

**Technical Specification 5.6.3**  
**Technical Requirements Manual 3.7.102.4**



102-08431 KJG/MSC  
April 29, 2022

**Palo Verde**  
**Nuclear Generating Station**  
PO Box 52034  
Phoenix, AZ 85072  
Mail Station 7636  
Tel (623) 393-2488

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

Subject: **Palo Verde Nuclear Generating Station (PVNGS) Units 1, 2, 3, and Independent Spent Fuel Storage Installation Renewed Operating License Nos. NPF-41, NPF-51, and NPF-74 Docket Nos. STN 50-528, STN 50-529, STN 50-530, and STN 72-44 Annual Radioactive Effluent Release Report 2021**

Enclosed please find the PVNGS Units 1, 2, and 3 Annual Radioactive Effluent Release Report for 2021. Arizona Public Service Company is submitting this report pursuant to the PVNGS Technical Specification Reporting Requirement, Section 5.6.3. The report also includes details regarding radioactive effluent releases from the PVNGS Independent Spent Fuel Storage Installation.

PVNGS Technical Requirement Manual, Section 3.7.102.4 requires an annual report to be prepared and submitted if sealed source or fission detector leakage tests reveal the presence of greater than or equal to 0.005 microcuries of removable contamination. There were no events in 2021 that met this reporting threshold.

No new commitments are being made to the Nuclear Regulatory Commission (NRC) by this letter.

Should you need further information regarding this submittal, please contact Matthew S. Cox, Licensing Section Leader, at (623) 393-5753.

Sincerely,

A handwritten signature in black ink that reads 'Katherine J. Gil'.

Digitally signed by Gil, Katherine J(Z05492)  
Date: 2022.04.29 10:42:19 -07'00'

Katherine J. Gil  
Director, Nuclear Regulatory Affairs

KJG/MSC/mg

Enclosure: Palo Verde Nuclear Generating Station Units 1, 2, and 3  
2021 Annual Radioactive Effluent Release Report

cc: S. A. Morris      NRC Region IV Regional Administrator  
S. P. Lingam      NRC NRR Project Manager for PVNGS  
L. N. Merker      NRC Senior Resident Inspector for PVNGS  
B. Goretzki      Arizona Department of Health Services – Bureau of Radiation Control

**Enclosure**

**Palo Verde Nuclear Generating Station  
Units 1, 2, and 3**

**2021 Annual Radioactive Effluent Release Report**



PALO VERDE NUCLEAR GENERATING STATION UNITS 1, 2 AND 3

## 2021 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

USNRC Docket No. STN 50-528/529/530

RCTSAI 1566



Prepared by: Podgurski, Craig J(Z99682) Digitally signed by Podgurski, Craig J(Z99682) Date: 2022.04.25 18:23:59 -07'00'

Reviewed by: Bungard, James P(Z18012) Digitally signed by Bungard, James P(Z18012) Date: 2022.04.25 19:08:47 -07'00'

Approved by: Grusecki, Lori J(Z39643) Digitally signed by Grusecki, Lori J(Z39643) Date: 2022.04.26 07:12:34 -07'00'

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## INTRODUCTION

This report meets the annual report requirements of 10 CFR 50.36a(a)(2) and summarizes the effluent and waste disposal source term data, meteorological data, and dose to members of the public from radioactive effluents for the Palo Verde Nuclear Generating Station (PVNGS) during the period of January through December 2021. Included in the report are tables that demonstrate compliance with the PVNGS Offsite Dose Calculation Manual (ODCM), 10 CFR 50.36a, and 10 CFR 50 Appendix I. The data presented in the report meets the format described in Regulatory Guide 1.21, Measuring, Evaluating, and Reporting Radioactivity in Solid Waste and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, Revision 1. The report summarizes the quantities of gaseous effluents released from each PVNGS unit and waste disposed of from PVNGS. Because PVNGS does not have a liquid effluent pathway, no liquid effluents are summarized.

### 1.0 REGULATORY LIMITS

#### 1.1 Liquid Releases

##### 1.1.1 PVNGS ODCM Requirement 3.2

The concentration of radioactive material discharged from secondary system liquid waste to the circulating water system shall be limited to:

5.0E-07  $\mu\text{Ci/ml}$  for principal gamma emitters (except Ce-144)

3.0E-06  $\mu\text{Ci/ml}$  for Ce-144

1.0E-06  $\mu\text{Ci/ml}$  for I-131

1.0E-03  $\mu\text{Ci/ml}$  for H-3

The concentration of radioactive material discharged from secondary system liquid waste to the onsite evaporation ponds shall be limited to:

2.0E-06  $\mu\text{Ci/ml}$  for Cs-134

2.0E-06  $\mu\text{Ci/ml}$  for Cs-137

The concentrations specified in 10 CFR Part 20.1001-20.2402, Appendix B, Table 2, Column 2, for all other isotopes.

##### 1.1.2 PVNGS ODCM Requirement 4.4

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each reactor unit, to areas at and beyond the SITE BOUNDARY shall be limited:

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

## 1.2 Gaseous Releases

### 1.2.1 PVNGS ODCM Requirement 3.1

The dose rate due to radioactive materials released in gaseous effluents from the site shall be limited to the following:

- a. For noble gases: Less than or equal to 500 mrem/yr to the total body and less than or equal to 3,000 mrem/yr to the skin, and
- b. For I-131 and I-133, for tritium, and for all radionuclides in particulate form with half-lives greater than 8 days: Less than or equal to 1,500 mrem/yr to any organ.

### 1.2.2 PVNGS ODCM Requirement 4.1

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

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

### 1.2.3 PVNGS ODCM Requirement 4.2

The dose to a MEMBER OF THE PUBLIC from iodine-131, iodine-133, tritium, and all radionuclides in particulate form with half-lives greater than 8 days in gaseous effluents released, from each reactor unit, to areas at and beyond the SITE BOUNDARY shall be limited to the following:

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

### 1.2.4 PVNGS ODCM Requirement 4.3

The GASEOUS RADWASTE SYSTEM and the VENTILATION EXHAUST TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected gaseous effluent air doses due to gaseous effluent releases, from each reactor unit, from the site, when averaged over 31 days, would exceed 0.2 mrad for gamma radiation and 0.4 mrad for beta radiation. The VENTILATION EXHAUST TREATMENT SYSTEM shall be used to reduce radioactive materials in gaseous waste prior to their discharge when the projected doses due to gaseous effluent releases, from each reactor unit, to areas at and beyond the SITE BOUNDARY when averaged over 31 days, would exceed 0.3 mrem to any organ of a MEMBER OF THE PUBLIC.

### 1.3 Total Dose

#### 1.3.1 PVNGS ODCM Requirement 5.1

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

## 2.0 MAXIMUM PERMISSIBLE CONCENTRATIONS

Air: Release Concentrations are limited to dose rate limits described in Section 1.2 of this report.

## 3.0 AVERAGE ENERGY

The average energy ( $\bar{E}$ ) of the radionuclide mixture in releases of fission and activation gases is not applicable to PVNGS.

## 4.0 MEASUREMENTS AND APPROXIMATIONS OF TOTAL RADIOACTIVITY IN GASEOUS EFFLUENTS

For continuous releases, sampling is in accordance with PVNGS ODCM Table 3-1. Particulate and iodine radionuclides are sampled continuously at the Plant Vent and Fuel Building exhaust points. The particulate filters and charcoal cartridges are exchanged for analysis at least four times per month. Noble gas and tritium are sampled at least once per 31 days. The hourly average Radiation Monitoring System (RMS) effluent monitor readings are used, when available, to account for increases and decreases in noble gas concentrations between noble gas grab samples. The tritium concentration is assumed constant between sampling periods.

For batch releases, sampling is also in accordance with PVNGS ODCM Table 3-1. For containment purges, the noble gas concentration may be adjusted to account for decreases or increases in concentration during the purge using RMS readings. The volume of air released during the purge is determined using the exhaust fan rated flow rate. For Waste Gas Decay Tank releases, the volume released is corrected to standard pressure.

Effective January 1, 2004, Containment Purge release permits are updated by removing the permit pre-release particulate and iodine activity. This eliminates double accounting for the Containment Purge particulate and iodine activity at the Plant Vent but allows the particulate and iodine activity to be included in the Containment Purge pre-release dose projection.

The Lower Limit of Detection (LLD) of a measurement system is defined in Table 3 - 1 of the PVNGS ODCM. An average LLD for each radionuclide is provided in Table 3.

## **5.0 BATCH RELEASES**

### 5.1 Gaseous

Batch release durations are presented in Table 2.

### 5.2 Liquid

None.

## **6.0 ABNORMAL RELEASES**

None.

## **7.0 OFFSITE DOSE CALCULATION MANUAL AND PROCESS CONTROL PROGRAM (PCP) REVISIONS**

7.1 There were no revisions to the Offsite Dose Calculation Manual (ODCM) in 2021.

7.2 There were no revisions to the Process Control Program (PCP) in 2021.

## **8.0 EFFLUENTS AND SOLID WASTES**

### 8.1 Gaseous Effluents

8.1.1 Gaseous effluent information is presented in Table 1 through Table 41. Included in these tables are summaries of the effluents and estimated total error.

### 8.2 Liquid Effluents

8.2.1 There were no liquid effluent releases beyond the site boundary from PVNGS.

### 8.3 Solid Waste

8.3.1 Solid Waste Shipments are summarized in Appendix A.

## **9.0 MISCELLANEOUS INFORMATION**

### 9.1 EVAPORATION PONDS

Releases made to the Evaporation Ponds are limited to the concentrations specified in PVNGS ODCM Requirement 3.2. The Evaporation Ponds were monitored in accordance with PVNGS ODCM Requirement 6.1.

The historical average evaporation rate is approximately 12 inches per pond for the first and fourth quarters, and 33 inches per pond for the second and third quarters. Evaporation Pond One is approximately 261 acres which is divided into three segments: Pond 1A (131 acres), Pond 1B (77.5 acres) and Pond 1C (52.5 acres). This equates to an evaporation rate from Pond One of  $3.22E+11$  cc for the first and fourth quarters, and  $8.85E+11$  cc evaporated for the second and third quarters. Evaporation Pond Two is approximately 232 acres which is divided into three segments: Pond 2A (117 acres), Pond 2B (87 acres) and Pond 2C (30 acres). Pond 2C is utilized as a sludge pond and water level is maintained

to ensure adequate dust control. Pond 2C is not a mandatory sampling location; however, sampling is occasionally conducted for informational purposes. Evaporation rates for Pond 2C are conservative because the water distribution and depth are assumed to include the entire pond. The evaporation rate from Pond Two is 2.89E+11 cc for the first and fourth quarters, and 7.97E+11 cc for the second and third quarters.

Evaporation Pond Three is constructed of two smaller ponds of 90 acres each (3A and 3B). The evaporation rate from Pond Three is 2.20E+11 cc for the first and fourth quarters, and 6.04E+11 cc for the second and third quarters.

Using a site boundary X/Q of 5.0E-05 sec/m<sup>3</sup> for the evaporation ponds and equation 4-3 from the ODCM, the dose from the evaporation ponds to a hypothetical individual at the site boundary, for all pathways, is summarized in Table 1.

## 9.2 RADIATION MONITORING SYSTEM SETPOINT VERIFICATION

Current effluent monitor noble gas channel alert alarm set points are based on an assumed one percent failed fuel source term. The current method used for the set point values are more reliable than basing the set points upon the constantly varying values of the actual noble gas source term presented in Table 38.

## 9.3 RCS RADIOIODINE (TRM T5.0.600)

There were no cases where primary coolant specific activity exceeded the Technical Specification 3.4.17 limits during the reporting period.

## 9.4 INDEPENDENT SPENT FUEL STORAGE INSTALLATION (ISFSI)

There are no radioactive effluents from the NAC-UMS and NAC-MAGNASTOR Systems. Direct dose at the Site Boundary is reported in the Annual Radiological Environmental Operating Report.

## 9.5 MAJOR CHANGES TO THE RADIOACTIVE WASTE SYSTEMS (liquid, gaseous, and solid).

None.

## 9.6 NEI 07-07, Industry Groundwater Protection Initiative

Sample results from the groundwater wells that are not described in the ODCM as part of the REMP (NEI 07-07, Industry Groundwater Protection Initiative, August 2007), are included in Appendix C. This initiative provides added assurance that ground water will not be adversely affected by PVNGS operations.

There were no NEI 07-07 reportable leaks or spills. There were no positive sample results, and all samples results were below the Lower Limit of Detection.

## 9.7 REPORT ADDENDUM

None.

## 10.0 METEOROLOGICAL DATA

The data recovery for the reporting period was 99.5 percent. The predominant wind direction was from the southwest approximately 15.5 percent of the time. The predominant stability class was stability class "G" approximately 23.1 percent of the time. Average wind speed during the reporting period was approximately 6.6 miles per hour at the 35-foot elevation.

The annual meteorological data (Hourly Average Data or Joint Frequency Distribution) will be maintained on site in a file that shall be provided to the NRC upon request.

## 11.0 DISCUSSION

### 11.1 Unit One

Unit One operated without a refueling outage.

Maintenance outages:

None.

Estimated number of fuel defects <sup>1</sup>											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	0	0	0	0	0	0	0	0

### 11.2 Unit Two

Unit Two operated with a refueling outage (2R23) from October 9, 2021, to November 11, 2021.

Maintenance outages:

Unit 2 had two maintenance outages during 2021:

- 2M23A from February 26, 2021, to March 1, 2021
- 2M23B from May 19, 2021, to May 22, 2021.

Estimated number of fuel defects											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	0	0	0	0	0	0	0	0

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<sup>1</sup> Source: Institute of Nuclear Power (INPO), Consolidated Data Entry (CDE)



### 11.3 Unit Three

Unit Three operated with a refueling outage (3R22) from April 10, 2021, to May 18, 2021.

Maintenance outages:

Unit 3 had one maintenance outage (3M23A) from December 6, 2021, to December 9, 2021.

Estimated number of fuel defects											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0	0	0	0	0	0	0	0	0	0	0

### 11.4 Carbon-14

Carbon-14 is formed naturally in the upper atmosphere, and it is also formed in operating nuclear reactors.

Carbon-14 is not a new power plant effluent. The overall quantity of radioactive releases has steadily decreased due to improvements in power plant operations. Based on the decline in other radionuclides released, carbon-14 has the potential to achieve the status of a principal radionuclide as defined in Regulatory Guide 1.21.

The dose received by a member of the public from carbon-14 from nuclear power plant effluents is much lower than regulatory limits, and has been a very small contributor to the total radiation dose received each year from natural and manmade sources. Studies by the United Nations Scientific Committee on the Effects of Atomic Radiation, the National Research Council report on the Biological Effects of Ionizing Radiation (BEIR VII), and the National Council on Radiation Protection and Measurements all show that the risk associated with low-dose radiation from natural and man-made sources, including nuclear power plants, is negligible.

The average member of the public in the United States is exposed to 620 mrem every year, of which approximately 311 mrem of this comes from natural sources. The majority of the remaining dose (approximately 300 mrem) comes from medical procedures (such as, x-Rays, CAT scans, etc.). Less than one-tenth of a percent of all non-occupational radiation exposure is from nuclear facilities.<sup>2</sup>

The PVNGS calculated carbon-14 production rate is 18.5 curies per operating cycle (500 days) or 13.5 curies per year. The production rate of 13.5 curies will be divided equally between each quarter, 3.38 curies per reactor, and the estimated carbon-14 activity is included in the inhalation and ingestion dose calculations.

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<sup>2</sup> Source: NCRP Report No. 160, Table 1.1

## 11.5 Tritium

PVNGS does not have a liquid release pathway. Removal of tritium is performed by operation of the Boric Acid Concentrator (BAC) in the release mode. Comparison of PVNGS annual tritium curies released to other utilities should be made only after summing both liquid and gaseous tritium curies released.

## 11.6 Dose Summary

Dose for 2021 was primarily due to the release of tritium. The calculated tritium production rate for each PVNGS reactor is estimated to be approximately 1150 curies per year; however, a large fraction of the tritium produced does not become part of the reactor coolant source term. The tritium produced in the coolant contributes immediately to the overall tritium source term, but the tritium produced by fission and neutron capture in the Control Element Assemblies (CEAs) and borated shim rods only contributes to the reactor coolant source term if it is released through the cladding. To control in-plant tritium concentrations, tritium releases account for tritium production that enters the reactor coolant. For 2021, the total tritium released from PVNGS was 2.58E+03 curies (see Table 39).

## APPENDIX A: EFFLUENT AND WASTE DISPOSAL REPORTS

<b>Table 1: Evaporation Pond Data</b>					
Evaporation Pond 1(1A, 1B, 1C)	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Historical Evaporation (ml)	3.22E+11	8.85E+11	8.85E+11	3.22E+11	1.95E+00
Tritium Concentration ( $\mu\text{Ci/cc}$ )	7.63E-07	7.98E-07	7.98E-07	9.15E-07	
Tritium Curies	2.46E-01	7.06E-01	7.06E-01	2.94E-01	
Evaporation Pond 2 (2A and 2B)	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Historical Evaporation (ml)	2.89E+11	7.94E+11	7.94E+11	2.89E+11	1.55E+00
Tritium Concentration ( $\mu\text{Ci/cc}$ )	6.24E-07	8.76E-07	6.15E-07	6.52E-07	
Tritium Curies	1.80E-01	6.95E-01	4.88E-01	1.88E-01	
Evaporation Pond 3 (3A <sup>(1)</sup> and 3B)	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Historical Evaporation (ml)	1.10E+11	3.02E+11	3.02E+11	1.10E+11	4.76E-01
Tritium Concentration ( $\mu\text{Ci/cc}$ )	5.37E-07	5.37E-07	5.37E-07	8.46E-07	
Tritium Curies	5.90E-02	1.62E-01	1.62E-01	9.29E-02	
Dose (mrem)	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Pond 1	3.41E-03	9.79E-03	9.79E-03	4.08E-03	2.71E-02
Pond 2	2.50E-03	9.64E-03	6.77E-03	2.61E-03	2.15E-02
Pond 3	8.18E-04	2.25E-03	2.25E-03	1.29E-03	6.60E-03
Total	6.72E-03	2.17E-02	1.88E-02	7.98E-03	5.52E-02

(1): Releases from Evaporation Pond 3A were excluded because the pond has no detectable tritium, no plant related influent, and is considered empty.

<b>Table 2: Batch Release Data</b>			
All times are in hours	Unit 1	Unit 2	Unit 3
January - June			
Number of batch releases	17	21	43
Total time period for batch releases	127.95	365.04	1680.685
Maximum time period for a batch release	81.60	122.82	168.00
Average time period for a batch release	7.53	17.38	39.09
Minimum time period for a batch release	0.11	0.03	0.44
July - December			
Number of batch releases	16	36	24
Total time period for batch releases	320.67	1246.51	320.74
Maximum time period for a batch release	162.40	168.00	150.00
Average time period for a batch release	20.04	34.63	13.36
Minimum time period for a batch release	0.53	0.12	0.65
January - December			
Number of batch releases	33	57	67
Total time period for batch releases	448.62	1611.55	2001.43
Maximum time period for a batch release	162.40	168.00	168.00
Average time period for a batch release	13.59	28.27	29.87
Minimum time period for a batch release	0.11	0.03	0.44

**Table 3:  
Units 1, 2, and 3  
Gaseous Effluents Average Lower Limit of Detection (μCi/cc)**

Nuclide	Continuous	Batch	Nuclide	Continuous	Batch
Antimony-122	2.20E-13	1.90E-11	Argon-41	4.50E-08	4.50E-08
Antimony-124	8.40E-14	1.70E-11	Krypton-85	7.40E-06	7.40E-06
Barium-140	3.40E-13	5.70E-11	Krypton-85m	2.20E-08	2.20E-08
Bromine-82	3.30E-13	1.40E-11	Krypton-87	5.70E-08	5.70E-08
Cerium-141	8.70E-14	3.10E-11	Krypton-88	7.40E-08	7.40E-08
Cerium-144	3.60E-13	6.50E-11	Xenon-125	2.20E-08	2.20E-08
Cesium-134	1.00E-13	2.60E-11	Xenon-127	2.10E-08	2.10E-08
Cesium-137	8.10E-14	1.70E-11	Xenon-131m	9.10E-07	9.10E-07
Cesium-138	5.20E-10	7.30E-10	Xenon-133	6.30E-08	6.30E-08
Chromium-51	6.90E-13	1.40E-10	Xenon-133m	1.90E-07	1.90E-07
Cobalt-58	8.50E-14	1.70E-11	Xenon-135	2.00E-08	2.00E-08
Cobalt-60	1.00E-13	1.90E-11	Xenon-135m	8.90E-08	8.90E-08
Iron-59	1.70E-13	3.20E-11	Xenon-138	2.00E-07	2.00E-07
Lanthanum-140	2.80E-13	2.10E-11	Iodine-131	8.00E-14	7.00E-12
Manganese-54	8.30E-14	1.70E-11	Iodine-132	6.60E-12	1.90E-11
Molybdenum-99	2.40E-13	2.80E-11	Iodine-133	4.70E-13	1.10E-11
Niobium-95	8.70E-14	1.80E-11	Iodine-134	5.90E-11	8.20E-11
Rubidium-88	1.90E-08	1.90E-08	Iodine-135	7.00E-12	5.50E-11
Ruthenium-103	7.40E-14	1.50E-11			
Strontium-89	2.15E-15	(1)			
Strontium-90	5.60E-16	(1)			
Tellurium-123m	6.60E-14	1.50E-11			
Tritium	3.80E-07	3.80E-07			
Zinc-65	1.90E-13	3.80E-11			
Zirconium-95	1.80E-13	4.10E-11			
Gross Alpha	3.60E-15	(1)			
(1) Not required for batch releases.					

Table 4: Unit 1 Gaseous Effluents (Summation Of All Releases)							Est. Total Error (%) <sup>(1)</sup>
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	
<b>A. Fission &amp; activation gases</b>							
1. Total release	Ci	2.89E-02	3.01E-02	1.88E-02	2.62E-02	1.04E-01	3.54E+01
2. Average release rate for period	µCi/sec	3.72E-03	3.83E-03	2.36E-03	3.30E-03	3.30E-03	
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	
<b>B. Iodine 131</b>							
1. Total Iodine 131	Ci	2.15E-06	<LLD	<LLD	<LLD	2.15E-06	3.32E+01
2. Average release rate for period	µCi/sec	2.77E-07	<LLD	<LLD	<LLD	6.83E-08	
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	
<b>C. Particulates</b>							
1. Particulates with half- lives > 8 days	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	3.43E+01
2. Average release rate for period	µCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD	
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	
4. Gross Alpha radioactivity	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	
<b>D. Tritium</b>							
1. Total release	Ci	4.70E+01	6.49E+01	2.11E+02	1.61E+02	4.84E+02	3.85E+01
2. Average release rate for period	µCi/sec	6.05E+00	8.26E+00	2.66E+01	2.02E+01	1.54E+01	
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	
(1) Estimated total error methodology is presented in Table 40.							
(2) See Table 11 for percent of ODCM Requirement limits.							

Table 5: Unit 1 Gaseous Effluents - Ground Level Releases - Continuous - Fission Gases and Iodines						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
<b>2. Iodines</b>						
I-131	Ci	2.15E-06	<LLD	<LLD	<LLD	2.15E-06
I-132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	2.15E-06	<LLD	<LLD	<LLD	2.15E-06



Table 6: Unit 1 Gaseous Effluents - Ground Level Releases - Continuous - Particulates						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-60	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Os-191	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
<b>4. Tritium</b>						
H-3	Ci	3.83E+01	3.11E+01	3.08E+01	2.26E+01	1.23E+02

Table 7: Unit 1 Gaseous Effluents - Ground Level Releases- Batch - Fission Gases and Iodines						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	2.89E-02	3.00E-02	1.87E-02	2.62E-02	1.04E-01
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	1.43E-04	1.05E-04	<LLD	2.48E-04
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	2.89E-02	3.01E-02	1.88E-02	2.62E-02	1.04E-01
<b>2. Iodines</b>						
I-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	<LLD	<LLD

Table 8: Unit 1 Gaseous Effluents - Ground Level Releases - Batch - Particulates						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-60	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Os-191	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	Note 1	Note 1	Note 1	Note 1	Note 1
Sr-90	Ci	Note 1	Note 1	Note 1	Note 1	Note 1
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
<b>4. Tritium</b>						
H-3	Ci	8.72E+00	3.39E+01	1.81E+02	1.38E+02	3.61E+02
Note 1 - Not required for batch releases						

Table 9: Unit 1 Gaseous Effluents - Continuous and Batch - Fission Gases and Iodines						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	2.89E-02	3.00E-02	1.87E-02	2.62E-02	1.04E-01
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	1.43E-04	1.05E-04	<LLD	2.48E-04
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	2.89E-02	3.01E-02	1.88E-02	2.62E-02	1.04E-01
<b>2. Iodines</b>						
I-131	Ci	2.15E-06	<LLD	<LLD	<LLD	2.15E-06
I-132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	2.15E-06	<LLD	<LLD	<LLD	2.15E-06

<b>Table 10: Unit 1 Gaseous Effluents - Continuous and Batch - Particulates</b>						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-60	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Os-191	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total > 8 days	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
<b>4. Tritium</b>						
H-3	Ci	4.70E+01	6.49E+01	2.11E+02	1.61E+02	4.84E+02

<b>Table 11:</b> <b>Unit 1</b> <b>Radiation Doses At And Beyond The Site Boundary</b>						
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Gamma Air Dose	mrad	6.37E-05	6.61E-05	4.11E-05	5.77E-05	2.29E-04
ODCM Req. 4.1 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% ODCM Limit	%	1.27E-03	1.32E-03	8.23E-04	1.15E-03	2.29E-03
Beta Air Dose	mrad	2.25E-05	2.34E-05	1.45E-05	2.04E-05	8.07E-05
ODCM Req. 4.1 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% ODCM Limit	%	2.25E-04	2.34E-04	1.45E-04	2.04E-04	4.04E-04
Maximum Organ Dose (excluding skin)	mrem	2.87E-02	2.87E-02	6.77E-02	5.24E-02	1.62E-01
Age		Child	Child	Teen	Teen	Teen
Organ		Bone	Bone	T. Body	T. Body	Thyroid
ODCM Req. 4.2 Limit	mrem	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
% ODCM Limit	%	3.83E-01	3.83E-01	9.02E-01	6.99E-01	1.08E+00

Calculations are based on parameters and methodologies of the ODCM using historical meteorology. Dose is calculated to a hypothetical individual. In contrast, Appendix C dose calculations are based on concurrent meteorology, a real individual, and only the actual pathways present.

Table 12: Unit 2 Gaseous Effluents - Summation Of All Releases							
Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Est. Total Error (%) <sup>(1)</sup>	
<b>A. Fission &amp; activation gases</b>							
1. Total release	Ci	3.95E-02	5.20E-02	1.09E-01	1.09E+00	1.29E+00	3.54E+01
2. Average release rate for period	µCi/sec	5.08E-03	6.61E-03	1.37E-02	1.37E-01	4.08E-02	
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	
<b>B. Iodine 131</b>							
1. Total Iodine 131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	3.32E+01
2. Average release rate for period	µCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD	
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	
<b>C. Particulates</b>							
1. Particulates with half-lives > 8 days	Ci	6.78E-06	1.82E-05	<LLD	1.33E-04	1.58E-04	3.43E+01
2. Average release rate for period	µCi/sec	8.71E-07	2.31E-06	<LLD	1.67E-05	5.00E-06	
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	
4. Gross Alpha radioactivity	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	
<b>D. Tritium</b>							
1. Total release	Ci	4.74E+01	4.84E+02	4.47E+02	1.17E+02	1.10E+03	3.85E+01
2. Average release rate for period	µCi/sec	6.10E+00	6.16E+01	5.63E+01	1.47E+01	3.48E+01	
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	
(1) Estimated total error methodology is presented in Table 40.							
(2) See Table 19 for percent of ODCM Requirement limits.							



Table 13: Unit 2 Gaseous Effluents - Ground Level Releases - Continuous - Fission Gases and Iodines						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	<LLD	<LLD	4.01E-01	4.01E-01
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	4.01E-01	4.01E-01
<b>2. Iodines</b>						
I-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-132	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	<LLD	<LLD

Table 14: Unit 2 Gaseous Effluents - Ground Level Releases - Continuous - Particulates						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	1.57E-05	1.57E-05
Co-60	Ci	6.78E-06	1.82E-05	<LLD	1.32E-05	3.82E-05
Cr-51	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	1.58E-06	1.58E-06
Os-191	Ci	<LLD	<LLD	<LLD	1.44E-06	1.44E-06
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	6.78E-06	1.82E-05	<LLD	3.19E-05	5.69E-05
<b>4. Tritium</b>						
H-3	Ci	4.74E+01	2.45E+01	2.80E+01	2.57E+01	1.26E+02

<b>Table 15: Unit 2 Gaseous Effluents - Ground Level Releases - Batch - Fission Gases and Iodines</b>						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	3.72E-02	4.88E-02	1.02E-01	3.00E-02	2.18E-01
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	2.17E-03	3.16E-03	6.27E-03	6.54E-01	6.66E-01
Xe-133m	Ci	<LLD	<LLD	<LLD	4.54E-04	4.54E-04
Xe-135	Ci	<LLD	<LLD	1.15E-04	<LLD	1.15E-04
Xe-135m	Ci	1.54E-04	<LLD	<LLD	<LLD	1.54E-04
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	3.95E-02	5.20E-02	1.09E-01	6.84E-01	8.84E-01
<b>2. Iodines</b>						
I-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-132	Ci	<LLD	<LLD	<LLD	1.47E-05	1.47E-05
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	1.47E-05	1.47E-05

Table 16: Unit 2 Gaseous Effluents - Ground Level Releases - Batch - Particulates						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	4.69E-06	4.69E-06
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	2.58E-05	2.58E-05
Co-60	Ci	<LLD	<LLD	<LLD	2.11E-05	2.11E-05
Cr-51	Ci	<LLD	<LLD	<LLD	2.25E-05	2.25E-05
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	2.66E-07	2.66E-07
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	1.93E-05	1.93E-05
Os-191	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	Note 1	Note 1	Note 1	Note 1	Note 1
Sr-90	Ci	Note 1	Note 1	Note 1	Note 1	Note 1
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	1.20E-05	1.20E-05
Total	Ci	<LLD	<LLD	<LLD	1.06E-04	1.06E-04
<b>4. Tritium</b>						
H-3	Ci	4.79E-03	4.60E+02	4.19E+02	9.15E+01	9.71E+02
Note 1 - Not required for batch releases						

Table 17: Unit 2 Gaseous Effluents - Continuous and Batch - Fission Gases and Iodines						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	3.72E-02	4.88E-02	1.02E-01	3.00E-02	2.18E-01
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	2.17E-03	3.16E-03	6.27E-03	1.06E+00	1.07E+00
Xe-133m	Ci	<LLD	<LLD	<LLD	4.54E-04	4.54E-04
Xe-135	Ci	<LLD	<LLD	1.15E-04	<LLD	1.15E-04
Xe-135m	Ci	1.54E-04	<LLD	<LLD	<LLD	1.54E-04
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	3.95E-02	5.20E-02	1.09E-01	1.09E+00	1.29E+00
<b>2. Iodines</b>						
I-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-132	Ci	<LLD	<LLD	<LLD	1.47E-05	1.47E-05
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	1.47E-05	1.47E-05

Table 18: Unit 2 Gaseous Effluents - Continuous and Batch -Particulates						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	4.69E-06	4.69E-06
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	<LLD	<LLD	4.15E-05	4.15E-05
Co-60	Ci	6.78E-06	1.82E-05	<LLD	3.43E-05	5.93E-05
Cr-51	Ci	<LLD	<LLD	<LLD	2.25E-05	2.25E-05
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	<LLD	2.66E-07	2.66E-07
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	<LLD	<LLD	2.09E-05	2.09E-05
Os-191	Ci	<LLD	<LLD	<LLD	1.44E-06	1.44E-06
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	<LLD	1.20E-05	1.20E-05
Total	Ci	6.78E-06	1.82E-05	<LLD	1.38E-04	1.63E-04
Total > 8 days	Ci	6.78E-06	1.82E-05	<LLD	1.33E-04	1.58E-04
<b>4. Tritium</b>						
H-3	Ci	4.74E+01	4.84E+02	4.47E+02	1.17E+02	1.10E+03

**Table 19:  
Unit 2  
Radiation Doses At And Beyond The Site Boundary**

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Gamma Air Dose	mrad	8.68E-05	1.14E-04	2.39E-04	1.56E-04	5.96E-04
ODCM Req. 4.1 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% ODCM Limit	%	1.74E-03	2.28E-03	4.78E-03	3.12E-03	5.96E-03
Beta Air Dose	mrad	3.14E-05	4.13E-05	8.63E-05	4.16E-04	5.75E-04
ODCM Req. 4.1 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% ODCM Limit	%	3.14E-04	4.13E-04	8.63E-04	4.16E-03	2.87E-03
Maximum Organ Dose (excluding skin)	mrem	3.04E-02	1.59E-01	1.47E-01	4.16E-02	3.66E-01
Age		Child	Teen	Teen	Teen	Teen
Organ		Bone	Lung	T. Body	Lung	Lung
ODCM Req. 4.2 Limit	%	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
% ODCM Limit	%	4.05E-01	2.12E+00	1.96E+00	5.55E-01	2.44E+00

Calculations are based on parameters and methodologies of the ODCM using historical meteorology. Dose is calculated to a hypothetical individual. In contrast, Appendix C dose calculations are based on concurrent meteorology, a real individual, and only the actual pathways present.



Table 20: Unit 3 Gaseous Effluents - Summation Of All Releases						
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>A. Fission &amp; activation gases</b>						
1. Total release	Ci	1.13E+00	5.76E-01	6.78E-02	8.80E-02	1.86E+00
2. Average release rate for period	µCi/sec	1.46E-01	7.32E-02	8.54E-03	1.11E-02	5.91E-02
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
<b>B. Iodine 131</b>						
1. Total Iodine 131	Ci	<LLD	7.14E-06	<LLD	<LLD	7.14E-06
2. Average release rate for period	µCi/sec	<LLD	9.08E-07	<LLD	<LLD	2.26E-07
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
<b>C. Particulates</b>						
1. Particulates with half- lives > 8 days	Ci	<LLD	5.02E-03	<LLD	<LLD	5.02E-03
2. Average release rate for period	µCi/sec	<LLD	6.38E-04	<LLD	<LLD	1.59E-04
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
4. Gross Alpha radioactivity	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
<b>D. Tritium</b>						
1. Total release	Ci	3.90E+02	3.81E+02	4.00E+01	1.92E+02	1.00E+03
2. Average release rate for period	µCi/sec	5.01E+01	4.85E+01	5.04E+00	2.41E+01	3.18E+01
3. Percent of ODCM Requirement limit	%	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>	NA <sup>(2)</sup>
(1) Estimated total error methodology is presented in Table 40.						
(2) See Table 27 for percent of ODCM Requirement limits.						

<b>Table 21: Unit 3 Gaseous Effluents - Ground Level Releases - Continuous - Fission Gases and Iodines</b>						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
<b>2. Iodines</b>						
I-131	Ci	<LLD	7.14E-06	<LLD	<LLD	7.14E-06
I-132	Ci	<LLD	1.77E-04	<LLD	<LLD	1.77E-04
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	1.84E-04	<LLD	<LLD	1.84E-04

Table 22: Unit 3 Gaseous Effluents - Ground Level Releases - Continuous - Particulates						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	1.32E-06	<LLD	<LLD	1.32E-06
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	3.31E-04	<LLD	<LLD	3.31E-04
Co-60	Ci	<LLD	1.84E-04	<LLD	<LLD	1.84E-04
Cr-51	Ci	<LLD	1.02E-03	<LLD	<LLD	1.02E-03
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	2.06E-05	<LLD	<LLD	2.06E-05
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	2.72E-05	<LLD	<LLD	2.72E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	2.41E-04	<LLD	<LLD	2.41E-04
Os-191	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	4.44E-06	<LLD	<LLD	4.44E-06
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	1.64E-04	<LLD	<LLD	1.64E-04
Total	Ci	<LLD	2.00E-03	<LLD	<LLD	2.00E-03
<b>4. Tritium</b>						
H-3	Ci	2.11E+01	3.73E+01	4.00E+01	2.41E+01	1.22E+02

<b>Table 23: Unit 3 Gaseous Effluents - Ground Level Releases - Batch - Fission Gases and Iodines</b>						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year Total
<b>1. Fission gases</b>						
Ar-41	Ci	1.08E+00	8.23E-02	6.52E-02	8.38E-02	1.31E+00
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	5.92E-04	<LLD	<LLD	5.92E-04
Xe-133	Ci	5.47E-02	4.92E-01	2.69E-03	4.13E-03	5.54E-01
Xe-133m	Ci	<LLD	3.10E-04	<LLD	<LLD	3.10E-04
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	1.13E+00	5.76E-01	6.78E-02	8.80E-02	1.86E+00
<b>2. Iodines</b>						
I-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-132	Ci	<LLD	2.14E-06	<LLD	<LLD	2.14E-06
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	2.14E-06	<LLD	<LLD	2.14E-06

Table 24: Unit 3 Gaseous Effluents - Ground Level Releases - Batch - Particulates						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	3.80E-06	<LLD	<LLD	3.80E-06
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	5.17E-04	<LLD	<LLD	5.17E-04
Co-60	Ci	<LLD	1.95E-04	<LLD	<LLD	1.95E-04
Cr-51	Ci	<LLD	7.97E-04	<LLD	<LLD	7.97E-04
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	5.75E-05	<LLD	<LLD	5.75E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	8.20E-04	<LLD	<LLD	8.20E-04
Os-191	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	Note 1	Note 1	Note 1	Note 1	Note 1
Sr-90	Ci	Note 1	Note 1	Note 1	Note 1	Note 1
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	6.32E-04	<LLD	<LLD	6.32E-04
Total	Ci	<LLD	3.02E-03	<LLD	<LLD	3.02E-03
<b>4. Tritium</b>						
H-3	Ci	3.69E+02	3.44E+02	1.46E-02	1.68E+02	8.80E+02
Note 1 - Not required for batch releases						

<b>Table 25: Unit 3 Gaseous Effluents - Continuous and Batch - Fission Gases and Iodines</b>						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	1.08E+00	8.23E-02	6.52E-02	8.38E-02	1.31E+00
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	5.92E-04	<LLD	<LLD	5.92E-04
Xe-133	Ci	5.47E-02	4.92E-01	2.69E-03	4.13E-03	5.54E-01
Xe-133m	Ci	<LLD	3.10E-04	<LLD	<LLD	3.10E-04
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	1.13E+00	5.76E-01	6.78E-02	8.80E-02	1.86E+00
<b>2. Iodines</b>						
I-131	Ci	<LLD	7.14E-06	<LLD	<LLD	7.14E-06
I-132	Ci	<LLD	1.79E-04	<LLD	<LLD	1.79E-04
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	1.86E-04	<LLD	<LLD	1.86E-04

Table 26: Unit 3 Gaseous Effluents - Continuous and Batch -Particulates						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	1.32E-06	<LLD	<LLD	1.32E-06
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	3.80E-06	<LLD	<LLD	3.80E-06
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	8.49E-04	<LLD	<LLD	8.49E-04
Co-60	Ci	<LLD	3.79E-04	<LLD	<LLD	3.79E-04
Cr-51	Ci	<LLD	1.82E-03	<LLD	<LLD	1.82E-03
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	2.06E-05	<LLD	<LLD	2.06E-05
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	8.47E-05	<LLD	<LLD	8.47E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	1.06E-03	<LLD	<LLD	1.06E-03
Os-191	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	4.44E-06	<LLD	<LLD	4.44E-06
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	7.97E-04	<LLD	<LLD	7.97E-04
Total	Ci	<LLD	5.02E-03	<LLD	<LLD	5.02E-03
Total > 8 days	Ci	<LLD	5.02E-03	<LLD	<LLD	5.02E-03
<b>4. Tritium</b>						
H-3	Ci	3.90E+02	3.81E+02	4.00E+01	1.92E+02	1.00E+03

<b>Table 27: Unit 3 Radiation Doses At And Beyond The Site Boundary</b>						
	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Gamma Air Dose	mrad	2.84E-03	2.62E-04	1.71E-04	2.21E-04	3.49E-03
ODCM Req. 4.1 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% ODCM Limit	%	5.68E-02	5.24E-03	3.43E-03	4.41E-03	3.49E-02
Beta Air Dose	mrad	1.02E-03	2.82E-04	6.15E-05	7.94E-05	1.45E-03
ODCM Req. 4.1 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% ODCM Limit	%	1.02E-02	2.82E-03	6.15E-04	7.94E-04	7.23E-03
Maximum Organ Dose (excluding skin)	mrem	1.45E-01	1.44E-01	3.43E-02	7.36E-02	3.81E-01
Age		Teen	Teen	Child	Teen	Teen
Organ		T. Body	Lung	Bone	T. Body	Lung
ODCM Req. 4.2 Limit	mrem	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
% ODCM Limit	%	1.93E+00	1.92E+00	4.57E-01	9.81E-01	2.54E+00

Calculations are based on parameters and methodologies of the ODCM using historical meteorology. Dose is calculated to a hypothetical individual. In contrast, Appendix C dose calculations are based on concurrent meteorology, a real individual, and only the actual pathways present.



Table 28: Units 1, 2 and 3 Gaseous Effluents - Continuous - Fission Gases and Iodines - Total By Quarter						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	<LLD	<LLD	4.01E-01	4.01E-01
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	4.01E-01	4.01E-01
<b>2. Iodines</b>						
I-131	Ci	2.15E-06	7.14E-06	<LLD	<LLD	9.29E-06
I-132	Ci	<LLD	1.77E-04	<LLD	<LLD	1.77E-04
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	2.15E-06	1.84E-04	<LLD	<LLD	1.86E-04

**Table 29:  
Units 1, 2 and 3  
Gaseous Effluents - Continuous - Particulates - Total By Quarter**

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	1.32E-06	<LLD	<LLD	1.32E-06
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	3.31E-04	<LLD	1.57E-05	3.47E-04
Co-60	Ci	6.78E-06	2.02E-04	<LLD	1.32E-05	2.22E-04
Cr-51	Ci	<LLD	1.02E-03	<LLD	<LLD	1.02E-03
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	2.06E-05	<LLD	<LLD	2.06E-05
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	2.72E-05	<LLD	<LLD	2.72E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	2.41E-04	<LLD	1.58E-06	2.43E-04
Os-191	Ci	<LLD	<LLD	<LLD	1.44E-06	1.44E-06
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	4.44E-06	<LLD	<LLD	4.44E-06
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	1.64E-04	<LLD	<LLD	1.64E-04
Total	Ci	6.78E-06	2.02E-03	<LLD	3.19E-05	2.06E-03
<b>4. Tritium</b>						
H-3	Ci	1.07E+02	9.28E+01	9.88E+01	7.25E+01	3.71E+02

**Table 30:  
Units 1, 2 and 3  
Gaseous Effluents - Batch - Fission Gases and Iodines - Total By Quarter**

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	1.14E+00	1.61E-01	1.86E-01	1.40E-01	1.63E+00
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	5.92E-04	<LLD	<LLD	5.92E-04
Xe-133	Ci	5.68E-02	4.96E-01	9.06E-03	6.58E-01	1.22E+00
Xe-133m	Ci	<LLD	3.10E-04	<LLD	4.54E-04	7.64E-04
Xe-135	Ci	<LLD	<LLD	1.15E-04	<LLD	1.15E-04
Xe-135m	Ci	1.54E-04	<LLD	<LLD	<LLD	1.54E-04
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	1.20E+00	6.58E-01	1.95E-01	7.99E-01	2.85E+00
<b>2. Iodines</b>						
I-131	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-132	Ci	<LLD	2.14E-06	<LLD	1.47E-05	1.68E-05
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	2.14E-06	<LLD	1.47E-05	1.68E-05

**Table 31:  
Units 1, 2 and 3  
Gaseous Effluents - Batch - Particulates - Total By Quarter**

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	3.80E-06	<LLD	4.69E-06	8.49E-06
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	5.17E-04	<LLD	2.58E-05	5.43E-04
Co-60	Ci	<LLD	1.95E-04	<LLD	2.11E-05	2.16E-04
Cr-51	Ci	<LLD	7.97E-04	<LLD	2.25E-05	8.20E-04
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	5.75E-05	<LLD	2.66E-07	5.77E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	8.20E-04	<LLD	1.93E-05	8.39E-04
Os-191	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	Note 1	Note 1	Note 1	Note 1	Note 1
Sr-90	Ci	Note 1	Note 1	Note 1	Note 1	Note 1
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	6.32E-04	<LLD	1.20E-05	6.44E-04
Total	Ci	<LLD	3.02E-03	<LLD	1.06E-04	3.13E-03
<b>4. Tritium</b>						
H-3	Ci	3.77E+02	8.37E+02	6.00E+02	3.97E+02	2.21E+03

<b>Table 32: Units 1, 2 and 3 Gaseous Effluents - Continuous and Batch - Fission Gases and Iodines - Total By Quarter</b>						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>1. Fission gases</b>						
Ar-41	Ci	1.14E+00	1.61E-01	1.86E-01	1.40E-01	1.63E+00
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	5.92E-04	<LLD	<LLD	5.92E-04
Xe-133	Ci	5.68E-02	4.96E-01	9.06E-03	1.06E+00	1.62E+00
Xe-133m	Ci	<LLD	3.10E-04	<LLD	4.54E-04	7.64E-04
Xe-135	Ci	<LLD	<LLD	1.15E-04	<LLD	1.15E-04
Xe-135m	Ci	1.54E-04	<LLD	<LLD	<LLD	1.54E-04
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	1.20E+00	6.58E-01	1.95E-01	1.20E+00	3.25E+00
<b>2. Iodines</b>						
I-131	Ci	2.15E-06	7.14E-06	<LLD	<LLD	9.29E-06
I-132	Ci	<LLD	1.79E-04	<LLD	1.47E-05	1.94E-04
I-133	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	2.15E-06	1.86E-04	<LLD	1.47E-05	2.03E-04

<b>Table 33: Units 1, 2 and 3 Gaseous Effluents - Continuous and Batch - Particulates - Total By Quarter</b>						
Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
<b>3. Particulates</b>						
Ag-110m	Ci	<LLD	1.32E-06	<LLD	<LLD	1.32E-06
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	3.80E-06	<LLD	4.69E-06	8.49E-06
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	8.49E-04	<LLD	4.15E-05	8.90E-04
Co-60	Ci	6.78E-06	3.98E-04	<LLD	3.43E-05	4.39E-04
Cr-51	Ci	<LLD	1.82E-03	<LLD	2.25E-05	1.84E-03
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	2.06E-05	<LLD	<LLD	2.06E-05
La-140	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	8.47E-05	<LLD	2.66E-07	8.50E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	1.06E-03	<LLD	2.09E-05	1.08E-03
Os-191	Ci	<LLD	<LLD	<LLD	1.44E-06	1.44E-06
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	4.44E-06	<LLD	<LLD	4.44E-06
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	7.97E-04	<LLD	1.20E-05	8.09E-04
Total	Ci	6.78E-06	5.04E-03	<LLD	1.38E-04	5.18E-03
Total > 8 days	Ci	6.78E-06	5.04E-03	<LLD	1.33E-04	5.18E-03
<b>4. Tritium</b>						
H-3	Ci	4.84E+02	9.30E+02	6.99E+02	4.70E+02	2.58E+03

Table 34: Units 1, 2 and 3 Gaseous Effluents- Continuous - Fission Gases and Iodine-Total By Unit					
Nuclides Released	Unit	Unit 1	Unit 2	Unit 3	Total
<b>1. Fission gases</b>					
Ar-41	Ci	<LLD	<LLD	<LLD	<LLD
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	<LLD	<LLD
Xe-133	Ci	<LLD	4.01E-01	<LLD	4.01E-01
Xe-133m	Ci	<LLD	<LLD	<LLD	<LLD
Xe-135	Ci	<LLD	<LLD	<LLD	<LLD
Xe-135m	Ci	<LLD	<LLD	<LLD	<LLD
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	4.01E-01	<LLD	4.01E-01
<b>2. Iodines</b>					
I-131	Ci	2.15E-06	<LLD	7.14E-06	9.29E-06
I-132	Ci	<LLD	<LLD	1.77E-04	1.77E-04
I-133	Ci	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD
Total	Ci	2.15E-06	<LLD	1.84E-04	1.86E-04

**Table 35:  
Units 1, 2 and 3  
Gaseous Effluents- Continuous - Particulates - Total By Unit**

Nuclides Released	Unit	Unit 1	Unit 2	Unit 3	Total
<b>3. Particulates</b>					
Ag-110m	Ci	<LLD	<LLD	1.32E-06	1.32E-06
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	<LLD	<LLD	<LLD
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	1.57E-05	3.31E-04	3.47E-04
Co-60	Ci	<LLD	3.82E-05	1.84E-04	2.22E-04
Cr-51	Ci	<LLD	<LLD	1.02E-03	1.02E-03
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	2.06E-05	2.06E-05
La-140	Ci	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	<LLD	2.72E-05	2.72E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	1.58E-06	2.41E-04	2.43E-04
Os-191	Ci	<LLD	1.44E-06	<LLD	1.44E-06
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	4.44E-06	4.44E-06
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	<LLD	1.64E-04	1.64E-04
Total	Ci	<LLD	5.69E-05	2.00E-03	2.06E-03
<b>4. Tritium</b>					
H-3	Ci	1.23E+02	1.26E+02	1.22E+02	3.71E+02



**Table 36:  
Units 1, 2 and 3  
Gaseous Effluents- Batch - Fission Gases and Iodine - Total By Unit**

Nuclides Released	Unit	Unit 1	Unit 2	Unit 3	Total
<b>1. Fission gases</b>					
Ar-41	Ci	1.04E-01	2.18E-01	1.31E+00	1.63E+00
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	5.92E-04	5.92E-04
Xe-133	Ci	2.48E-04	6.66E-01	5.54E-01	1.22E+00
Xe-133m	Ci	<LLD	4.54E-04	3.10E-04	7.64E-04
Xe-135	Ci	<LLD	1.15E-04	<LLD	1.15E-04
Xe-135m	Ci	<LLD	1.54E-04	<LLD	1.54E-04
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD
Total	Ci	1.04E-01	8.84E-01	1.86E+00	2.85E+00
<b>2. Iodines</b>					
I-131	Ci	<LLD	<LLD	<LLD	<LLD
I-132	Ci	<LLD	1.47E-05	2.14E-06	1.68E-05
I-133	Ci	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	1.47E-05	2.14E-06	1.68E-05

**Table 37:  
Units 1, 2 and 3  
Gaseous Effluents- Batch - Particulates - Total By Unit**

Nuclides Released	Unit	Unit 1	Unit 2	Unit 3	Total
<b>3. Particulates</b>					
Ag-110m	Ci	<LLD	<LLD	<LLD	<LLD
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	4.69E-06	3.80E-06	8.49E-06
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	2.58E-05	5.17E-04	5.43E-04
Co-60	Ci	<LLD	2.11E-05	1.95E-04	2.16E-04
Cr-51	Ci	<LLD	2.25E-05	7.97E-04	8.20E-04
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	<LLD	<LLD
La-140	Ci	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	2.66E-07	5.75E-05	5.77E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	1.93E-05	8.20E-04	8.39E-04
Os-191	Ci	<LLD	<LLD	<LLD	<LLD
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	<LLD	<LLD
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	Note 1	Note 1	Note 1	Note 1
Sr-90	Ci	Note 1	Note 1	Note 1	Note 1
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	1.20E-05	6.32E-04	6.44E-04
Total	Ci	<LLD	1.06E-04	3.02E-03	3.13E-03
<b>4. Tritium</b>					
H-3	Ci	3.61E+02	9.71E+02	8.80E+02	2.21E+03
Note 1 - Not required for batch releases					

Table 38: Units 1, 2 and 3 Gaseous Effluents- Continuous and Batch - Fission Gases and Iodine - Total By Unit					
Nuclides Released	Unit	Unit 1	Unit 2	Unit 3	Total
<b>1. Fission gases</b>					
Ar-41	Ci	1.04E-01	2.18E-01	1.31E+00	1.63E+00
Kr-83m	Ci	<LLD	<LLD	<LLD	<LLD
Kr-85	Ci	<LLD	<LLD	<LLD	<LLD
Kr-85m	Ci	<LLD	<LLD	<LLD	<LLD
Kr-87	Ci	<LLD	<LLD	<LLD	<LLD
Kr-88	Ci	<LLD	<LLD	<LLD	<LLD
Kr-89	Ci	<LLD	<LLD	<LLD	<LLD
Kr-90	Ci	<LLD	<LLD	<LLD	<LLD
Xe-131m	Ci	<LLD	<LLD	5.92E-04	5.92E-04
Xe-133	Ci	2.48E-04	1.07E+00	5.54E-01	1.62E+00
Xe-133m	Ci	<LLD	4.54E-04	3.10E-04	7.64E-04
Xe-135	Ci	<LLD	1.15E-04	<LLD	1.15E-04
Xe-135m	Ci	<LLD	1.54E-04	<LLD	1.54E-04
Xe-137	Ci	<LLD	<LLD	<LLD	<LLD
Xe-138	Ci	<LLD	<LLD	<LLD	<LLD
Total	Ci	1.04E-01	1.29E+00	1.86E+00	3.25E+00
<b>2. Iodines</b>					
I-131	Ci	2.15E-06	<LLD	7.14E-06	9.29E-06
I-132	Ci	<LLD	1.47E-05	1.79E-04	1.94E-04
I-133	Ci	<LLD	<LLD	<LLD	<LLD
I-134	Ci	<LLD	<LLD	<LLD	<LLD
I-135	Ci	<LLD	<LLD	<LLD	<LLD
Total	Ci	2.15E-06	1.47E-05	1.86E-04	2.03E-04

Table 39: Units 1, 2 and 3 Gaseous Effluents - Continuous and Batch - Particulates - Total By Unit					
Nuclides Released	Unit	Unit 1	Unit 2	Unit 3	Total
<b>3. Particulates</b>					
Ag-110m	Ci	<LLD	<LLD	1.32E-06	1.32E-06
Ba-140	Ci	<LLD	<LLD	<LLD	<LLD
Br-82	Ci	<LLD	4.69E-06	3.80E-06	8.49E-06
Ce-141	Ci	<LLD	<LLD	<LLD	<LLD
Ce-144	Ci	<LLD	<LLD	<LLD	<LLD
Co-57	Ci	<LLD	<LLD	<LLD	<LLD
Co-58	Ci	<LLD	4.15E-05	8.49E-04	8.90E-04
Co-60	Ci	<LLD	5.93E-05	3.79E-04	4.39E-04
Cr-51	Ci	<LLD	2.25E-05	1.82E-03	1.84E-03
Cs-134	Ci	<LLD	<LLD	<LLD	<LLD
Cs-136	Ci	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD
Cs-138	Ci	<LLD	<LLD	<LLD	<LLD
Fe-59	Ci	<LLD	<LLD	2.06E-05	2.06E-05
La-140	Ci	<LLD	<LLD	<LLD	<LLD
Mn-54	Ci	<LLD	2.66E-07	8.47E-05	8.50E-05
Mo-99	Ci	<LLD	<LLD	<LLD	<LLD
Nb-95	Ci	<LLD	2.09E-05	1.06E-03	1.08E-03
Os-191	Ci	<LLD	1.44E-06	<LLD	1.44E-06
Rb-88	Ci	<LLD	<LLD	<LLD	<LLD
Ru-103	Ci	<LLD	<LLD	<LLD	<LLD
Ru-106	Ci	<LLD	<LLD	<LLD	<LLD
Sb-122	Ci	<LLD	<LLD	<LLD	<LLD
Sb-124	Ci	<LLD	<LLD	4.44E-06	4.44E-06
Sb-125	Ci	<LLD	<LLD	<LLD	<LLD
Se-75	Ci	<LLD	<LLD	<LLD	<LLD
Sn-113m	Ci	<LLD	<LLD	<LLD	<LLD
Sr-89	Ci	<LLD	<LLD	<LLD	<LLD
Sr-90	Ci	<LLD	<LLD	<LLD	<LLD
Tc-99m	Ci	<LLD	<LLD	<LLD	<LLD
Te-123m	Ci	<LLD	<LLD	<LLD	<LLD
Zn-65	Ci	<LLD	<LLD	<LLD	<LLD
Zr-95	Ci	<LLD	1.20E-05	7.97E-04	8.09E-04
Total	Ci	<LLD	1.63E-04	5.02E-03	5.18E-03
Total > 8 days	Ci	<LLD	1.58E-04	5.02E-03	5.18E-03
<b>4. Tritium</b>					
H-3	Ci	4.84E+02	1.10E+03	1.00E+03	2.58E+03

Noble Gases	Iodines	Particulates	Tritium	Error
25	25	25	25	Sample counting error
10	10	10	10	Counting system calibration error
5	5	5	5	Counting system source error
20	N/A	N/A	N/A	Temperature/volume correction error
10	10	10	10	Process flow measuring device <sup>(1)</sup>
N/A	15	15	15	Sample flow measuring device
N/A	5	N/A	N/A	Iodine collection efficiency error
N/A	N/A	10	N/A	Plate-out error
N/A	N/A	N/A	20	Bubbler collection efficiency error
N/A	N/A	N/A	2	Sample volume transfer error (pipette)
N/A	N/A	N/A	2	Sample volume error (graduate)

Note 1 - % of full scale

The estimated total error is calculated as follows:

$$\text{Total Percent Error} = (E_1^2 + E_2^2 + E_3^2 + \dots + E_n^2)^{\frac{1}{2}}$$

Where  $E_n$  = Percent error associated with each contributing parameter.

Parameters contributing to errors in the measurement of gaseous effluents include: process flow rates, sample collection, analytical counting and tank volumes. The values in Table 40 (%) were used for error calculations.

Unit	Instrument	Dates of Inoperability	Cause of Inoperability	Explanation
None				

**Table 42: Solid Waste Summary**

## 1.0 Solid Waste Shipped Offsite For Burial or Disposal (not irradiated fuel)

<b>Table 1.a: Spent Resin, Filters, Sludge, Evaporator Bottoms, etc.</b>				
Waste Class	Volume (ft3)	Volume (m3)	Curies Shipped	Percent Error
A	3.45E+03	9.77E+01	7.62E+01	2.50E+01
B	6.02E+02	1.71E+01	1.86E+02	2.50E+01
C	0.00E+00	0.00E+00	0.00E+00	N/A
All	4.05E+03	1.15E+02	2.62E+02	2.50E+01

<b>Table 1.b: Dry Compressible Waste, Contaminated Equipment, etc.</b>				
Waste Class	Volume (ft3)	Volume (m3)	Curies Shipped	Percent Error
A	2.21E+04	6.27E+02	1.04E+00	2.50E+01
B	0.00E+00	0.00E+00	0.00E+00	N/A
C	0.00E+00	0.00E+00	0.00E+00	N/A
All	2.21E+04	6.27E+02	1.04E+00	2.50E+01

<b>Table 1.c: Irradiated Components</b>				
Waste Class	Volume (ft3)	Volume (m3)	Curies Shipped	Percent Error
A	4.15E+02	1.17E+01	1.70E+01	2.50E+01
B	0.00E+00	0.00E+00	0.00E+00	N/A
C	0.00E+00	0.00E+00	0.00E+00	N/A
All	4.15E+02	1.17E+01	1.70E+01	2.50E+01

<b>Table 1.d: Other Waste (Oil, Metal)</b>				
Waste Class	Volume (ft3)	Volume (m3)	Curies Shipped	Percent Error
A	6.21E+02	1.76E+01	5.50E-02	2.50E+01
B	0.00E+00	0.00E+00	0.00E+00	N/A
C	0.00E+00	0.00E+00	0.00E+00	N/A
All	6.21E+02	1.76E+01	5.50E-02	2.50E+01

<b>Table 1.e: Summary of All Waste Shipped</b>				
Waste Class	Volume (ft3)	Volume (m3)	Curies Shipped	Percent Error
A	2.66E+04	7.54E+02	9.43E+01	2.50E+01
B	6.02E+02	1.71E+01	1.86E+02	2.50E+01
C	0.00E+00	0.00E+00	0.00E+00	N/A
All	2.72E+04	7.71E+02	2.80E+02	2.50E+01

## 2.0 Estimate of major nuclide composition

<b>Table 2.a: Spent Resin, Filters, Sludge, Evaporator bottoms, etc.</b>			
Nuclide	Percent Abundance	Curies	Percent Error
H-3	4.80E-03	1.26E+00	2.50E+01
C-14	1.90E-02	4.99E+00	2.50E+01
Cr-51	4.84E-06	1.27E-03	2.50E+01
Mn-54	2.63E-02	6.91E+00	2.50E+01
Fe-55	3.79E-01	9.93E+01	2.50E+01
Fe-59	4.99E-07	1.31E-04	2.50E+01
Co-57	1.24E-03	3.26E-01	2.50E+01
Co-58	2.07E-02	5.44E+00	2.50E+01
Co-60	1.34E-01	3.51E+01	2.50E+01
Ni-59	3.30E-03	8.66E-01	2.50E+01
Ni-63	3.68E-01	9.65E+01	2.50E+01
Zn-65	2.75E-04	7.22E-02	2.50E+01
Sr-89	2.09E-03	5.48E-01	2.50E+01
Sr-90	4.84E-04	1.27E-01	2.50E+01
Zr-95	1.70E-05	4.46E-03	2.50E+01
Nb-94	4.38E-06	1.15E-03	2.50E+01
Nb-95	3.53E-05	9.27E-03	2.50E+01
Tc-99	2.56E-04	6.71E-02	2.50E+01
Ag-108m	4.84E-06	1.27E-03	2.50E+01
Ag-110m	4.00E-03	1.05E+00	2.50E+01
Sn-113	4.23E-04	1.11E-01	2.50E+01
Sb-124	2.17E-05	5.69E-03	2.50E+01
Sb-125	2.92E-02	7.66E+00	2.50E+01
Cs-137	6.29E-03	1.65E+00	2.50E+01
Ce-144	1.95E-04	5.11E-02	2.50E+01
Pu-238	4.27E-05	1.12E-02	2.50E+01
Pu-239	1.67E-05	4.39E-03	2.50E+01
Pu-241	7.32E-04	1.92E-01	2.50E+01
Pu-242	3.18E-07	8.35E-05	2.50E+01
Am-241	6.06E-05	1.59E-02	2.50E+01
Am-243	2.55E-06	6.69E-04	2.50E+01
Cm-242	1.17E-06	3.08E-04	2.50E+01
Cm-243	2.86E-05	7.50E-03	2.50E+01
	Total	2.62E+02	2.50E+01

<b>Table 2.b: Dry Active Waste</b>			
Nuclide	Percent Abundance	Curies	Percent Error
C-14	2.89E-03	3.02E-03	2.50E+01
Sc-46	2.92E-04	3.05E-04	2.50E+01
Cr-51	.36E-01	1.42E-01	2.50E+01
Mn-54	1.85E-02	1.93E-02	2.50E+01
Fe-55	2.11E-01	2.20E-01	2.50E+01
Fe-59	4.31E-03	4.50E-03	2.50E+01
Co-57	5.55E-04	5.79E-04	2.50E+01
Co-58	1.10E-01	1.15E-01	2.50E+01
Co-60	1.34E-01	1.40E-01	2.50E+01
Ni-63	1.36E-02	1.42E-02	2.50E+01
Zn-65	4.22E-03	4.38E-03	2.50E+01
Sr-89	7.50E-04	7.83E-04	2.50E+01
Sr-90	1.84E-04	1.91E-04	2.50E+01
Zr-95	1.28E-01	1.34E-01	2.50E+01
Nb-95	2.18E-01	2.28E-01	2.50E+01
Tc-99	1.99E-03	2.08E-03	2.50E+01
Ag-110m	2.61E-04	2.72E-04	2.50E+01
Sn-113	3.20E-03	3.34E-03	2.50E+01
Sb-124	1.99E-03	2.08E-03	2.50E+01
Sb-125	6.75E-03	7.05E-03	2.50E+01
Te-123m	2.38E-04	2.48E-04	2.50E+01
Cs-137	3.01E-04	3.14E-04	2.50E+01
Ce-144	1.15E-03	1.20E-03	2.50E+01
Hf-181	9.47E-04	9.89E-04	2.50E+01
Pu-238	2.16E-06	2.25E-06	2.50E+01
Pu-239	9.77E-08	1.02E-07	2.50E+01
Pu-241	2.20E-08	2.30E-08	2.50E+01
Am-241	1.69E-06	1.76E-06	2.50E+01
Cm-242	2.81E-06	2.93E-06	2.50E+01
Cm-243	1.40E-06	1.46E-06	2.50E+01
	Total	1.04E+00	2.50E+01



<b>Table 2.c: Irradiated Components</b>			
Nuclide	Percent Abundance	Curies	Percent Error
H-3	5.11E-05	8.68E-04	2.50E+01
C-14	8.07E-05	1.37E-03	2.50E+01
Sc-46	1.28E-05	2.17E-04	2.50E+01
Cr-51	7.07E-02	1.20E+00	2.50E+01
Mn-54	3.66E-02	6.21E-01	2.50E+01
Fe-55	4.25E-01	7.21E+00	2.50E+01
Fe-59	4.18E-03	7.09E-02	2.50E+01
Co-57	1.14E-05	1.94E-04	2.50E+01
Co-58	3.31E-02	5.62E-01	2.50E+01
Co-60	3.98E-01	6.76E+00	2.50E+01
Ni-59	1.05E-04	1.79E-03	2.50E+01
Ni-63	2.01E-02	3.41E-01	2.50E+01
Zn-65	2.49E-04	4.23E-03	2.50E+01
Sr-89	1.38E-06	2.34E-05	2.50E+01
Sr-90	1.21E-06	2.06E-05	2.50E+01
Zr-95	4.25E-03	7.22E-02	2.50E+01
Nb-94	1.47E-06	2.49E-05	2.50E+01
Nb-95	7.30E-03	1.24E-01	2.50E+01
Tc-99	1.60E-06	2.71E-05	2.50E+01
Ag-110m	9.01E-06	1.53E-04	2.50E+01
Sn-113	8.78E-05	1.49E-03	2.50E+01
Sb-124	1.95E-04	3.31E-03	2.50E+01
Sb-125	1.15E-04	1.95E-03	2.50E+01
I-129	6.71E-08	1.14E-06	2.50E+01
Cs-137	5.15E-06	8.75E-05	2.50E+01
Ce-144	2.09E-05	3.55E-04	2.50E+01
Hf-181	3.19E-05	5.41E-04	2.50E+01
	Total	1.70E+01	2.50E+01

<b>Table 2.d: Other Waste: Oil, Metal</b>			
Nuclide	Percent Abundance	Curies	Percent Error
Mn-54	1.31E-03	7.20E-05	2.50E+01
Fe-55	7.60E-01	4.18E-02	2.50E+01
Co-60	2.35E-01	1.29E-02	2.50E+01
Sb-125	2.51E-03	1.38E-04	2.50E+01
Cs-137	1.24E-03	6.80E-05	2.50E+01
	Total	5.50E-02	2.50E+01

**Table 2.e: Summary of All Waste Shipped**

Nuclide	Percent Abundance	Curies	Percent Error
H-3	4.50E-03	1.26E+00	2.50E+01
C-14	1.78E-02	4.99E+00	2.50E+01
Sc-46	1.86E-06	5.22E-04	2.50E+01
Cr-51	4.79E-03	1.34E+00	2.50E+01
Mn-54	2.69E-02	7.55E+00	2.50E+01
Fe-55	3.81E-01	1.07E+02	2.50E+01
Fe-59	2.69E-04	7.55E-02	2.50E+01
Co-57	1.17E-03	3.27E-01	2.50E+01
Co-58	2.18E-02	6.12E+00	2.50E+01
Co-60	1.50E-01	4.20E+01	2.50E+01
Ni-59	3.10E-03	8.68E-01	2.50E+01
Ni-63	3.45E-01	9.69E+01	2.50E+01
Zn-65	2.88E-04	8.07E-02	2.50E+01
Sr-89	1.96E-03	5.49E-01	2.50E+01
Sr-90	4.54E-04	1.27E-01	2.50E+01
Zr-95	7.51E-04	2.11E-01	2.50E+01
Nb-94	4.19E-06	1.17E-03	2.50E+01
Nb-95	1.29E-03	3.61E-01	2.50E+01
Tc-99	2.47E-04	6.92E-02	2.50E+01
Ag-108m	4.53E-06	1.27E-03	2.50E+01
Ag-110m	3.75E-03	1.05E+00	2.50E+01
Sn-113	4.13E-04	1.16E-01	2.50E+01
Sb-124	3.95E-05	1.11E-02	2.50E+01
Sb-125	2.74E-02	7.67E+00	2.50E+01
Te-123m	8.85E-07	2.48E-04	2.50E+01
I-129	4.07E-09	1.14E-06	2.50E+01
Cs-137	5.89E-03	1.65E+00	2.50E+01
Ce-144	1.88E-04	5.27E-02	2.50E+01
Hf-181	5.46E-06	1.53E-03	2.50E+01
Pu-238	4.00E-05	1.12E-02	2.50E+01
Pu-239	1.57E-05	4.39E-03	2.50E+01
Pu-241	6.85E-04	1.92E-01	2.50E+01
Pu-242	2.98E-07	8.35E-05	2.50E+01
Am-241	5.67E-05	1.59E-02	2.50E+01
Am-243	2.39E-06	6.69E-04	2.50E+01
Cm-242	1.11E-06	3.11E-04	2.50E+01
Cm-243	2.68E-05	7.50E-03	2.50E+01
Total		2.80E+02	2.50E+01

### 3.0 Irradiated Fuel Shipments

None.

### 4.0 Supplemental Information

<b>Table 4.a: Shipment Mode and Location</b>		
Number of Shipments	Mode of Transport	Destination
10	Highway	Energy Solutions, UT
33	Highway	Waste Control Specialists, TX

<b>Table 4.b: Shipping Container Characteristics</b>			
Number of Containers	Type of Waste	Container Type	Solidification Agent
22	Dry Active Waste	20' Sealand	None
2	Dry Active Waste	Metal Liner	None
1	Dry Active Waste	Intermodal	None
12	Resin	Polyethylene Liner	None
4	Sludge	Metal Liner	None
9	Concentrates	Metal Liner	None
2	Irradiated Components	Metal Liner	None
2	Other: Oil	Metal Liner	None
1	Other: Metal	20' Sealand	None

<b>Table 4.c: Container Volume in m<sup>3</sup> by Waste Class</b>			
Type of Waste	Class A	Class B	Class C
Spent Resin, Filters, Sludge, Evaporator bottoms, etc.	9.77E+01	1.71E+01	0.00E+00
Dry Active Waste	6.27E+02	0.00E+00	0.00E+00
Irradiated Components	1.71E+01	0.00E+00	0.00E+00
Other Waste: Oil	1.76E+01	0.00E+00	0.00E+00

<b>Table 4.d: Container Activity in Ci by Waste Class</b>			
Type of Waste	Class A	Class B	Class C
Spent Resin, Filters, Sludge, Evaporator bottoms, etc.	7.62E+01	1.86E+02	0.00E+00
Dry Active Waste	1.04E+00	0.00E+00	0.00E+00
Irradiated Components	1.70E+01	0.00E+00	0.00E+00
Other Waste: Oil	5.50E-02	0.00E+00	0.00E+00

<b>Table 4.e: Principle Radionuclides</b>
Refer to Tables 2.a – 2.e.

<b>Table 4.f Source of Waste and Processing Employed</b>	
Type of Waste	Source
Spent Resin, Filters, Sludge, Evaporator bottoms, etc.	Mechanical filters: no processing. Concentrates as a liquid: no processing, Resin: dewatered prior to shipment
Dry Active Waste	Non-compacted dry active waste: no processing employed
Irradiated Components	Irradiated Components: no processing employed
Other Waste: Oil	Oil: no processing employed, Metal: no processing employed

<b>Table 4.g Type of Container</b>	
Type of Waste	Type of Container
Spent Resin, Filters, Sludge, Evaporator bottoms, etc.	(25) General Design Containers
Dry Active Waste	(25) General Design Containers
Irradiated Components	(2) General Design Containers
Other Waste: Oil	(3) General Design Containers

<b>Table 4.h Solidification Agent or Absorbent</b>	
Type of Waste	Solidification Agent/Absorbent
Spent Resin, Filters, Sludge, Evaporator bottoms, etc.	No solidification agents or absorbents used to process material
Dry Active Waste	No solidification agents or absorbents used to process material
Irradiated Components	No solidification agents or absorbents used to process material
Other Waste: Oil	No solidification agents or absorbents used to process material

## **APPENDIX B: DOSE CALCULATIONS**

## GASEOUS EFFLUENT DOSE CALCULATIONS

Doses to the maximum individual and the surrounding population resulting from the release of radioactive material in gaseous effluents from the Palo Verde Nuclear Generating Station were calculated using the GASPARG computer program. The radionuclides considered in the dose calculations were Tritium, Iodine-131, Iodine-132, Iodine-133, Iodine-135, all noble gases, and particulates having a half-life greater than eight days and for which dose factors are contained in NUREG-0172. Locations selected for individual dose calculations included for each sector, the site boundary, and within five miles, if present, the nearest residence, the nearest garden, and the nearest milk animal. GASPARG implements the radiological dose models of Regulatory Guide 1.109 to determine the radiation exposure to man from four principal atmospheric exposure pathways: plume, ground deposition, inhalation, and ingestion. Doses to the maximum individual and the population were calculated as a function of age group and pathway for significant body organs.

The Energy Information Center was relocated to an offsite location in 2011; however, Table 43 provides doses to the historical location of the Energy Information Center for comparison purposes.

Table 44 presents the Integrated Population Dose for 2021.

Table 45 summarizes the individual doses and compares the result to PVNGS ODCM Requirement limits. The site boundary and residence locations for which data are presented represent the highest annual doses.

Based on results obtained by placing thermoluminescent dosimeters (TLDs) on the site boundary in each sector, the net dose for this reporting period, from direct-radiation, (plume and ground deposition) from all three units was indistinguishable from preoperational values of 8 - 14  $\mu\text{R/hr}$  (17 - 30 mR/Std Qtr).

## LIQUID EFFLUENT DOSE CALCULATIONS

There were no liquid effluents associated with the operation of this facility.

## DOSE CALCULATION MODELS

The GASPARG computer code was used to evaluate the radiological consequences of the routine release of gaseous effluents. GASPARG implements the dose calculation methodologies of Regulatory Guide 1.109, Revision 1.

Source terms for each quarter are combined with station-specific demographic data and each quarter's atmospheric diffusion estimates for gaseous dose calculations.

Atmospheric diffusion estimates are generated by the XOQDOQ computer code using onsite meteorological data as input. Additional input to GASPARG includes the following site-specific data:

0 to 5-mile nearest residence, milk animal and garden in each of the 16 compass sectors, based on the 2021 Land Use Census.

0 to 10-mile population from the PVNGS Emergency Plan, Rev 72.

The 10 to 50-mile population distribution was established using data from the US Census Zip Code Tabulating Areas (ZCTA). The population distribution of metropolitan Phoenix greater than 50 miles from PVNGS is conservatively included in the 40 to 50-mile sectors (N=1,434; NNE=2,301; NE=66,655; ENE=470,712; E=1,636,641; ESE=138,586; SSE=3,391, S=3,556; WNW=4,046).

Absolute humidity of 6 g/m<sup>3</sup> from the PVNGS UFSAR, Table 2.3-16.

The fraction of the year that vegetables are grown (0.667) from the PVNGS ER-OL, Section 2.1.3.4, Table 2.1-8.

The fraction of daily feed derived from pasture while on pasture (0.35) and length of grazing season for milk animals beyond 5 miles (0.75) from the PVNGS ER-OL, Section 2.1.3.4.3.

The fraction of daily feed derived from pasture while on pasture (0.05) and length of grazing season for meat animals (0.25) from the PVNGS ER-OL, Section 2.1.3.4.4.

There were ten (10) sectors reported as containing milk animal (goat or cow) locations within five (5) miles. For calculation purposes these milk animals are assumed to be fed 100% on pasture grass during the year.

Other values used for input to GASPARG are default values from Regulatory Guide 1.109, Rev. 1.



**Table 43: Doses to Special Location (EIC)**

(mrem)	T.BODY	GI-TRACT	BONE	LIVER	KIDNEY	THYROID	LUNG	SKIN
1ST QUARTER								
ADULT	3.79E-01	3.79E-01	4.16E-03	3.79E-01	3.79E-01	3.79E-01	3.79E-01	3.81E-01
TEEN	3.81E-01	3.81E-01	4.16E-03	3.81E-01	3.81E-01	3.81E-01	3.82E-01	3.84E-01
CHILD	3.38E-01	3.38E-01	4.16E-03	3.38E-01	3.38E-01	3.38E-01	3.38E-01	3.40E-01
INFANT	1.96E-01	1.96E-01	4.16E-03	1.96E-01	1.96E-01	1.96E-01	1.96E-01	1.99E-01
2ND QUARTER								
ADULT	3.95E-01	3.95E-01	9.06E-03	3.95E-01	3.95E-01	3.95E-01	3.96E-01	3.97E-01
TEEN	3.97E-01	3.97E-01	9.07E-03	3.97E-01	3.97E-01	3.97E-01	3.98E-01	3.99E-01
CHILD	3.51E-01	3.51E-01	9.08E-03	3.51E-01	3.51E-01	3.51E-01	3.54E-01	3.53E-01
INFANT	2.07E-01	2.07E-01	9.07E-03	2.07E-01	2.07E-01	2.07E-01	2.07E-01	2.08E-01
1ST SEMI-ANNUAL								
ADULT	7.74E-01	7.74E-01	1.32E-02	7.74E-01	7.74E-01	7.74E-01	7.75E-01	7.78E-01
TEEN	7.79E-01	7.79E-01	1.32E-02	7.79E-01	7.79E-01	7.79E-01	7.80E-01	7.83E-01
CHILD	6.89E-01	6.89E-01	1.32E-02	6.89E-01	6.89E-01	6.89E-01	6.91E-01	6.93E-01
INFANT	4.03E-01	4.03E-01	1.32E-02	4.03E-01	4.03E-01	4.03E-01	4.04E-01	4.07E-01
3RD QUARTER								
ADULT	2.91E-01	2.91E-01	3.39E-04	2.91E-01	2.91E-01	2.91E-01	2.91E-01	2.91E-01
TEEN	2.92E-01	2.92E-01	3.39E-04	2.92E-01	2.92E-01	2.92E-01	2.92E-01	2.93E-01
CHILD	2.59E-01	2.59E-01	3.39E-04	2.59E-01	2.59E-01	2.59E-01	2.59E-01	2.59E-01
INFANT	1.49E-01	1.49E-01	3.39E-04	1.49E-01	1.49E-01	1.49E-01	1.49E-01	1.49E-01
4TH QUARTER								
ADULT	5.96E-01	5.96E-01	2.71E-03	5.96E-01	5.96E-01	5.96E-01	5.97E-01	5.97E-01
TEEN	6.01E-01	6.01E-01	2.71E-03	6.01E-01	6.01E-01	6.01E-01	6.01E-01	6.02E-01
CHILD	5.32E-01	5.32E-01	2.71E-03	5.32E-01	5.32E-01	5.32E-01	5.32E-01	5.33E-01
INFANT	3.06E-01	3.06E-01	2.71E-03	3.06E-01	3.06E-01	3.06E-01	3.06E-01	2.30E-01
2ND SEMI-ANNUAL								
ADULT	8.87E-01	8.87E-01	3.05E-03	8.87E-01	8.87E-01	8.87E-01	8.88E-01	8.88E-01
TEEN	8.93E-01	8.93E-01	3.05E-03	8.93E-01	8.93E-01	8.93E-01	8.93E-01	8.95E-01
CHILD	7.90E-01	7.90E-01	3.05E-03	7.90E-01	7.90E-01	7.90E-01	7.90E-01	7.92E-01
INFANT	4.55E-01	4.55E-01	3.05E-03	4.55E-01	4.55E-01	4.55E-01	4.55E-01	3.79E-01
ANNUAL								
ADULT	1.66E+00	1.66E+00	1.63E-02	1.66E+00	1.66E+00	1.66E+00	1.66E+00	1.67E+00
TEEN	1.67E+00	1.67E+00	1.63E-02	1.67E+00	1.67E+00	1.67E+00	1.67E+00	1.68E+00
CHILD	1.48E+00	1.48E+00	1.63E-02	1.48E+00	1.48E+00	1.48E+00	1.48E+00	1.49E+00
INFANT	8.58E-01	8.58E-01	1.63E-02	8.58E-01	8.58E-01	8.58E-01	8.59E-01	7.86E-01

The Energy Information Center (EIC) was repurposed as Building C after the Palo Verde Energy Education Center was opened in Buckeye, AZ. Building C is located onsite 0.45 Mile S from Unit 1, 0.29 Mile SSE from Unit 2, and 0.20 Mile ESE From Unit 3

**Table 44: Integrated Population Dose (rem)**

**January to March**

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	7.57E-04	7.57E-04	7.57E-04	7.57E-04	7.57E-04	7.57E-04	7.57E-04	1.43E-03
	0.01%	0.01%	85.08%	0.01%	0.01%	0.01%	0.01%	0.02%
Ground	1.32E-04	1.32E-04	1.32E-04	1.32E-04	1.32E-04	1.32E-04	1.32E-04	1.56E-04
	0.00%	0.00%	14.87%	0.00%	0.00%	0.00%	0.00%	0.00%
Inhalation	4.08E+00	4.08E+00	3.14E-07	4.08E+00	4.08E+00	4.08E+00	4.08E+00	4.08E+00
	44.65%	44.65%	0.04%	44.65%	44.65%	44.65%	44.65%	44.65%
Vegetation	4.24E+00	4.24E+00	1.44E-07	4.24E+00	4.24E+00	4.24E+00	4.24E+00	4.24E+00
	46.33%	46.33%	0.02%	46.33%	46.33%	46.33%	46.33%	46.33%
Cow Milk	6.12E-01	6.12E-01	2.16E-08	6.12E-01	6.12E-01	6.12E-01	6.12E-01	6.12E-01
	6.69%	6.69%	0.00%	6.69%	6.69%	6.69%	6.69%	6.69%
Meat	2.12E-01	2.12E-01	2.94E-11	2.12E-01	2.12E-01	2.12E-01	2.12E-01	2.12E-01
	2.32%	2.32%	0.00%	2.32%	2.32%	2.32%	2.32%	2.32%
Total Integrated Population Dose	9.15E+00	9.15E+00	8.89E-04	9.15E+00	9.15E+00	9.15E+00	9.15E+00	9.15E+00
Per Capita Dose (rem) <sup>(1)</sup>	1.94E-06	1.94E-06	1.89E-10	1.94E-06	1.94E-06	1.94E-06	1.94E-06	1.94E-06

**April through June**

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	3.67E-04	3.67E-04	3.67E-04	3.67E-04	3.67E-04	3.67E-04	3.67E-04	1.06E-03
	0.00%	0.00%	2.99%	0.00%	0.00%	0.00%	0.00%	0.01%
Ground	1.17E-02	1.17E-02	1.17E-02	1.17E-02	1.17E-02	1.17E-02	1.17E-02	1.37E-02
	0.13%	0.13%	95.23%	0.13%	0.13%	0.13%	0.13%	0.16%
Inhalation	4.16E+00	4.16E+00	2.13E-04	4.16E+00	4.16E+00	4.16E+00	4.17E+00	4.16E+00
	48.02%	48.02%	1.74%	48.02%	48.02%	48.02%	48.08%	48.01%
Vegetation	3.74E+00	3.74E+00	4.37E-06	3.74E+00	3.74E+00	3.74E+00	3.74E+00	3.74E+00
	43.20%	43.21%	0.04%	43.20%	43.20%	43.20%	43.15%	43.19%
Cow Milk	5.77E-01	5.77E-01	1.67E-07	5.77E-01	5.77E-01	5.77E-01	5.77E-01	5.77E-01
	6.66%	6.66%	0.00%	6.66%	6.66%	6.66%	6.65%	6.66%
Meat	1.71E-01	1.72E-01	1.22E-07	1.71E-01	1.71E-01	1.71E-01	1.71E-01	1.71E-01
	1.98%	1.98%	0.00%	1.98%	1.98%	1.98%	1.98%	1.98%
Total Integrated Population Dose	8.66E+00	8.67E+00	1.23E-02	8.66E+00	8.66E+00	8.66E+00	8.67E+00	8.67E+00
Per Capita Dose (rem) <sup>(1)</sup>	1.84E-06	1.84E-06	2.61E-09	1.84E-06	1.84E-06	1.84E-06	1.84E-06	1.84E-06

**Table 44: Integrated Population Dose (rem)  
(continued)**

**January through June**

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03	1.12E-03	2.49E-03
	0.01%	0.01%	8.55%	0.01%	0.01%	0.01%	0.01%	0.01%
Ground	1.18E-02	1.18E-02	1.18E-02	1.18E-02	1.18E-02	1.18E-02	1.18E-02	1.39E-02
	0.07%	0.07%	89.79%	0.07%	0.07%	0.07%	0.07%	0.08%
Inhalation	8.25E+00	8.25E+00	2.13E-04	8.25E+00	8.25E+00	8.25E+00	8.26E+00	8.25E+00
	46.29%	46.29%	1.62%	46.29%	46.29%	46.29%	46.32%	46.28%
Vegetation	7.98E+00	7.98E+00	4.51E-06	7.98E+00	7.98E+00	7.98E+00	7.98E+00	7.98E+00
	44.81%	44.81%	0.03%	44.81%	44.81%	44.81%	44.78%	44.80%
Cow Milk	1.19E+00	1.19E+00	1.89E-07	1.19E+00	1.19E+00	1.19E+00	1.19E+00	1.19E+00
	6.67%	6.67%	0.00%	6.67%	6.67%	6.67%	6.67%	6.67%
Meat	3.84E-01	3.84E-01	1.22E-07	3.84E-01	3.84E-01	3.84E-01	3.84E-01	3.84E-01
	2.15%	2.15%	0.00%	2.15%	2.15%	2.15%	2.15%	2.15%
Total Integrated Population Dose	1.78E+01	1.78E+01	1.31E-02	1.78E+01	1.78E+01	1.78E+01	1.78E+01	1.78E+01
Per Capita Dose (rem) <sup>(1)</sup>	3.77E-06	3.77E-06	2.78E-09	3.77E-06	3.77E-06	3.77E-06	3.77E-06	3.77E-06

**July through September**

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	6.91E-05	6.91E-05	6.91E-05	6.91E-05	6.91E-05	6.91E-05	6.91E-05	1.26E-04
	0%	0.00%	100.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Ground	3.57E-21	3.57E-21	3.57E-21	3.57E-21	3.57E-21	3.57E-21	3.57E-21	4.18E-21
	0%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Inhalation	1.29E+00	1.29E+00	0.00E+00	1.29E+00	1.29E+00	1.29E+00	1.29E+00	1.29E+00
	41.26%	41.26%	0.00%	41.26%	41.26%	41.26%	41.26%	41.26%
Vegetation	1.58E+00	1.58E+00	0.00E+00	1.58E+00	1.58E+00	1.58E+00	1.58E+00	1.58E+00
	50.79%	50.79%	0.00%	50.79%	50.79%	50.79%	50.79%	50.79%
Cow Milk	1.73E-01	1.73E-01	0.00E+00	1.73E-01	1.73E-01	1.73E-01	1.73E-01	1.73E-01
	5.55%	5.55%	0.00%	5.55%	5.55%	5.55%	5.55%	5.55%
Meat	7.48E-02	7.48E-02	0.00E+00	7.48E-02	7.48E-02	7.48E-02	7.48E-02	7.48E-02
	2.4%	2.40%	0.00%	2.40%	2.40%	2.40%	2.40%	2.40%
Total Integrated Population Dose	3.12E+00	3.12E+00	6.91E-05	3.12E+00	3.12E+00	3.12E+00	3.12E+00	3.12E+00
Per Capita Dose (rem) <sup>(1)</sup>	6.62E-07	6.62E-07	1.47E-11	6.62E-07	6.62E-07	6.62E-07	6.62E-07	6.62E-07

**Table 44 Integrated Population Dose (rem)  
(continued)**

**October through December**

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	9.70E-04	9.70E-04	9.70E-04	9.70E-04	9.70E-04	9.70E-04	9.70E-04	3.21E-03
	0.01%	.01%	65.33%	0.01%	0.01%	0.01%	0.01%	0.03%
Ground	5.09E-04	5.09E-04	5.09E-04	5.09E-04	5.09E-04	5.09E-04	5.09E-04	5.99E-04
	.01%	0.01%	34.27%	0.01%	0.01%	0.01%	0.01%	0.01%
Inhalation	3.74E+00	3.74E+00	5.84E-06	3.74E+00	3.74E+00	3.74E+00	3.74E+00	3.74E+00
	39.20%	39.20%	0.39%	39.20%	39.20%	39.20%	39.20%	39.19%
Vegetation	4.99E+00	4.99E+00	1.77E-08	4.99E+00	4.99E+00	4.99E+00	4.99E+00	4.99E+00
	52.36%	52.36%	0.00%	52.36%	52.36%	52.36%	52.35%	52.35%
Cow Milk	5.55E-01	5.55E-01	1.02E-10	5.55E-01	5.55E-01	5.55E-01	5.55E-01	5.55E-01
	5.82%	5.82%	0.00%	5.82%	5.82%	5.82%	5.82%	5.82%
Meat	2.48E-01	2.48E-01	1.27E-09	2.48E-01	2.48E-01	2.48E-01	2.48E-01	2.48E-01
	2.60%	2.60%	0.00%	2.60%	2.60%	2.60%	2.60%	2.60%
Total Integrated Population Dose	9.53E+00	9.53E+00	1.49E-03	9.53E+00	9.53E+00	9.53E+00	9.53E+00	9.54E+00
Per Capita Dose (rem) <sup>(1)</sup>	2.02E-06	2.02E-06	3.16E-10	2.02E-06	2.02E-06	2.02E-06	2.02E-06	2.02E-06

**July through December**

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	1.04E-03	1.04E-03	1.04E-03	1.04E-03	1.04E-03	1.04E-03	1.04E-03	3.34E-03
	0.01%	0.01%	66.87%	0.01%	0.01%	0.01%	0.01%	0.03%
Ground	5.09E-04	5.09E-04	5.09E-04	5.09E-04	5.09E-04	5.09E-04	5.09E-04	5.99E-04
	0.00%	0.00%	32.75%	0.00%	0.00%	0.00%	0.00%	0.00%
Inhalation	5.02E+00	5.02E+00	5.84E-06	5.02E+00	5.02E+00	5.02E+00	5.02E+00	5.02E+00
	39.71%	39.71%	0.38%	39.71%	39.71%	39.71%	39.71%	39.70%
Vegetation	6.58E+00	6.58E+00	1.77E-08	6.58E+00	6.58E+00	6.58E+00	6.58E+00	6.58E+00
	51.97%	51.97%	0.00%	51.97%	51.97%	51.97%	51.97%	51.96%
Cow Milk	7.28E-01	7.28E-01	1.02E-10	7.28E-01	7.28E-01	7.28E-01	7.28E-01	7.28E-01
	5.76%	5.76%	0.00%	5.76%	5.76%	5.76%	5.76%	5.76%
Meat	3.23E-01	3.23E-01	1.27E-09	3.23E-01	3.23E-01	3.23E-01	3.23E-01	3.23E-01
	2.55%	2.55%	0.00%	2.55%	2.55%	2.55%	2.55%	2.55%
Total Integrated Population Dose	1.27E+01	1.27E+01	1.55E-03	1.27E+01	1.27E+01	1.27E+01	1.27E+01	1.27E+01
Per Capita Dose (rem) <sup>(1)</sup>	2.69E-06	2.69E-06	3.29E-10	2.69E-06	2.69E-06	2.69E-06	2.69E-06	2.69E-06

**Table 44: Integrated Population Dose (rem)  
(continued)**

**January through December**

Pathway	Total Body	GI-Tract	Bone	Liver	Kidney	Thyroid	Lung	Skin
Plume	2.16E-03	2.16E-03	2.16E-03	2.16E-03	2.16E-03	2.16E-03	2.16E-03	5.82E-03
	0.01%	0.01%	14.72%	0.01%	0.01%	0.01%	0.01%	0.02%
Ground	1.23E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02	1.23E-02	1.45E-02
	0.04%	0.04%	83.76%	0.04%	0.04%	0.04%	0.04%	0.05%
Inhalation	1.33E+01	1.33E+01	2.19E-04	1.33E+01	1.33E+01	1.33E+01	1.33E+01	1.33E+01
	43.56%	43.55%	1.49%	43.56%	43.56%	43.56%	43.58%	43.55%
Vegetation	1.46E+01	1.46E+01	4.53E-06	1.46E+01	1.46E+01	1.46E+01	1.46E+01	1.46E+01
	47.78%	47.79%	0.03%	47.78%	47.78%	47.78%	47.77%	47.78%
Cow Milk	1.92E+00	1.92E+00	1.89E-07	1.92E+00	1.92E+00	1.92E+00	1.92E+00	1.92E+00
	6.29%	6.29%	0.00%	6.29%	6.29%	6.29%	6.29%	6.29%
Meat	7.06E-01	7.06E-01	1.23E-07	7.06E-01	7.06E-01	7.06E-01	7.06E-01	7.06E-01
	2.32%	2.32%	0.00%	2.32%	2.32%	2.32%	2.32%	2.32%
Total Integrated Population Dose	3.05E+01	3.05E+01	1.47E-02	3.05E+01	3.05E+01	3.05E+01	3.05E+01	3.05E+01
Per Capita Dose (rem) <sup>(1)</sup>	6.47E-06	6.47E-06	3.12E-09	6.47E-06	6.47E-06	6.47E-06	6.47E-06	6.47E-06

(1) : Person-rem total divided by 50-mile population of 4,716,000

**Table 45:  
Summary of Individual Doses for 2021  
Radiation Doses At And Beyond The Site Boundary**

	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Year total
Gamma Air Dose	mrad	2.47E-03	1.48E-04	1.22E-04	5.07E-04	3.22E-03
ODCM Req 4.1 Limit	mrad	5.00E+00	5.00E+00	5.00E+00	5.00E+00	1.00E+01
% ODCM Limit	%	4.94E-02	2.96E-03	2.44E-03	1.01E-02	3.22E-02
<b>Beta Air Dose</b>						
Beta Air Dose	mrad	8.85E-04	1.02E-04	4.36E-05	5.16E-04	1.54E-03
ODCM Req 4.1 Limit	mrad	1.00E+01	1.00E+01	1.00E+01	1.00E+01	2.00E+01
% ODCM Limit	%	8.85E-03	1.02E-03	4.36E-04	5.16E-03	7.70E-03
<b>Maximum Individual</b>						
Total Body	mrem	1.64E-03	9.69E-05	8.09E-05	3.26E-04	2.13E-03
Skin	mrem	2.64E-03	1.69E-04	1.30E-04	6.14E-04	3.53E-03
<b>Receptor Location From Each PVNGS Unit</b>						
Unit 1	miles	1.70 SSE	1.70 SSE	1.27 SE	1.70 SSE	1.70 SSE
Unit 2	miles	1.88 SSE	1.88 SSE	1.31 SE	1.88 SSE	1.88 SSE
Unit 3	miles	1.73 SSE	1.73 SSE	1.40 SE	1.73 SSE	1.73 SSE
<b>Maximum Organ Dose<sup>(1)</sup> From All Radionuclides</b>						
	Age	Infant	Infant	Infant	Infant	Infant
	Organ	Bone	Bone	Bone	Bone	Bone
	mrem	1.81E+00	1.33E+00	8.62E-01	2.16E+00	5.13E+00
ODCM Req. 4.2 Limit	mrem	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
% ODCM Limit <sup>(2)</sup>	%	2.41E+01	1.77E+01	1.15E+01	2.88E+01	3.42E+01
<b>Receptor Location From Each PVNGS Unit</b>						
Unit 1	miles	3.91 SE	2.85 NE	1.30 WSW	3.91 SE	3.91 SE
Unit 2	miles	3.92 SE	3.08 NE	1.08 WSW	3.92 SE	3.92 SE
Unit 3	miles	3.87 ESE	3.30 NE	0.93 WSW	3.87 ESE	3.87 ESE
<b>Maximum Organ Dose<sup>(1)</sup> From All Radionuclides Excluding C-14</b>						
	Age	Infant	Infant	Infant	Infant	Infant
	Organ	Thyroid (2)	Thyroid (2)	Thyroid (2)	Lung	Thyroid (2)
	mrem	1.55E-01	2.62E-01	1.27E-01	2.11E-01	5.92E-01
ODCM Req. 4.2 Limit	mrem	7.50E+00	7.50E+00	7.50E+00	7.50E+00	1.50E+01
% ODCM Limit <sup>(2)</sup>	%	2.07E+00	3.49E+00	1.69E+00	2.81E+00	3.95E+00
<b>Receptor Location From Each PVNGS Unit</b>						
Unit 1	miles	1.94 E	2.85 NE	1.30 WSW	3.91 SE	1.94 E
Unit 2	miles	2.12 ENE	3.08 NE	1.08 WSW	3.92 SE	2.12 ENE
Unit 3	miles	2.25 ENE	3.30 NE	0.93 WSW	3.87 ESE	2.25 ENE
Organ Dose from tritium only for Unit 2 location above	mrem	1.55E-01	2.61E-01	1.27E-01	2.10E-01	5.91E-01
Fraction of organ dose from tritium only for Unit 2 location above	%	100.00	99.62	100.00	99.53	99.83
X/Q for Unit 2 location above	sec/m <sup>3</sup>	1.49E-06	1.26E-06	8.39E-07	2.52E-06	1.05E-06
D/Q for Unit 2 location above	m-2	1.61E-09	3.31E-09	3.69E-09	5.80E-10	1.78E-09
(1) Excluding skin						
(2) ODCM Requirement 5.1 has higher limits than ODCM Requirement 4.2; therefore, the percent of limits are more conservative based on ODCM Requirement 4.2 than on ODCM Requirement 5.1						

## **APPENDIX C: NEI 07-07 GROUNDWATER PROTECTION INITIATIVE SAMPLING**

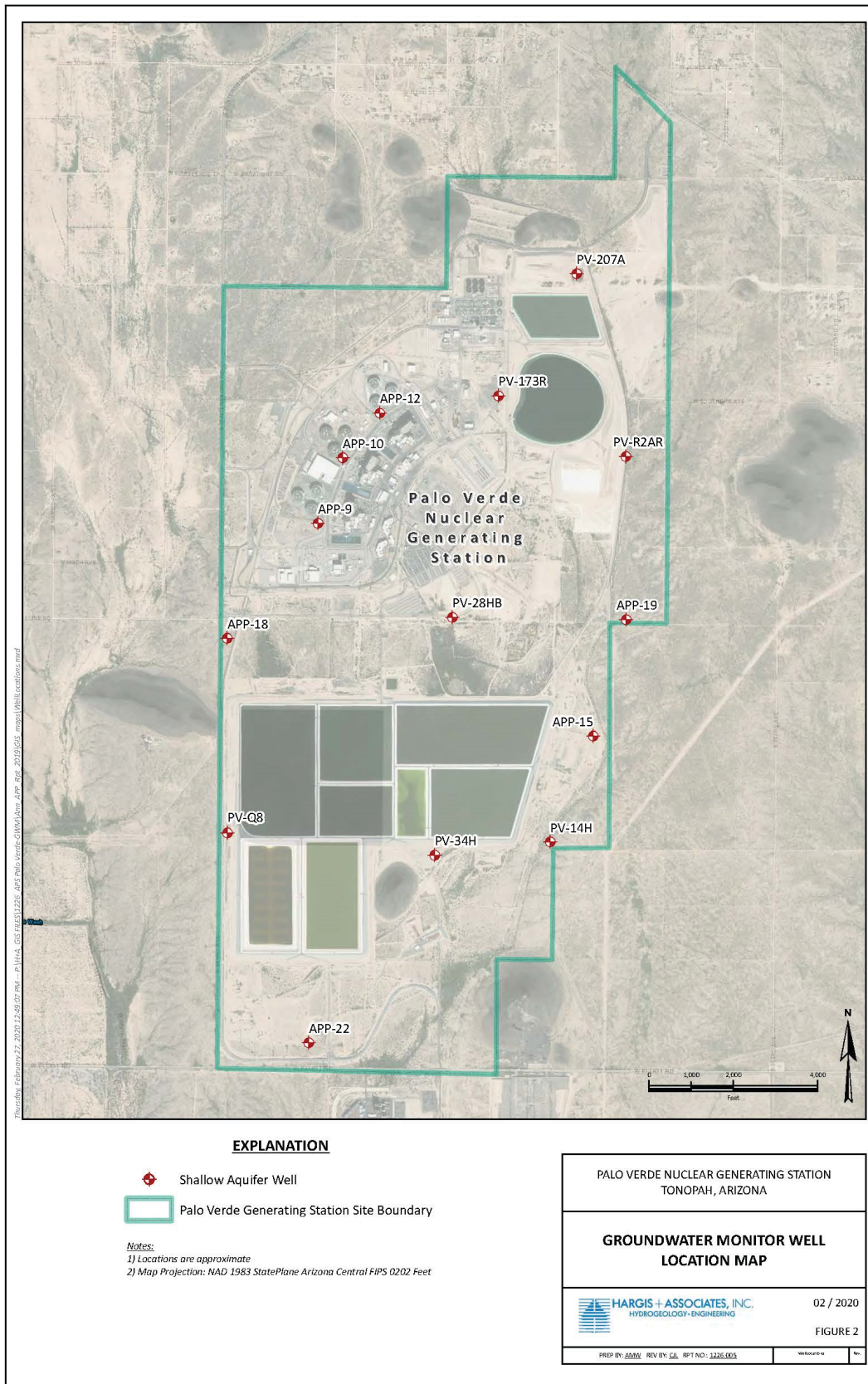


Figure 1. Onsite Well Locations.



**Table 46: 2021 NEI 07-07 Ground Water Protection Initiative PVNGS Well Data**

Monitoring Well ID	Sample ID	Sample Date	Radionuclide	Concentration (pCi/L)
APP-10	PV-APP-10-0221	–	Cesium-134	–
APP-10	PV-APP-10-0221	–	Cesium-137	–
APP-10	PV-APP-10-0221	–	Cobalt-60	–
APP-10	PV-APP-10-0221	02/25/2021	Tritium	≤401
APP-10	PV-APP-10-0421	–	Cesium-134	–
APP-10	PV-APP-10-0421	–	Cesium-137	–
APP-10	PV-APP-10-0421	–	Cobalt-60	–
APP-10	PV-APP-10-0421	04/29/2021	Tritium	≤433
APP-10	PV-APP-10-0721	–	Cesium-134	–
APP-10	PV-APP-10-0721	–	Cesium-137	–
APP-10	PV-APP-10-0721	–	Cobalt-60	–
APP-10	PV-APP-10-0721	07/08/2021	Tritium	≤373
APP-10	PV-APP-10-1121	11/03/2021	Cesium-134	≤5.56
APP-10	PV-APP-10-1121	11/03/2021	Cesium-137	≤7.3
APP-10	PV-APP-10-1121	11/03/2021	Cobalt-60	≤6.55
APP-10	PV-APP-10-1121	11/03/2021	Tritium	≤408
APP-12	PV-APP-12-0221	–	Cesium-134	–
APP-12	PV-APP-12-0221	–	Cesium-137	–
APP-12	PV-APP-12-0221	–	Cobalt-60	–
APP-12	PV-APP-12-0221	02/25/2021	Tritium	≤401
APP-12	PV-APP-12-0421	–	Cesium-134	–
APP-12	PV-APP-12-0421	–	Cesium-137	–
APP-12	PV-APP-12-0421	–	Cobalt-60	–
APP-12	PV-APP-12-0421	04/29/2021	Tritium	≤434
APP-12	PV-APP-12-0721	–	Cesium-134	–
APP-12	PV-APP-12-0721	–	Cesium-137	–
APP-12	PV-APP-12-0721	–	Cobalt-60	–
APP-12	PV-APP-12-0721	07/08/2021	Tritium	≤372
APP-12	PV-APP-12-1121	11/03/2021	Cesium-134	≤7.07
APP-12	PV-APP-12-1121	11/03/2021	Cesium-137	≤7.89
APP-12	PV-APP-12-1121	11/03/2021	Cobalt-60	≤6.85
APP-12	PV-APP-12-1121	11/03/2021	Tritium	≤422
APP-15	PV-APP-15-1121	–	Cesium-134	Pump Failure <sup>(1)</sup>
APP-15	PV-APP-15-1121	–	Cesium-137	“
APP-15	PV-APP-15-1121	–	Cobalt-60	“
APP-15	PV-APP-15-1121	–	Tritium	“
APP-22	PV-APP-22-1121	11/02/2021	Cesium-134	≤9.07
APP-22	PV-APP-22-1121	11/02/2021	Cesium-137	≤13.8
APP-22	PV-APP-22-1121	11/02/2021	Cobalt-60	≤14.9
APP-10	PV-APP-10-0221	–	Cesium-134	–
APP-10	PV-APP-10-0221	–	Cesium-137	–
APP-22	PV-APP-22-1121	11/02/2021	Tritium	≤375

(1) – Pump failure, no sample obtained (CR.21-08136)

**Table 46: 2021 NEI 07-07 Ground Water Protection Initiative PVNGS Well Data**  
(Continued)

Monitoring Well ID	Sample ID	Sample Date	Radionuclide	Concentration (pCi/L)
APP-9	PV-APP-9-0221	–	Cesium-134	–
APP-9	PV-APP-9-0221	–	Cesium-137	–
APP-9	PV-APP-9-0221	–	Cobalt-60	–
APP-9	PV-APP-9-0221	02/25/2021	Tritium	≤401
APP-9	PV-APP-9-0421	–	Cesium-134	–
APP-9	PV-APP-9-0421	–	Cesium-137	–
APP-9	PV-APP-9-0421	–	Cobalt-60	–
APP-9	PV-APP-9-0421	04/29/2021	Tritium	≤434
APP-9	PV-APP-9-0721	–	Cesium-134	–
APP-9	PV-APP-9-0721	–	Cesium-137	–
APP-9	PV-APP-9-0721	–	Cobalt-60	–
APP-9	PV-APP-9-0721	07/08/2021	Tritium	≤373
APP-9	PV-APP-9-1121	11/03/2021	Cesium-134	≤4.97
APP-9	PV-APP-9-1121	11/03/2021	Cesium-137	≤6.07
APP-9	PV-APP-9-1121	11/03/2021	Cobalt-60	≤5.69
APP-9	PV-APP-9-1121	11/03/2021	Tritium	≤397
PV-14H	PV-PV-14H-1121	11/02/2021	Cesium-134	≤4.94
PV-14H	PV-PV-14H-1121	11/02/2021	Cesium-137	≤5.96
PV-14H	PV-PV-14H-1121	11/02/2021	Cobalt-60	≤5.93
PV-14H	PV-PV-14H-1121	11/02/2021	Tritium	≤374
PV-34H	PV-PV-34H-1121	11/03/2021	Cesium-134	≤6.74
PV-34H	PV-PV-34H-1121	11/03/2021	Cesium-137	≤9.04
PV-34H	PV-PV-34H-1121	11/03/2021	Cobalt-60	≤8.62
PV-34H	PV-PV-34H-1121	11/03/2021	Tritium	≤418
PV-R2AR	PV-PV-R2AR-0421	04/28/2021	Cesium-134	≤4.83
PV-R2AR	PV-PV-R2AR-0421	04/28/2021	Cesium-137	≤5.5
PV-R2AR	PV-PV-R2AR-0421	04/28/2021	Cobalt-60	≤5.6
PV-R2AR	PV-PV-R2AR-0421	04/28/2021	Tritium	≤434
PV-R2AR	PV-PV-R2AR-1121	11/04/2021	Cesium-134	≤5.01
PV-R2AR	PV-PV-R2AR-1121	11/04/2021	Cesium-137	≤6.14
PV-R2AR	PV-PV-R2AR-1121	11/04/2021	Cobalt-60	≤6.1
PV-R2AR	PV-PV-R2AR-1121	11/04/2021	Tritium	≤381
APP-4R	PV-APP-4R-1121	11/02/2021	Cesium-134	≤4.75
APP-4R	PV-APP-4R-1121	11/02/2021	Cesium-137	≤8.86
APP-4R	PV-APP-4R-1121	11/02/2021	Cobalt-60	≤9.39
APP-4R	PV-APP-4R-1121	11/02/2021	Tritium	≤372

## **APPENDIX D: ADJUSTED 2021 PERMITS**

<b>Table 47: Adjusted 2021 Permits</b>	
Permit	Reason for Adjustment
Various	Permits 20211048, 20211063, 20211067, 20211086, 20211131, 20211132, 20212120, 20212121, 20213017, 20213063, 20213071, 20213157, 20213172, and 20213186 were generated, but were not used.
Various	Batch permits with durations greater than 216 hours were considered continuous releases.
20211111 20211114	The tritium activity listed on Plant Vent permits 20211111 and 20211114 was excluded because the activity was the result of BAC Operations, and the activity was accounted for on BAC permits 20211110 and 20211113.
20212122	The Ar-41 activity listed on batch permit 20212122 was adjusted from 3.69 Ci to 5.88E-04 curies to account for 11.83 hours of decay (reactor shutdown to release start) and one volume of containment (2.6E6 ft3).
20212133 20212137	The tritium activity listed on Plant Vent permits 20212133 and 20212137 was excluded because the activity was accounted for on Refueling Purge batch permits 20212131, 20212134, and 20212139.
20212143 20212147	The tritium activity listed on Plant Vent permits 20212143 and 20212147 was excluded because the activity was the result of BAC Operations, and the activity was accounted for on BAC permits 20212141 and 20212144.
20213050	The Ar-41 activity listed on batch permit 20213050 was adjusted from 10.2 Ci to 3.90E-04 Ci to account for 15.72 hours of decay (reactor shutdown to release start) and only one volume of containment (2.6E6 ft3).
20213061 20213066 20213077	The tritium activity listed on Plant Vent permits 20213061, 20213066, and 20213077 was excluded because the activity was accounted for on Refueling Purge batch permits 20213059, 20213062, 20213067, and 20213074.
20213183	Permit 20213183 was generated in 2021; however, the entire release occurred in 2022. Based on the release occurring in 2022, the activity accounted for on Permit 20213183 will be included in the 2022 ARERR.