

APPLICABILITY: At all times.

COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Annual cumulative liquid and gaseous effluents dose does not meet ODCMS 3.8.D.1 items d or e.	<p>-----NOTE-----</p> <p>Calculations shall include direct radiation contributions from reactor units and outside storage tanks.</p> <p>-----</p> <p>A.1 Initiate actions to determine whether the limits in ODCMS 3.8.D.1 items a, b or c have been exceeded.</p>	Immediately

(continued)

## COMPENSATORY MEASURES (Continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
B. Dose limits of ODCMS 3.8.D.1 items a, b or c have been exceeded.	<p>B.1 Submit a Special Report to the NRC that includes the corrective action(s) taken, the schedule for achieving conformance with required limits, estimates of radiation exposure to the real individual for the calendar year, descriptions of the levels of radiation and concentrations of radioactive material involved, and the cause of the exposure level or concentrations.</p> <p><u>AND</u></p>	31 days
	<p>-----NOTE----- ----- Only applicable if the release condition resulting in violation of 40 CFR 190 or 10 CFR 72.104 has not been corrected. ----- -----</p> <p>B.2 Submit a request for a variance in accordance with 40 CFR 190 and a request for an exemption from 10 CFR 72.104.</p>	31 days

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT			FREQUENCY
ODCMS	4.8.D.1.1	Determine total gas and liquid cumulative dose contributions in accordance with methodology and parameters in the ODCM.	31 days
ODCMS	4.8.D.1.2	Determine the cumulative dose contribution from gas and liquid effluents and the direct radiation from the reactor units and from high and low level radwaste storage in accordance with the methodology and parameters in the ODCM.	92 days

## 3.8.E Radiological Environmental Monitoring

ODCMS 3.8.E.1 Radiological environmental monitoring samples shall be collected at locations and analyzed as specified in Table 4.8.E.1 and the ODCM.

APPLICABILITY: At all times.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Milk samples permanently unavailable from any of the sample locations listed in the ODCM.	A.1 Identify locations for obtaining replacement samples and add them to radiological environmental monitoring program. Delete locations from which samples are unavailable.	31 days
	<u>AND</u> A.2 Identify in the AREOR the cause of the unavailability of samples and new locations for obtaining samples and include in the report revised figures and tables for the ODCM reflecting the new locations.	Prior to submittal in next AREOR

(continued)

## COMPENSATORY MEASURES (Continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
<p>B. Level of radioactivity as a result of plant effluents in an environmental sampling medium at one or more locations specified in the ODCM exceeds the action levels of Table 3.8.E.1 when averaged over the calendar quarter.</p> <p><u>OR</u></p> <p>Level of radioactivity as a result of plant effluents in an environmental sampling medium at one or more locations specified in the ODCM exceeds the action levels of Table 3.8.E.1 when averaged over the calendar quarter and more than one radionuclide from Table 3.8.E.1 is detected and the equation in ODCMS 4.8.E.1.2 is satisfied.</p>	<p>B.1 Submit a Special Report to the NRC which includes an evaluation of any release conditions, environmental factors, or other aspects which caused the action level of Table 3.8.E.1 to be exceeded and 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 reporting level of Table 3.8.E.1.</p>	<p>30 days</p>

(continued)

## COMPENSATORY MEASURES (Continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
<p>C. Radionuclides other than those in Table 3.8.E.1 detected and the potential annual dose to a MEMBER OF THE PUBLIC is greater than or equal to the calendar year limits of ODCMS 3.8.B.2, or ODCMS 3.8.C.2, or ODCMS 3.8.C.3, or ODCMS 3.8.D.1.</p>	<p>C.1      -----NOTE----- Only required if the radionuclides detected are the result of plant effluents. -----</p> <p>Submit a Special Report to the NRC to evaluate any release conditions, environmental factors, or other aspects which caused the action level of Table 3.8.E.1 to be exceeded; and the corrective actions to be taken to reduce radioactive effluents so that potential annual dose to a MEMBER OF THE PUBLIC is less than the calendar year reporting level of Table 3.8.E.1</p> <p><u>AND</u></p>	<p>31 days after end of affected calendar quarter</p> <p>(continued)</p>

## COMPENSATORY MEASURES (Continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
C. (continued)	<p>C.2      -----NOTE----- Only required if the radionuclides detected are not the result of plant effluents. -----</p> <p>Describe the condition in the Annual Radiological Environmental Operating Report.</p>	Prior to submittal of next Annual Radiological Environmental Operating Report
D. Requirements of ODCMS 3.8.E.1 not met.	D.1      Prepare and submit, in the Annual Radiological Environmental Operating Report, a description of the reasons for not conducting the radiological environmental monitoring program as required and the actions taken to prevent recurrence.	In accordance with Technical Specification 5.6.3



## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
<p>ODCMS 4.8.E.1.1 -----NOTES-----</p> <ol style="list-style-type: none"> <li>1. Deviations are permitted from the required sampling schedule if specimens are unobtainable due to hazardous conditions, seasonal unavailabilities, malfunction of automatic sampling equipment or other legitimate reasons.</li> <li>2. If equipment malfunction occurs, an effort shall be made to complete corrective actions prior to the end of the next sampling period.</li> </ol> <p>-----</p> <p>Collect radiological environmental monitoring samples at the locations and analyze as specified in Table 4.8.E.1 and the ODCM.</p>	<p>In accordance with Table 4.8.E.1</p>
<p>ODCMS 4.8.E.1.2 -----NOTE-----</p> <p>All radionuclides used in this evaluation shall be averaged on a calendar quarterly basis.</p> <p>-----</p> <p>Evaluate the concentration of radioactivity as a result of plant effluents in an environmental sampling medium against the following equation:</p> $\frac{\text{concentration}(1)}{\text{reporting level}(1)} + \frac{\text{concentration}(2)}{\text{reporting level}(2)} + \dots \geq 1.0$	<p>92 days</p>

Table 3.8.E.1 (page 1 of 1)  
Reporting Levels for Radioactivity Concentration in Environmental Samples

## Action Levels

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE OR GASES (pCi/m <sup>3</sup> )	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)
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		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	

\*For drinking water samples. This is 40 CFR part 141 value.

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# Radiological Environmental Monitoring

Table 4.8.E.1 (page 1 of 3)  
Radiological Environmental Monitoring Program

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF SAMPLES AND SAMPLE LOCATION(a)	SAMPLING AND COLLECTION FREQUENCY (b), (c)
1. Direct Radiation	At least 40 routine monitoring stations either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously to be placed as follows: 1) an inner ring of stations in the general area of the SITE BOUNDARY and an outer ring in the 3 to 6 mile range from the site. A station is in each sector of each ring except as dictated by local geography. The balance of the stations are in special interest areas such as population centers, nearby residences, schools and in areas to serve as control stations.	Every 31 days or Every 92 days
2. Airborne		
Radioiodine and Particulates	<p>Samples from 5 locations:</p> <ul style="list-style-type: none"> <li>a. 3 samples from close to the SITE BOUNDARY locations (in different sectors) of the highest calculated annual average ground level D/Q.</li> <li>b. 1 sample from the vicinity of a community having the highest calculated annual average ground level D/Q.</li> <li>c. 1 sample from a control location unlikely to be affected by the plant.</li> </ul>	Continuous sampler operation with sample collection every 7 days or required by dust loading, whichever is more frequent.
3. Waterborne		
a. Surface	<ul style="list-style-type: none"> <li>a. 1 sample upstream</li> <li>b. 1 sample downstream</li> </ul>	Composite (b) sample over 31 day period.

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# Radiological Environmental Monitoring

3.8.E.1

Table 4.8.E.1 (page 2 of 3)  
Radiological Environmental Monitoring Program

EXPOSURE PATHWAY AND/OR SAMPLE	NUMBER OF SAMPLES AND SAMPLE LOCATION	SAMPLING AND COLLECTION FREQUENCY (b), (c)	TYPE AND FREQUENCY OF ANALYSIS
3. Waterborne (cont'd)			
b. Drinking	a. 1 sample of each of 1 to 3 of the nearest water supplies that could be affected by its discharge. b. 1 sample from a control location.	Composite (b) sample over 31 day composite period	Composite for gross beta and gamma (d) isotopic analyses every 31 days. Composite for tritium analysis at least every 92 days
c. Sediment from Shoreline	1 sample from downstream area with existing or potential recreational value.	Every 6 months	Gamma isotopic (d) analysis every 6 months
4. Ingestion			
a. Milk	a. Samples from milking animals in 3 locations within 3 miles distance having the highest dose potential. b. 1 sample from milking animals at a control location (unlikely to be affected by the plant).	Every 14 days when animals are on pasture, every 31 days at other times.	Gamma isotopic (d) analysis or 134, 137 Cs by chemical separation every 92 days. I-131 analysis of each sample.
b. Fish	a. 1 sample of each commercially and recreationally important species in vicinity of discharge point when available. b. 1 sample of same species in areas not influenced by plant discharge when available.	Sample in season, or every 6 months if they are not seasonal.	Gamma isotopic (d) analysis on edible portions.
c. Food Products	a. Samples of 3 different kinds of broad leaf vegetation grown nearest offsite garden of highest annual average ground level D/Q if milk sampling is not performed. b. 1 sample of each of the similar broad leaf vegetation grown 15 - 30 km distant in the least prevalent wind direction if milk sampling is not performed.	Every 31 days when available if milk sampling is not performed. Every 31 days when available if milk sampling is not performed	Gamma isotopic (d) and I-131 analysis Gamma isotopic (d) and I-131 analysis

Table 4.8.E.1 (page 3 of 3)  
Radiological Environmental Monitoring Program

NOTES

- (a) Fixed sample locations are shown in the Offsite Dose Calculation Manual, Table VII.A.1 and Figures VII.A.1, VII.A.2, and VII.A.3. At times it may not be possible or practicable to obtain samples of the media of choice at the most desired location or time. In those instances suitable alternative media and locations may be chosen for the particular pathway in question. Such necessary deviations are reported in the Annual Radiological Environmental Operating Report.
- (b) Composite samples shall be collected by collecting an aliquot at intervals not exceeding 2 hours.
- (c) Sample collection frequencies are defined as follows:
- |          |                                 |
|----------|---------------------------------|
| 7 days   | 7 calendar days $\pm$ 2 days    |
| 14 days  | 14 calendar days $\pm$ 3 days   |
| 31 days  | 31 calendar days $\pm$ 8 days   |
| 92 days  | 92 calendar days $\pm$ 10 days  |
| 6 months | 6 calendar months $\pm$ 20 days |
- (d) Gamma isotopic analysis means the identification and quantification of gamma-emitting radionuclides that may be attributable to the effluents from the facility.
- (e) N/A |
- (f) If the gross beta activity in air attributable to plant operation is greater than ten times the yearly mean of control samples, gamma isotopic analysis shall be performed on the individual samples.

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## Radiological Environmental Monitoring

3.8.E.1 |

Table 4.8.E.2 (page 1 of 2)  
 DETECTION CAPABILITIES FOR ENVIRONMENTAL SAMPLE ANALYSIS<sup>(a)</sup>  
 Lower Limit Of Detection (LLD)<sup>(b)</sup>

ANALYSIS	WATER (pCi/l)	AIRBORNE PARTICULATE (pCi/m <sup>3</sup> )	FISH (pCi/kg, wet)	MILK (pCi/l)	FOOD PRODUCTS (pCi/kg, wet)	SEDIMENT (pCi/kg, dry)
Gross Beta	4	0.01				
H-3	2,000					
Mn-54	15		130			
Fe-59	30		260			
Co-58, 60	15		130			
Zn-65	30		260			
Zr-95	30					
Nb-95	15					
I-131	-	0.07		1	60	
Cs-134	15	0.05	130	15	60	150
Cs-137	18	0.06	150	18	80	180
Ba-140	60			60		
La-140	15			15		

Table 4.8.E.2 (page 2 of 2)Notes:

- (a) This list does not mean that only these nuclides are to be considered. Other peaks that are identifiable at 95% confidence level, together with those of the above nuclides, shall also be analyzed and reported in the Annual Radiological Environmental Operating Report.
- (b) The LLD is defined, for purposes of these controls, 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):

$$LLD = \frac{4.66S_{\beta}}{E \cdot V \cdot 2.22 \cdot Y \cdot \exp(-\lambda\Delta t)}$$

Where:

LLD is the a priori lower limit of detection as defined above (as picocuries per unit mass or volume),

$S_{\beta}$  is the standard deviation of the background counting rate or of the counting rate of blank sample as appropriate (as counts per minute),

E is the counting efficiency (as counts per disintegration),

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

2.22 is the number of disintegrations per minute per picocurie,

Y is the fractional radiochemical yield (when applicable)

$\lambda$  is the radioactive decay constant for the particular radionuclide, and

$\Delta t$  for the environmental samples is the elapsed time between sample collection (or end of the sample collection period) and time of counting.

Typical values of E, V, Y, and  $\Delta t$  should be used in calculation.

It should be recognized that the LLD is defined as an a priori (before the fact) limit representing the capability of a measurement system and not as an after the fact limit for a particular measurement. Analyses shall be performed in such a manner that the stated LLDs will be achieved under routine conditions. Occasionally background fluctuations, unavoidably small sample sizes, the presence of interfering nuclides, or other uncontrollable circumstances may render these LLDs unachievable. In such cases, the contributing factors shall be identified and described in the Annual Radiological Environmental Operating Report.

## 3.8.E.2

ODCMS 3.8.E.2 A land use census shall be conducted and shall identify the location of the nearest milk animal in each of the 16 meteorological sectors within a distance of five miles.

APPLICABILITY: At all times.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
<p>A. Land use census identifies a location which yields a calculated dose or dose commitment (via the same exposure pathway) that is at least 20% greater than a location from which samples are currently being obtained in accordance with ODCMS 3.8.E.1.</p>	<p>A.1 Add the new location to the radiological environmental monitoring program.</p> <p><u>AND</u></p>	<p>31 days</p> <p>(continued)</p>



## COMPENSATORY MEASURES (Continued)

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. (continued)	<p>A.2 -----NOTE-----</p> <p>The indicator sampling location having the lowest calculated dose or dose commitment (via the same exposure pathway) may be deleted from the radiological environmental monitoring program after October 31 of the year in which land use census was conducted.</p> <p>-----</p> <p>Identify the new location in the Annual Radiological Environmental Operating Report and include the revised figures and tables for the ODCM reflecting the new location.</p>	In Accordance with Technical Specification 5.6.2
B. Land use census identifies a location which yields a calculated dose or dose commitment that is greater than values currently being calculated in ODCMS 3.8.C.3.	B.1 Identify the new location in the Annual Radiological Environmental Operating Report.	In Accordance with Technical Specification 5.6.2

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Radiological Environmental Monitoring  
3.8.E.2

ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.E.2.1 Conduct a land use census by a door-to-door survey or by consulting local agriculture authorities or by some other appropriate means.	12 months

## 3.8.E Radiological Environmental Monitoring

ODCMS 3.8.E.3 Analyses shall be performed on radioactive materials supplied as part of the EPA Environmental Radioactivity Intercomparison Studies Program, or another Interlaboratory Comparison Program traceable to NIST.

APPLICABILITY: At all times.

## COMPENSATORY MEASURES

CONDITION	REQUIRED COMPENSATORY MEASURE	COMPLETION TIME
A. Requirements of ODCMS 3.8.E.3 not met.	A.1 Include corrective actions to prevent recurrence in the Annual Radiological Environmental Operating Report.	In accordance with Technical Specification 5.6.2

## ODCMS REQUIREMENTS

ODCMS REQUIREMENT	FREQUENCY
ODCMS 4.8.E.3.1 Include a summary of the results of the Interlaboratory Comparison Program in the Annual Radiological Environmental Operating Report.	In accordance with Technical Specification 5.6.2

### 3.10 Reporting Requirements

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#### ODCMS 3.10.1 Annual Radiological Environmental Operating Report

The Annual Radiological Environmental Operating Report shall be submitted in accordance with the requirements of Technical Specification 5.6.2. In addition to the requirements of Technical Specification 5.6.2, the Annual Radiological Environmental Operating Report shall include or reference from previous reports:

- a. A summary description of the radiological environmental monitoring program including sampling methods for each sample type, size, and physical characteristics of each sample type, sample preparation methods, and measuring equipment used;
- b. At least two maps of all sampling locations keyed to a table giving distances and directions from the midpoint between reactor vents;
- c. Results of the land use census required by ODCMS 3.8.E.2; and
- d. Results of the Interlaboratory Comparison Program required by ODCMS 3.8.E.3 and discussion of all analyses in which the LLD required by Table 4.8.E.2 was not achievable.

#### ODCM 3.10.2 Radioactive Effluent Release Report

The Radioactive Effluent Release Report shall be submitted in accordance with the requirements of Technical Specification 5.6.3. In addition to the requirements of Technical Specification 5.6.3, the requirements of Technical Specification 5.6.3 the Radioactive Effluent Release Report shall include:

- a. Information for each class of solid waste (as defined by 10 CFR 61) shipped offsite during the report period:
  1. Container volume;
  2. Total curie quantity (specify whether determined by measurements or estimate);
  3. Principal radionuclides (specify whether determine by measurement of estimate);

4. Source of waste and processing employed (e.g., dewatered spent resin, compacted dry waste, evaporator bottomed); and
  5. Type of container (e.g., LSA, Type A, Type B, Large Quantity).
- 
- b. A list and description of unplanned releases from the site to areas at or beyond the SITE BOUNDARY of radioactive materials in gaseous and liquid effluents made during the reporting period.
  - c. Changes made during the reporting period to the Offsite Dose Calculation Manual (ODCM) and a list of new locations for dose calculations and/or environmental monitoring identified by the land use census required by ODCM 3.8.E.2.
  - d. Annual summary of hourly meteorological data collected over the previous 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 distributions of wind speed, wind direction, and atmospheric stability. The licensee 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.
  - e. An assessment of the radiation doses due to the radioactive liquid and gaseous effluents released from the unit or station during the previous calendar year.
  - f. Radiation doses from radioactive liquid and gaseous effluent to MEMBERS OF THE PUBLIC due to their activities inside the SITE BOUNDARY during the report period. All assumptions used in making these assessments (i.e., specific activity, exposure time and location) shall be included in these reports.
  - g. 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. Approximate methods are acceptable. The assessment of radiation doses shall be performed in accordance with the Offsite Dose Calculation Manual (ODCM).

- h. An assessment of radiation doses to the likely most 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. Guidance for calculating the dose contribution from liquid and gaseous effluents are given in Regulatory Guide 1.109, Revision 1, October 1977.

## B 3.8 ODCM SPECIFICATIONS

## BASES

General

It is expected that releases of radioactive material in effluents will be kept at small fractions of the limits specified in Section 20.1302 of 10 CFR, Part 20. At the same time, the licensee is permitted the flexibility of operation, compatible with consideration of health and safety, to assure that the public is provided a dependable source of power even under unusual operating conditions which may temporarily result in releases higher than such small fractions, but still within the limits specified in Section 20.1302 of 10 CFR, Part 20. It is expected that in using this operational flexibility under unusual operating conditions the licensee will exert his best efforts to keep levels of radioactive material in effluents as low as practicable.

Liquid Radwaste Effluents

## Concentration

This specification is provided to ensure that the concentration of radioactive materials released in liquid waste effluents to areas at and beyond the SITE BOUNDARY will be within 10 times the concentration levels specified in 10 CFR, Part 20, Appendix B, Table 2, Column 2. This instantaneous limitation provides additional assurance that the levels of radioactive materials in bodies of water in areas at or beyond the SITE BOUNDARY 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 20.1302 to the population. The concentration limit for 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 International Commission on Radiological Protection (ICP) Publication 2.

## Dose

This specification is provided to implement the requirements of Sections I.E., IXIA and I.E. of Appendix I, 10 CFR Part 50. ODCMS 3.8.B.2 implements the guidance set forth in Section I.E. of Appendix I and provides the required operating flexibility to implement the guides set forth in Section I.E. of Appendix I to assure that the releases of radioactive material in liquid effluents will be kept "as low as reasonably achievable." The dose calculations in the ODCM implement the requirements in Section IXIA 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 equations described in the Offsite Dose Calculation Manual for calculating the doses due to the actual release rates

(continued)

## BASES

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Liquid Radwaste Effluents

## Dose (continued)

of radioactive materials in liquid effluents 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 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," April 1977. This specification applies to the release of liquid effluents from the site.

## Instrumentation

The radioactive liquid effluent instrumentation is provided to monitor and control, as applicable, the releases of radioactive materials in liquid effluents during actual or potential release of liquid effluents. The FUNCTIONALITY 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.

## System Operation

The FUNCTIONALITY 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 reasonably achievable." This specification implements the requirements of 10 CFR, Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR, Part 50 and design objective 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 guide set forth in Section II.A of Appendix I, 10 CFR, Part 50, for liquid effluents.

The chemical/oily waste cleanup subsystem may include the portable Epicor oil/water emulsion system (as described in RW-625), an installed chemical/oily waste cleanup subsystem, or equivalent chemical/oil waste system.

The laundry drain filter may be used to process liquid wastes containing detergents or similar cleaning agents. Wastewater such as river water that is acceptable for release may be processed through the laundry drain filter.

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(continued)



## BASES (continued)

Gaseous Effluents

## Dose

This specification is provided to ensure that the dose from radioactive materials in gaseous effluents at and beyond the SITE BOUNDARY will be within the annual dose limits of 10 CFR Part 20. The annual dose limits are the doses associated with 10 times the concentrations of 10 CFR Part 20, Appendix B, Table 2, and 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, either within or outside the SITE BOUNDARY, to annual average concentrations exceeding the limits specified in Appendix B, Table 2 of 10 CFR part 20.1302. For MEMBERS OF THE PUBLIC who may at times be within the SITE BOUNDARY, the occupancy 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 are given in the ODCM. The specified limits restrict, at all times, the gamma and beta dose rates above background to a MEMBER OF THE PUBLIC, at or beyond the SITE BOUNDARY to  $\leq 500$  mrem/year to the total body or to  $\leq 3000$  mrem/year to the skin. These dose rate limits also restrict, at all times, the corresponding thyroid dose rate above background to a child via the inhalation pathway to  $\leq 1500$  mrem/year.

## Dose, Noble Gases

This specification is provided to implement the requirements of Sections II.B, III.A and IV.A of Appendix I, 10 CFR Part 50. ODCMS 3.8.C.2 implements the guidance set forth in Section II.B of Appendix I and provides the required operating flexibility to implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive material in gaseous effluents will be kept "as low as reasonably achievable." ODCMS 4.8.C.2.1 implements the requirements in Section III.A of Appendix I that conformance with the guidance 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 the appropriate pathways is unlikely to be substantially underestimated. The dose calculations 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 of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR 50, Appendix I," Revision 1, October 1977 and the atmospheric dispersion model submitted on September 30, 1976, in a report titled: "Information Requested in Enclosure 2 to letter from George Lear to E. G. Bauer dated February 17, 1976." The ODCM equations provided for determining the air doses at and beyond the SITE BOUNDARY are based upon the historical average atmospheric conditions.

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## BASES

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Gaseous Effluents (continued)

## Dose - Iodine-131, Tritium and Radionuclides in Particulate Form

This specification is provided to implement the requirements of Sections II.C, III.A and IV.A of Appendix I, 10 CFR Part 50. ODCMS 3.8.C.3 implements the guidance set forth in Section II.C of Appendix I and provides the required operating flexibility to implement the guides set forth in Section IV.A of Appendix I to assure that the releases of radioactive materials in gaseous effluents will be kept "as low as reasonably achievable." The ODCM calculational methods specified in the ODCMS 4.8.C.3.1 implements 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 methods 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 the Atmospheric Dispersion Model submitted on September 30, 1976 in a report titled: "Information Requested in Enclosure 2 to letter from George Lear to E. G. Bauer dated February 17, 1976." These equations also provide for determining the actual doses based upon the historical average atmospheric conditions. The release rate specifications for iodine-131, tritium, and radionuclides in particulate form with half-lives greater than 8 days are dependent on 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 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.

## Instrumentation

The radioactive gaseous effluent 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 FUNCTIONALITY and use of instrumentation is consistent with the requirements of General Design Criteria 60, 63, and 64 of Appendix A to 10 CFR, Part 50.

(continued)

## BASES

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Gaseous Effluents (continued)

## System Operation

The FUNCTIONALITY of the Gaseous Radwaste Treatment System ensures that this system will be available for use whenever gaseous effluents require treatment prior to release to the environment. The requirement that appropriate portions of this system 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 specification implements the requirements of 10 CFR, Part 50.36a, General Design Criterion 60 of Appendix A to 10 CFR, Part 50 and design objective Section II.D of Appendix I to 10 CFR, Part 50. The specified limits governing the use of appropriate portions of the Gaseous Radwaste Treatment System were specified as a suitable fraction of the guidance set forth in Section II.B and II.C of Appendix I, 10 CFR, Part 50, for gaseous effluents.

To determine if gaseous effluents shall be processed through installed treatment equipment, the average projected dose will be determined. For gaseous effluent pathways other than the specified unmonitored exhausts, treatment and monitoring will only be required for pathways that are significant. Regulatory Guide 1.109, "Calculations of Annual Doses to Man From Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10 CFR Part 50, Appendix I", states that a pathway is considered significant if a conservative evaluation yields an additional dose increment equal to or more than 10 percent of the total from all pathways. Therefore, the total dose from all release pathways that do not require treatment or monitoring can not exceed 10 percent of the limit specified in Section II.C of Appendix I, 10 CFR Part 50.

## Containment PURGE

ODCMS 3.8.C.6 requires that the primary containment atmosphere receive treatment for the removal of gaseous iodine and particulates prior to release to provide reasonable assurance that PURGING operations will not result in exceeding the annual dose limits of 10 CFR Part 20 for areas at or beyond the SITE BOUNDARY.

## BASES

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40 CFR 190 and 10 CFR 72.104

This specification is provided to meet the dose limitations of 40 CFR Part 190 that have been incorporated into 10 CFR 20.1301(d) as well as the dose limitations specific to Independent Spent Fuel Storage Installation (ISFSI) operations in accordance with 10 CFR 72.104.

Over the long term, as more ISFSI casks are placed on the ISFSI pad, it is expected that ISFSI operations will become the prominent contributor to the limits in this section. ISFSI dose contribution is in the form of direct radiation as no liquid or gas releases are expected to occur. The 10 CFR 72.212 report prepared in accordance with ISFSI requirements assumes a certain array of casks exists on the pad. The dose contribution from this array of casks in combination with historical uranium fuel cycle operations (e.g. PBAPS 2 & 3) prior to ISFSI operations was analyzed to be within the 40 CFR 190 and 10 CFR 72.104 limits. The difference between 40 CFR 190/10 CFR 72.104 limits and the analyzed ISFSI cask array contribution are identified in ODCMS 3.8.D.1 items d and e. Therefore, these values are used as assumptions in calculating combined ISFSI and PBAPS 2 & 3 doses. If these PBAPS 2 & 3 liquid and gas radiation values are exceeded, an evaluation is performed to determine if the overall 40 CFR 190 and 10 CFR 72.104 limits have been exceeded.

If the dose limits of 40 CFR 190 or 10 CFR 72.104 are exceeded, a special report to the NRC as well as an appropriate request for exemption /variance is required to be submitted to the NRC.

The requirement that the dose limits of 10CFR 72.104 apply to "any real individual" are controlled for ISFSI activities in the ISFSI 72.212 report. Therefore, for the purposes of analyzing dose in the south end of the site, the member of the public as defined in 40 CFR 190 at this area is the same as the "real individual" identified in the 72.212 report. The location for the real individual identified in the ISFSI 72.212 report is the limiting individual for calculating dose.

## BASES

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Radiological Environmental Monitoring

## Monitoring Program

The radiological environmental monitoring program required by this specification provides measurements of radiation and of radioactive materials in those exposure pathways and for those radionuclides, which lead to the highest potential radiation exposures of MEMBERS OF THE PUBLIC resulting from the two reactors at the sites. This monitoring program implements Section IV.B.2 of Appendix I to 10 CFR Part 50 and 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.

The required detection capabilities for environmental sample analyses are tabulated in terms of the Lower Limit of Detection (LLD). The LLD's required by Table 4.8.E.2 of the specifications are considered optimum for routine environmental measurements in industrial laboratories. The monitoring program was developed utilizing the experience of the first seven years of commercial operation. Program changes may be initiated based on the additional operational experience.

## Land Use Census

This specification is provided to ensure that significant changes in the use of areas at and beyond the SITE BOUNDARY are identified and that modifications to the radiological environmental monitoring program are made if required by the results of this census. This census satisfies the requirements of Section IV.B.3 of Appendix I to 10 CFR Part 50.

## Interlaboratory Comparison Program

The requirement for participation in an 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 reasonably valid for the purposes of Section IV.B.2 of Appendix I to 10 CFR Part 50.

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Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

## **APPENDIX C: ATTACHED REVISION OF RW-AA-100**

Peach Bottom Atomic Power Station  
Unit 2 and 3

Licensee: Exelon Generation Company, LLC  
PSEG Nuclear, LLC

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