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April 25, 2019

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT
DOCKET NOS. 50-445 AND 50-446
2018 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

Dear Sir or Madam:

Vistra Operations Company LLC ("Vistra OpCo") hereby submits the Comanche Peak Nuclear Power Plant (CPNPP) 2018 Annual Radioactive Effluent Release Report. The enclosed report is provided pursuant to 10 CFR 50.36a and CPNPP Technical Specification 5.6.3. The report covers the period from January 1, 2018 to December 31, 2018.

This communication contains no new commitments regarding CPNPP Units 1 and 2.

Should you have any questions, please contact Jim Barnette at (254) 897-5866 or Mark Clark at (254) 897-6835.

Sincerely,

Jack C. Hicks

Jack C. Hicks

IE48
NRR

Enclosure:
1 CPNPP 2018 Annual Radioactive Effluent Release Report

c - Scott A. Morris, Region IV
Natreon Jordan, NRR
Resident Inspectors, Comanche Peak

Luminant CPNPP

Comanche Peak Nuclear Power Plant

2018 ANNUAL RADIOACTIVE EFFLUENT RELEASE REPORT

January 1, 2018 - December 31, 2018

Preparer: Donald Rebstock Date: 4/10/19

Reviewer: Cierra Roberts Date: 4/10/19

Approval: Mark Clark Date: 4/10/19

Chemistry Manager

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ACRONYMS AND ABBREVIATIONS

AREOR	Annual Radiological Environmental Operating Report
CFR	Code of Federal Regulations
CPNPP	Comanche Peak Nuclear Power Plant
ECL	Effluent Concentration Limit
HIC	High Integrity Containers
ISFSI	Independent Spent Fuel Storage Installation
LDCR	Licensing Document Change Request
LHMT	Laundry Holdup and Monitor Tanks
LVW	Low Volume Waste
ODCM	Offsite Dose Calculation Manual
OOS	Out of Service
PET	Primary Effluent Tanks
pCi	Pico-Curie
REC	Radiological Effluent Control
SORC	Station Operations Review Committee
μCi	Micro-Curie
WMT	Waste Monitor Tanks
WWHT	Waste Water Holdup Tanks

1.0 Introduction

This Radioactive Effluent Release Report, for Comanche Peak Nuclear Power Plant (CPNPP) Unit 1 and Unit 2, is submitted as required by Technical Specification 5.6.3 and Offsite Dose Calculation Manual (ODCM) Administrative Control 6.9.1.4 for the period January 1, 2018 through December 31, 2018. Data in this report were calculated in accordance with the CPNPP ODCM using the Canberra OpenEMS software.

1.1 Executive Summary

The radioactive effluent monitoring program for 2018 was conducted as described in the following report. Results of the monitoring program indicate continued effort to maintain the release of radioactive effluents to the environment as low as reasonably achievable (ALARA).

In June 2009, the NRC provided revised guidance in Regulatory Guide 1.21, *Measuring, Evaluating and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste, Revision 2*, establishing an updated approach for identifying principal radionuclides. Because the overall quantity of radioactive releases has steadily decreased due to improvements in power plant operations, Carbon-14 (C-14) now qualifies as a "principal radionuclide" (anything greater than one percent of overall radioactivity in effluents) under federal regulations at many plants. In other words, C-14 has not increased and C-14 is not a new nuclear plant emission. Rather, improvements in the mitigation of other isotopes have made C-14 more prominent. Attachment 10.3 provides more detail about C-14.

1.1 Executive Summary (continued)

Gaseous Effluents:

Two-year summary of all the radioactive gaseous releases to the environment:

Gaseous Waste	2017	2018	Comments
Tritium (Ci)	34.4	32.6	1
C-14 (Ci)	19.3	25.3	2
Total Fission and Activation Products (Ci)	0.42	0.42	
Total Particulate (Ci)	0	0	3
Gross Alpha (Ci)	0	0	3
Iodine (Ci)	0	0	3
Calculated Gamma Air Dose (mRad)	3.60E-04	3.69E-04	
Calculated Beta Air Dose (mRad)	1.35E-04	1.38E-04	
Total Body Dose (mRem)	0.08	0.09	

Comments:

1. The major contributor to gaseous tritium activity is evaporation from the spent fuel pools. Factors contributing to the tritium activity in the pools are related to the type of fuel used (i.e., 18-month fuel) the core life, power output, and number of core cycles.

2. C-14 activity released from the site is estimated using reactor power in accordance with EPRI document "Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents". 2017 C-14 activity released was lower due to unit refueling and maintenance outages during the year which resulted in less total C-14 produced for the site.

3. No detectable particulate, gross alpha, or iodine activity was released during 2018.

Overall the gaseous radioactivity releases from CPNPP are well controlled and maintained ALARA. CPNPP is well below all applicable limits for gaseous releases. Neither unit had fuel defects during the year of this report.

1.1 Executive Summary (continued)

Liquid Effluents:

Two-year summary of all the radioactive liquid releases to the environment:

Liquid Waste	2017	2018	Comments
Total Activity Excluding Tritium (Ci)	1.06E-03	4.25E-04	1
Tritium Activity (Ci)	2510	2120	2
Total Body Dose (mRem)	0.13	0.14	
Total Volume Released (Gallons)	1,231,176	694,848	3

Comments:

1. Less total liquid activity was released during 2018 since there was only 1 refueling outage and no maintenance outages when compared with 2017.
2. Tritium released values can vary significantly from year to year based on a couple of factors. First, reactor coolant tritium production changes based on fuel burnup characteristics. Tritium activity increases following reactor startup, then plateaus mid-cycle, and begins to decline towards the end of cycle. Second, the tritium released value is dependent upon how many outages there were during a calendar year. More liquid waste is processed and released during unit outages. 2017 was a multi-outage year which resulted in more tritium activity being discharged.
3. Higher total liquid effluent volume released in 2017 was due to several refueling and maintenance outages that occurred during the calendar year. More liquid waste is processed and released during unit outages.

Meteorological Data

During 2018, the CPNPP meteorological system achieved a greater than 98% mean recoverable data rate for the joint frequency parameters required by Regulatory Guide 1.23 for wind speed, wind direction and delta temperature. See Section 7.1 for the actual recovery percentages.

Monitors OOS > 30 Days

During 2018, there were no Technical Specification/ODCM effluent radiation monitors out of service (OOS) for >30 days.

ODCM Changes

No changes were made to the ODCM during 2018.

1.1 Executive Summary (continued)

Solid Waste

Two-year summary of the solid waste production:

Total Waste	2017	2018	% Error
Shipped (m^3)	360	163	25%
Shipped (Ci)	22.6	1030	25%
Buried (m^3)	48.5	28.9	25%
Buried (Ci)	22.5	1030	25%

Comments:

Solid waste shipments and burials have generally trended downward over the past 5 years due to solid waste reduction measures.

2017 was a multi-outage year which led to a higher volume of solid waste shipped and buried. The Curie content buried was lower primarily due to overall lower activity within the buried waste.

During 2018, CPNPP shipped off 5 High Integrity Containers (HICs) containing high activity resin in order to make room for future resin transfers and filter changes. These shipments were necessary to ensure the expected volume of resin transferred from the plant during 2019 could be properly stored on site. These shipments led to higher values for Curies shipped and buried for 2018.

Groundwater Tritium

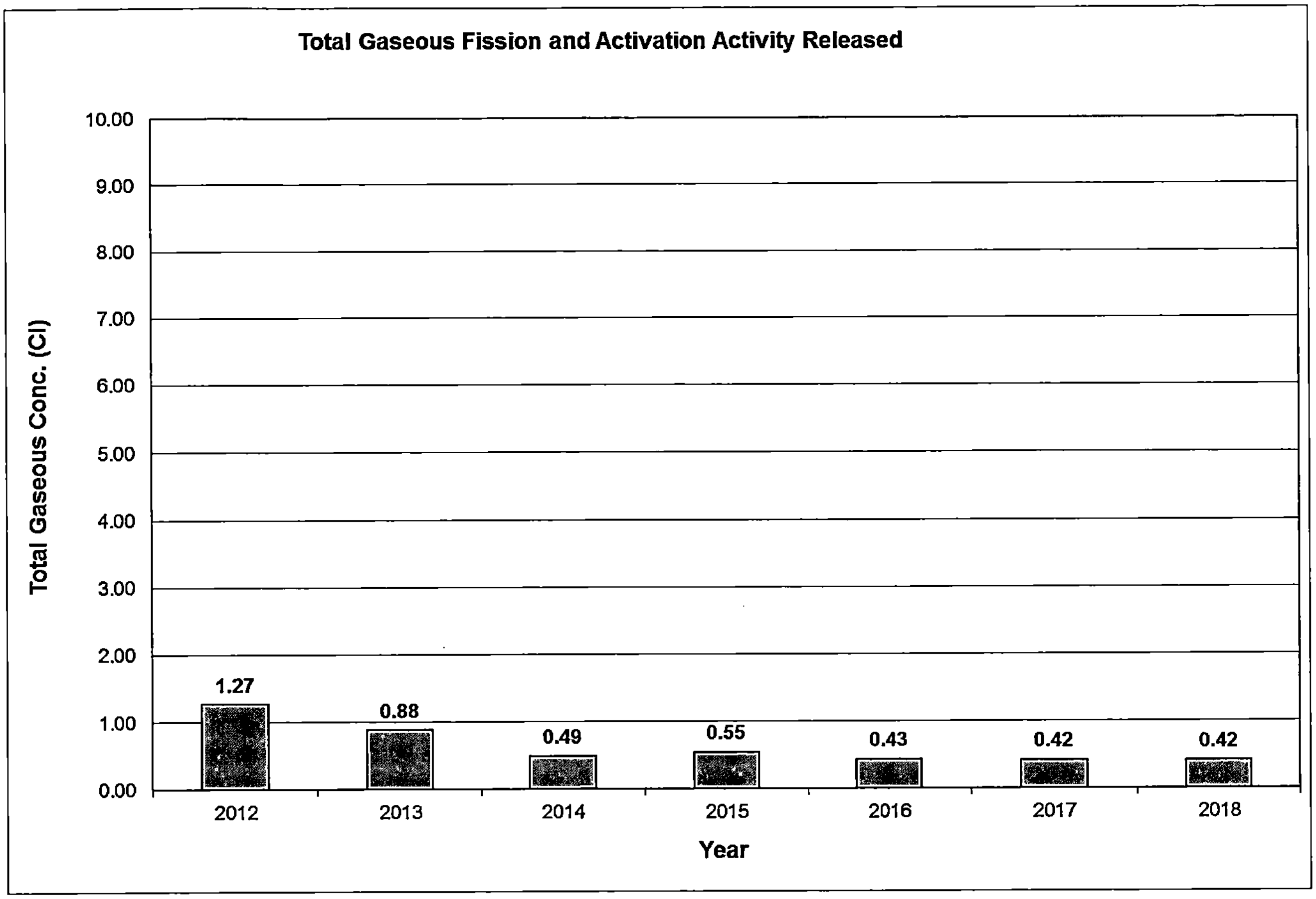
Water wells used to monitor CPNPP for tritium leaks into the groundwater all had results that were less than detectable during 2018. An initial sample collected from Well 11 had a slightly positive tritium result during the 2nd quarter of 2018. However, a subsequent verification sample collected from the same well two weeks later indicated less than detectable tritium activity.

See Section 8.8 for details.

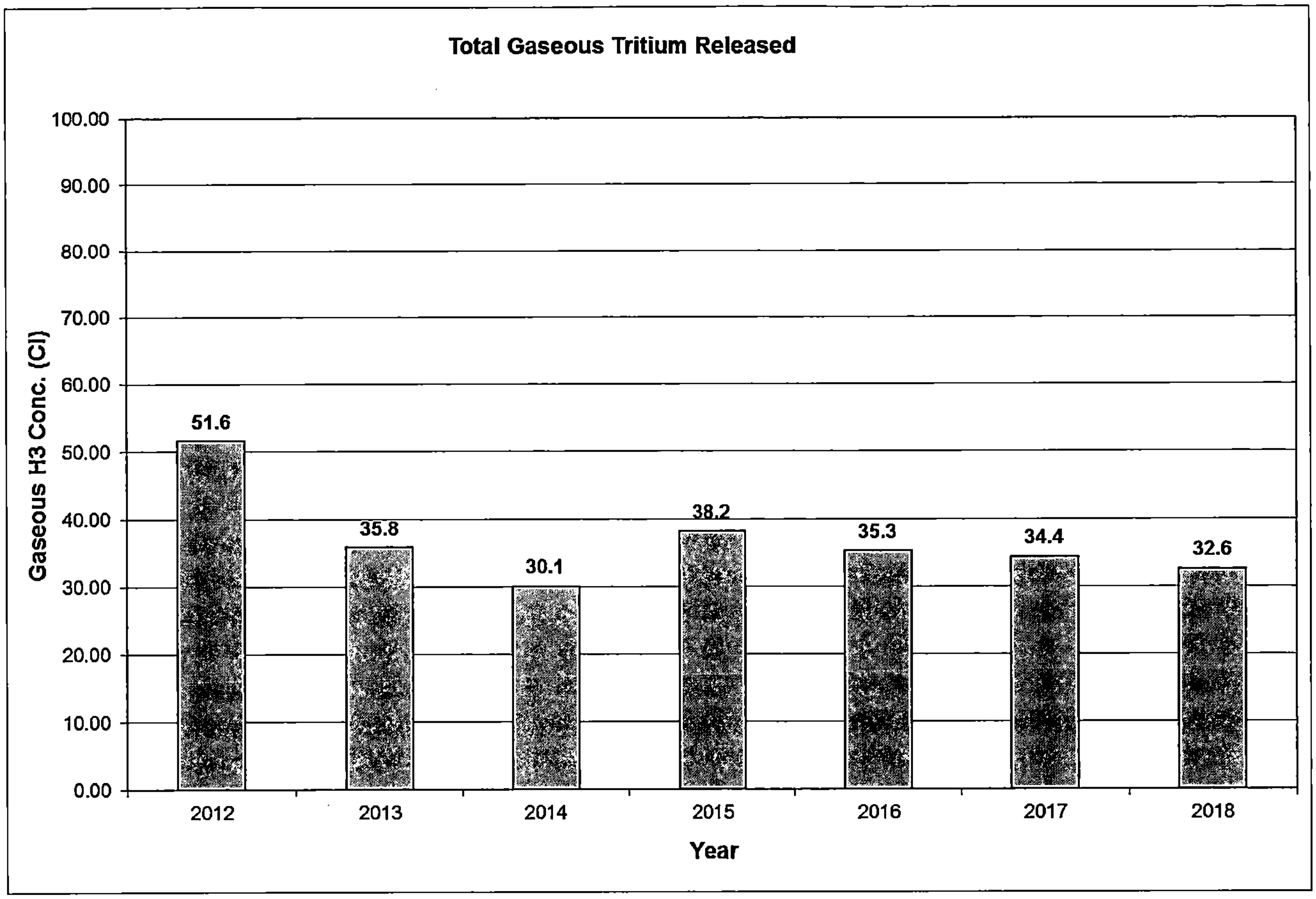
Conclusion

During 2018, the radioactive effluent monitoring program has been conducted in an appropriate manner to ensure the activity released and associated dose to the public has been maintained as low as reasonably achievable (ALARA).

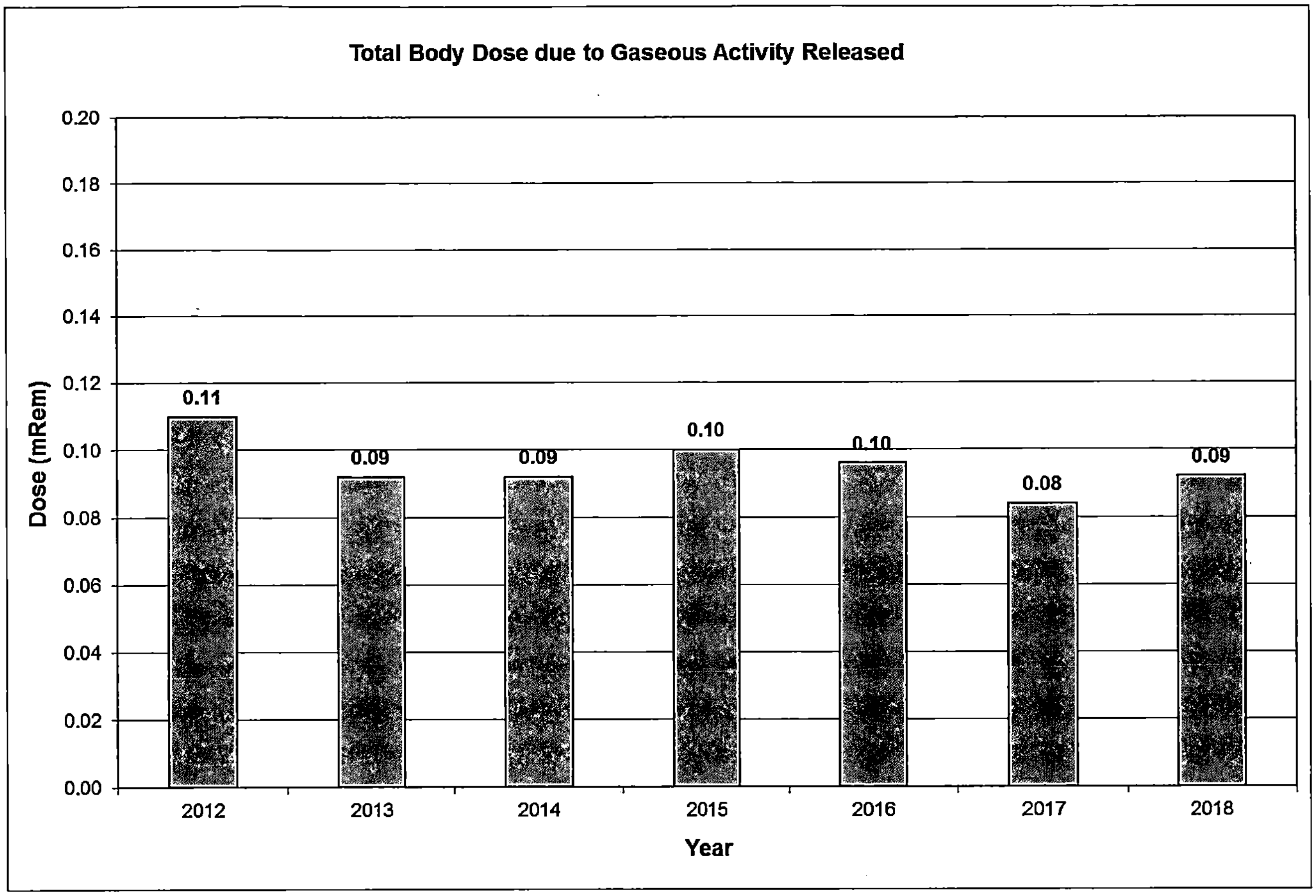
1.2 Historical Trend Graphs



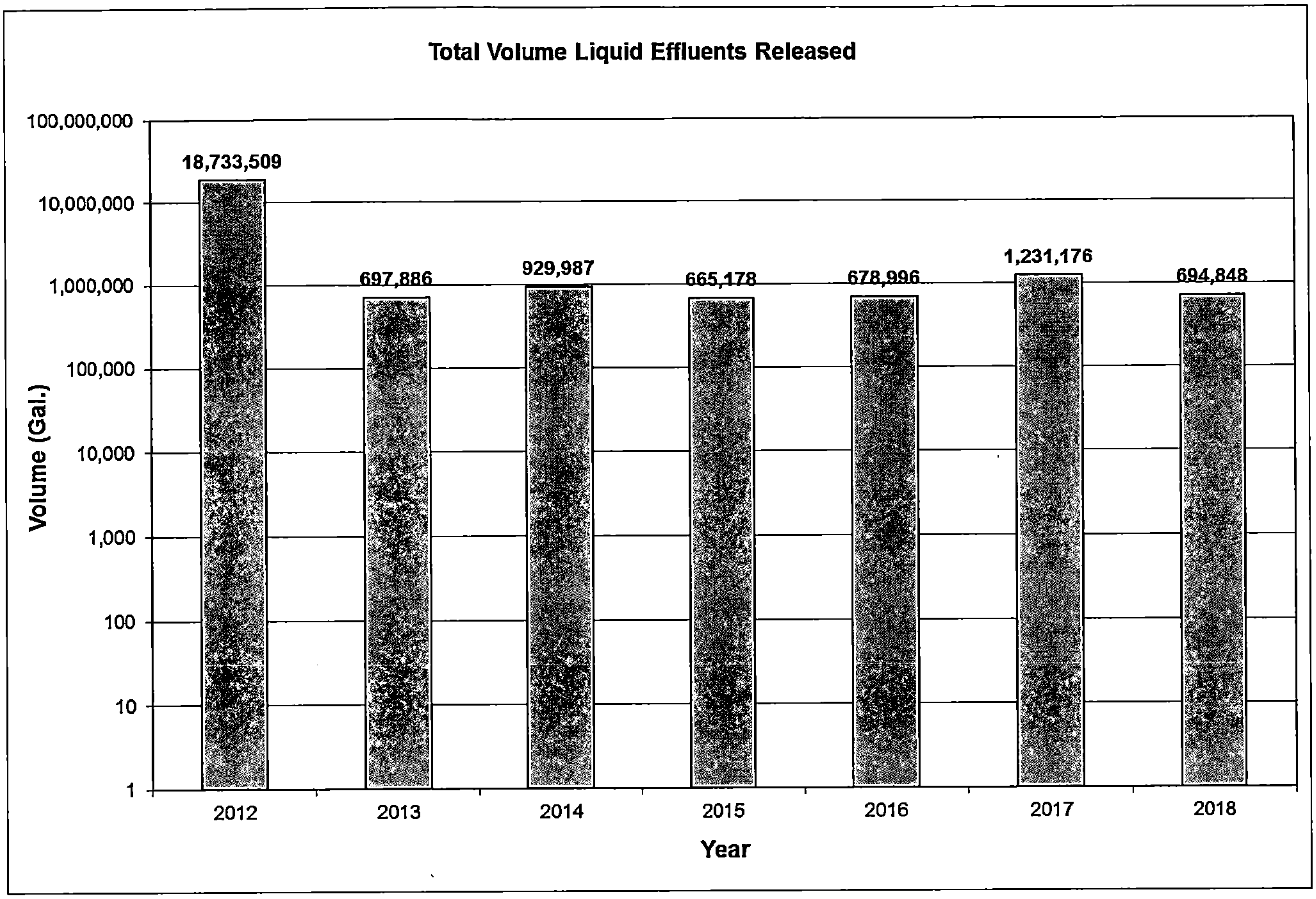
Year	Total Gaseous Fission and Activation Activity Released Comments
All	More gas activity was released during 2012 and 2013 because of a fuel leak in 2011.



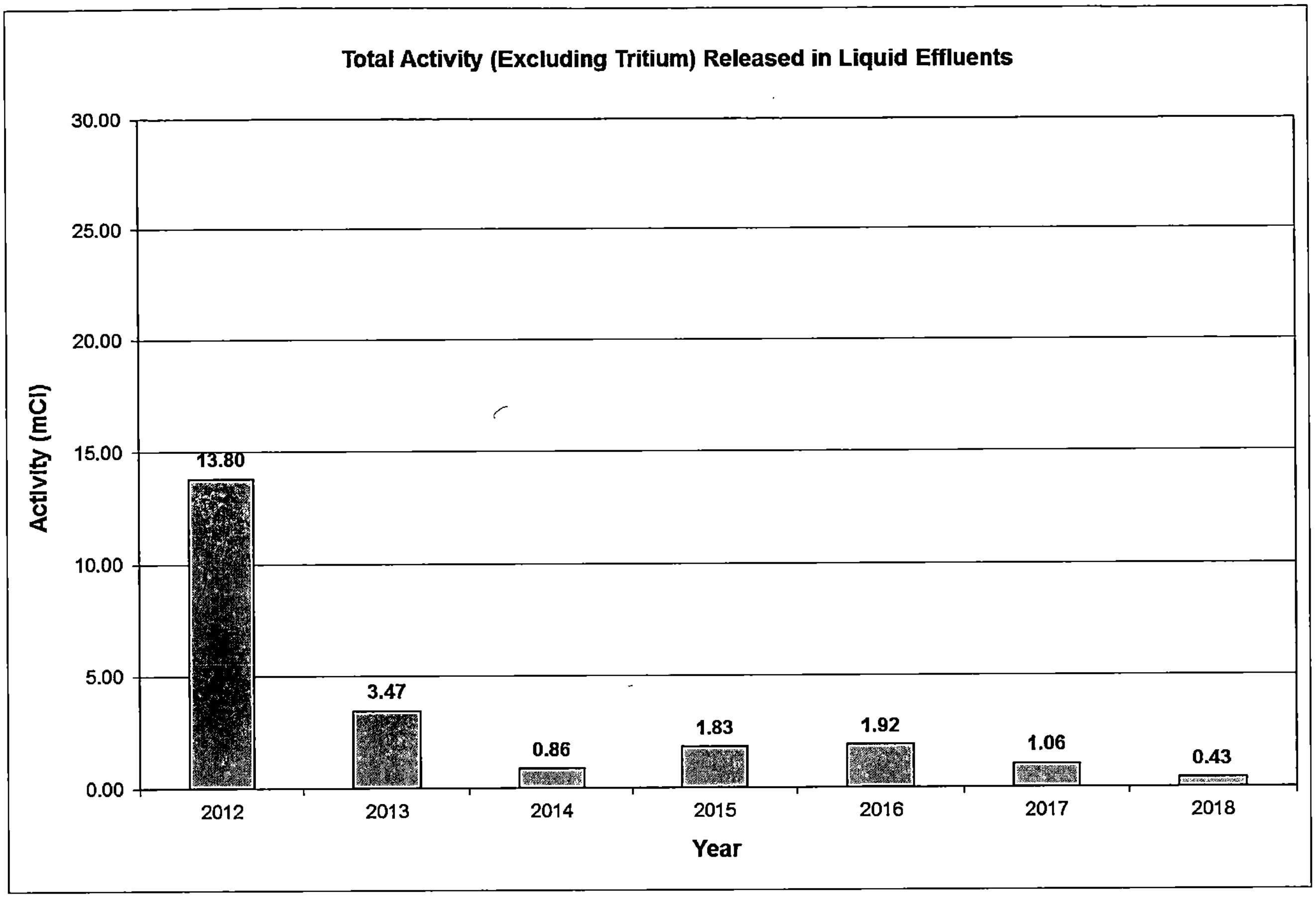
Year	Total Gaseous Tritium Released Comments
All	The major contributor to gaseous tritium activity is evaporation from the spent fuel pools. Factors contributing to the tritium activity in the pools is related to the type of fuel used (i.e., 18-month fuel) the core life, power output, and number of core cycles.



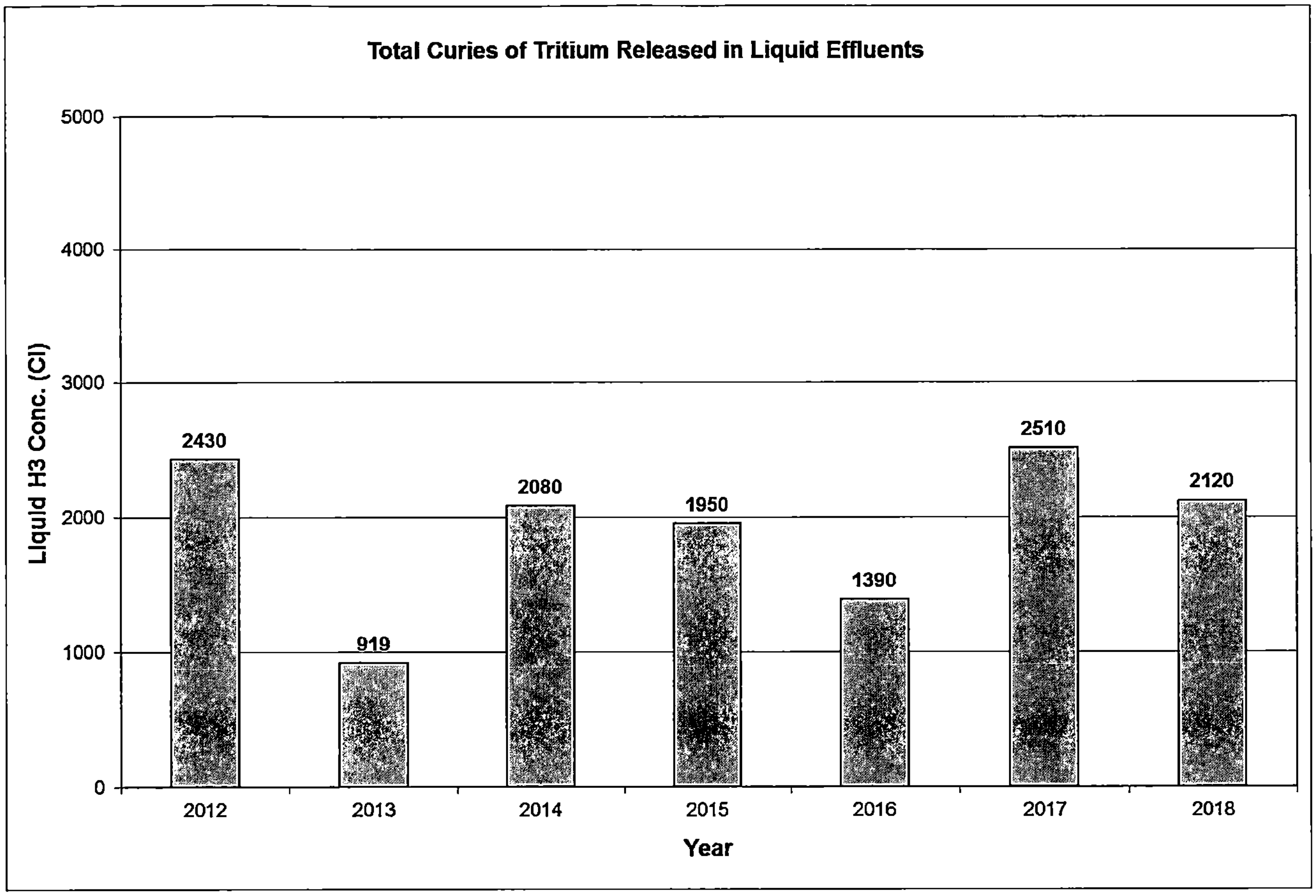
Year	Total Body Dose due to Gaseous Activity Released Comments
2012	There was a mid-cycle outage during 2012 that required degassing of the RCS in addition to a planned refueling outage resulting in slightly higher total body dose for 2012.



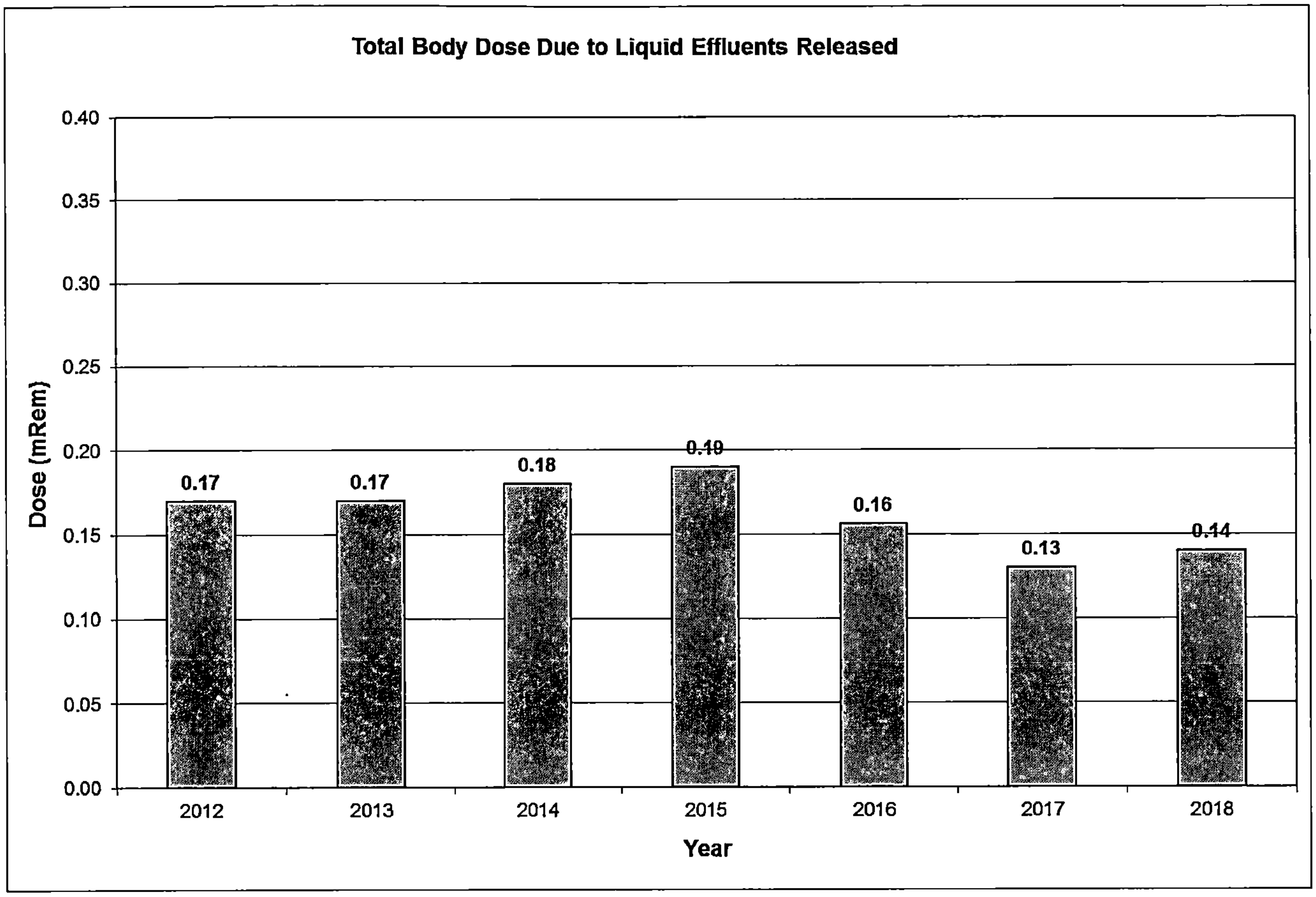
Year	Total Volume Liquid Effluents Released Comments
2012	Analysis of the 2nd quarter LVW composite indicated a small concentration of tritium. Consequently, the volume discharged from the LVW had to be accounted for as radioactive liquid waste for that quarter resulting in a much larger than normal total annual liquid waste volume.
2017	Higher total volume of liquid effluents released was due to unit refueling and maintenance outages during the calendar year. More liquid waste is processed and released during unit outages.



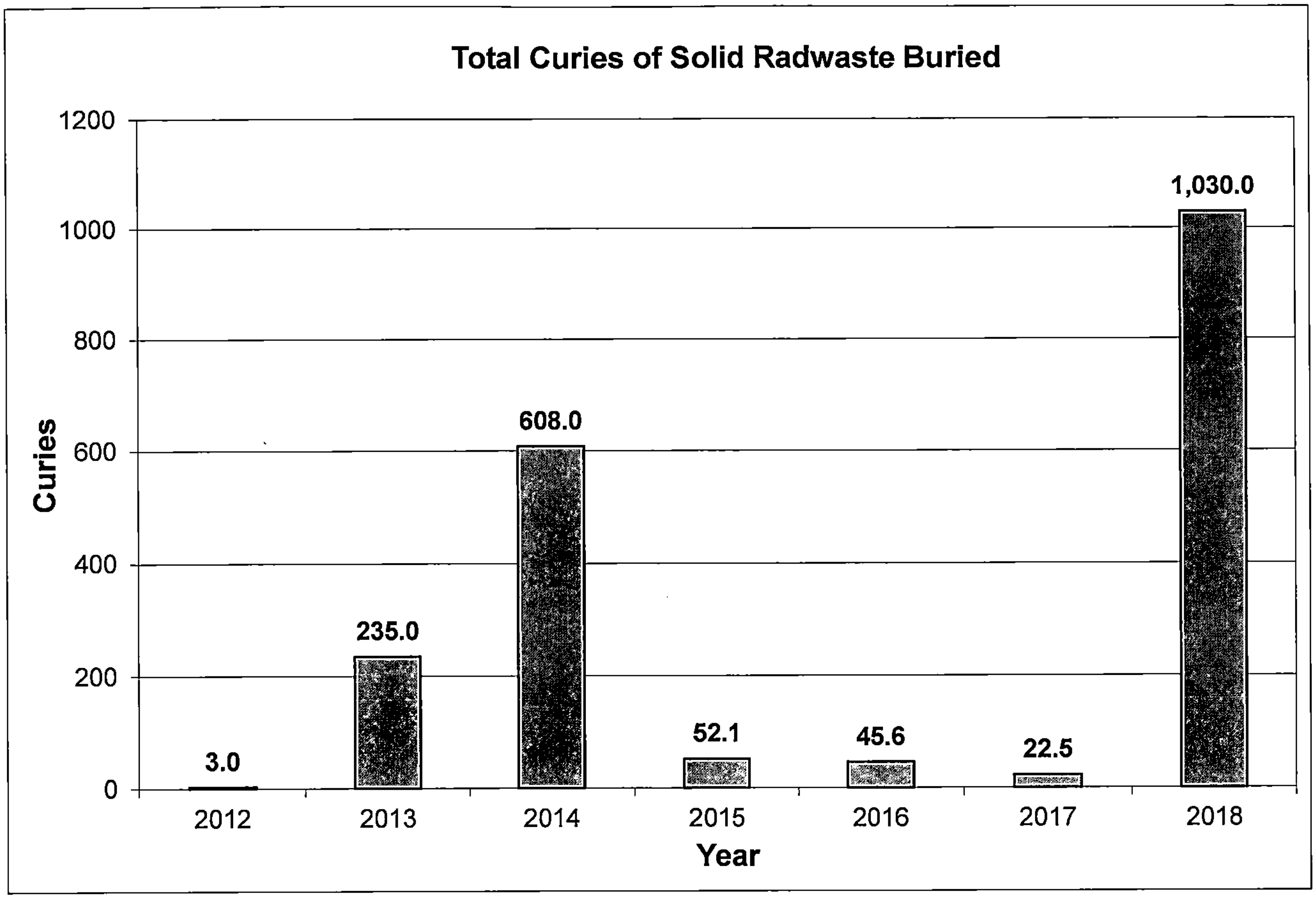
Year	Total Activity (Excluding Tritium) Released in Liquid Effluents Comments
2012	The increased activity for 2012 is attributed to waste water processing for 1 refueling outage, 1 forced outage, and dry cask storage operations.



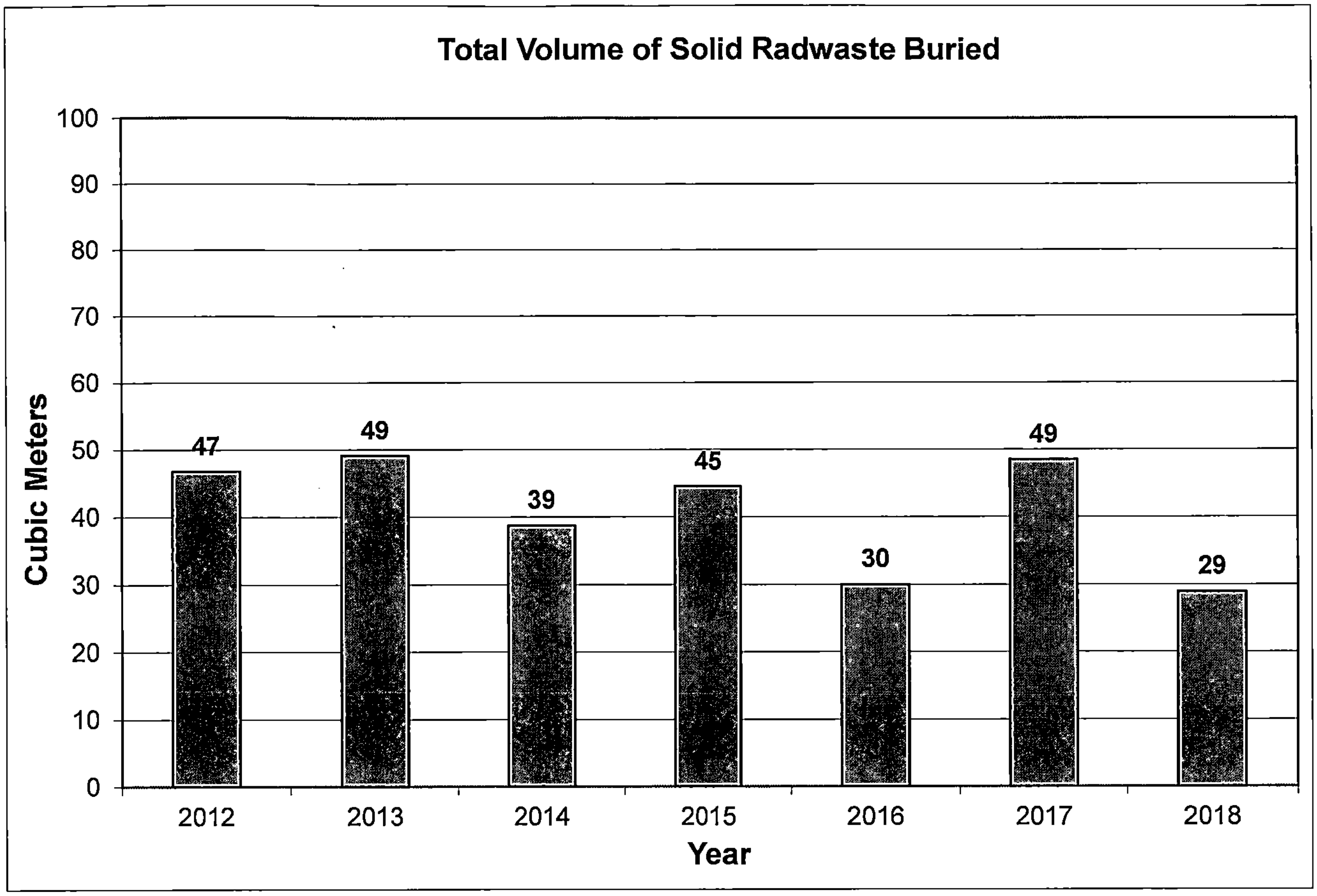
Year	Total Curies of Tritium Released in Liquid Effluents Comments
All	Tritium released values can vary significantly from year to year based on a couple of factors. First, reactor coolant tritium production changes based on fuel burnup characteristics. Tritium activity increases following reactor startup, then plateaus mid-cycle, and begins to decline towards the end of cycle. Second, the tritium released value is dependent upon on how many outages there were during a calendar year. More liquid waste is processed and released during unit outages.
2017	More tritium was released due to multiple outages during the year.



Year	Total Body Dose Due to Liquid Effluents Released Comments
N/A	No comments



Year	Total Curies of Solid Radwaste Buried Comments
2013	In 2013 CPNPP shipped and buried significantly more Class B and C waste to the compact disposal facility in Andrews, Texas. This waste has a very high specific activity with respect to Class A waste. In 2012, CPNPP only disposed of Class A waste and consequently the activity was very low with respect to 2013 values. The buried volume in both years are similar since Class B and C wastes are in packages of 120 cubic feet, or about 3 cubic meters, and consequently, the impact on the overall waste volume is minimal.
2014	In 2014 CPNPP continued to ship and bury stored Class B and Class C wastes at the compact disposal facility in Andrews, Texas. In advance of the compliance date for 10 CFR 37, waste containers with the highest radioactivity, particularly those exceeding category two quantities, were chosen to be shipped. In 2013, CPNPP had just began shipments to the new Andrews, Texas disposal facility and the waste containers chosen for shipment represented lower total activity to allow the staff to become familiar with the new procedure processes required by the new facility. Buried volume in both years are similar since these values are normally associated with Class A Dry Active Waste that represents an order of magnitude more volume than Class B and Class C wastes packaged in 120 cubic feet, or about 3 cubic meter, containers.
2017	Lower total activity buried was due to solid waste having lower activity.
2018	During 2018, CPNPP shipped off 5 High Integrity Containers (HICs) containing high activity resin in order to make room for future resin transfers and filter changes. These shipments were necessary to ensure the expected volume of resin transferred from the plant during 2019 could be properly stored on site. These shipments led to higher values for Curies shipped and buried for 2018.



Year	Total Volume of Solid Radwaste Buried Comments
2013	In 2013 CPNPP shipped and buried significantly more Class B and C waste to the compact disposal facility in Andrews, Texas. This waste has a very high specific activity with respect to Class A waste. In 2012, CPNPP only disposed of Class A waste and consequently the activity was very low with respect to 2013 values. The buried volume in both years are similar since Class B and C wastes are in packages of 120 cubic feet, or about 3 cubic meters, and consequently, the impact on the overall waste volume is minimal.
2014	In 2014 CPNPP continued to ship and bury stored Class B and Class C wastes at the compact disposal facility in Andrews, Texas. In advance of the compliance date for 10 CFR 37, waste containers with the highest radioactivity, particularly those exceeding category two quantities, were chosen to be shipped. In 2013, CPNPP had just began shipments to the new Andrews, Texas disposal facility and the waste containers chosen for shipment represented lower total activity to allow the staff to become familiar with the new procedure processes required by the new facility. Buried volume in both years are similar since these values are normally associated with Class A Dry Active Waste that represents an order of magnitude more volume than Class B and Class C wastes packaged in 120 cubic feet, or about 3 cubic meter, containers.
2016	2016 was a single outage year which resulted in less solid waste shipped and buried when compared to 2015.
2017	2017 was a multi-outage year which led to a higher volume of solid waste shipped and buried.
2018	Shipments of waste during 2018 were based on a one outage year since the last Unit 2 outage carried over into 2019. Additionally, the efficiency methods in place have reduced the shipped/buried volume of waste during the last few years.

2.0 SUPPLEMENTAL INFORMATION

2.1 Regulatory Limits

The ODCM Radiological Effluent Control limits applicable to the release of radioactive material in liquid and gaseous effluents are described in the following sections.

2.1.1 Fission and Activation Gases (Noble Gases)

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

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

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

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

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

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

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

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

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

2.1.3 Liquid Effluents

The concentration of radioactive material released in liquid effluents to unrestricted areas shall be limited to 10 times the concentrations specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 for radionuclides other than dissolved or entrained noble gases. For dissolved or entrained noble gases, the concentration shall be limited to 2.0E-4 µCi/mL total activity.

The dose or dose commitment to a MEMBER OF THE PUBLIC from radioactive materials in liquid effluents released, from each unit, to unrestricted areas shall be limited:

a. During any calendar quarter to less than or equal to 1.5 mRem to the whole 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 whole body and to less than or equal to 10 mRem to any organ.

2.1.4 LVW Pond Resin Inventory

The quantity of radioactive material contained in resins transferred to the LVW pond shall be limited by the following expression:

$$(264/V) \bullet \Sigma_j A_j/C_j < 1.0$$

excluding tritium, dissolved or entrained noble gases and radionuclides with less than an 8-day half-life, where:

A_j = pond inventory limit for a single radionuclide j (Curies),

C_j = 10CFR20, Appendix B, Table 2 Column 2, concentration for a single radionuclide j (µCi/mL),

V = volume of resins in the pond (gallons), and

264 = conversion factor (µCi/Ci per mL/gal)

This expression limits the total quantity of radioactive materials in resins discharged to the LVW Pond to a value such that the average concentration in the resins, calculated over the total volume of resins in the pond, will not exceed one times the Effluent Concentration Limits specified in 10 CFR 20, Appendix B, Table 2, Column 2.

2.1.5 Total Dose

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

2.2 Effluent Concentration Limits

2.2.1 Gaseous Effluents

For gaseous effluents, effluent concentration limits (ECL) values are not directly used in release rate calculations since the applicable limits are expressed in terms of dose rate at the site boundary.

2.2.2 Liquid Effluents

The values specified in 10 CFR Part 20, Appendix B, Table 2, Column 2 are used as the ECL for liquid radioactive effluents released to unrestricted areas. A value of 2.0E-04 µCi/mL is used as the ECL for dissolved and entrained noble gases in liquid effluents.

2.3 Measurements and Approximations of Total Radioactivity

Measurements of total radioactivity in liquid and gaseous radioactive effluents were accomplished in accordance with the sampling and analysis requirements of Tables 4.11-1 and 4.11-2, respectively, of the CPNPP ODCM.

2.3.1 Liquid Radioactive Effluents

Each batch release was sampled and analyzed for gamma emitting radionuclides using gamma spectroscopy. Composite samples were analyzed monthly and quarterly for the Primary Effluent Tanks (PET), Waste Monitor Tanks (WMT), Laundry Holdup and Monitor Tanks (LHMT), and Waste Water Holdup Tanks (WWHT). Composite samples were analyzed monthly for tritium and gross alpha radioactivity in the onsite laboratory using liquid scintillation and gas flow proportional counting techniques, respectively. Composite samples were analyzed quarterly for Sr-89, Sr-90, Fe-55, and Ni-63 by a contract laboratory. The results of the composite analyses from the previous month or quarter were used to estimate the quantities of these radionuclides in liquid effluents during the current month or quarter. The total radioactivity in liquid effluent releases was determined from the measured and estimated concentrations of each radionuclide present and the total volume of the effluent released during periods of discharge.

For batch releases of powdex resin to the LVW pond, samples were analyzed for gamma emitting radionuclides, using gamma spectroscopy techniques. Composite samples were analyzed quarterly for Sr-89 and Sr-90 by a contract laboratory.

For continuous releases to the Circulating Water Discharge from the LVW pond, daily grab samples were obtained over the period of pond discharge. These samples were composited and analyzed for gamma emitting radionuclides, using gamma spectroscopy techniques. Composite samples were also analyzed for tritium and gross alpha radioactivity using liquid scintillation and gas flow proportional counting techniques respectively. Composite samples were analyzed quarterly for Sr-89, Sr-90, Fe-55, and Ni-63 by a contract laboratory.

2.3.2 Gaseous Radioactive Effluents

Each gaseous batch release was sampled and analyzed for radioactivity prior to release. Waste Gas Decay Tank samples were analyzed for gamma emitting radionuclides. Containment Building charcoal (iodine), particulate, noble gas, and tritium grab samples were also analyzed for radioactivity prior to each release. The results of the analyses and the total volume of effluent released were used to determine the total amount of radioactivity released in the batch mode.

For continuous effluent release pathways, noble gas and tritium grab samples were collected and analyzed weekly. Samples were analyzed for gamma emitting radionuclides by gamma spectroscopy and liquid scintillation counting techniques. Continuous release pathways were continuously sampled using radioiodine adsorbers and particulate filters. The radioiodine adsorbers and particulate filters were analyzed weekly for I-131 and gamma emitting radionuclides using gamma spectroscopy. Results of the noble gas and tritium grab samples, radioiodine adsorber and particulate filter analyses from the current week and the average effluent flow rate for the previous week were used to determine the total amount of radioactivity released in the continuous mode. Monthly composites of particulate filters were analyzed for gross alpha activity, in the onsite laboratory using the gas flow proportional counting technique. Quarterly composites of particulate filters were analyzed for Sr-89 and Sr-90 by a contract laboratory.

C-14 was estimated in accordance with the methodology in the EPRI report *Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents.* EPRI, Palo Alto, CA: 2010, 1021106. See Attachment 10.3 for more information on C-14.

2.4 Batch Releases

A summary of information for liquid and gaseous batch releases is included in Table 9.1.

2.5 Abnormal (Unplanned) Releases

Abnormal releases are defined as unplanned or uncontrolled releases of radioactive material from the site boundary. There were no abnormal (unplanned) liquid or gaseous radioactive effluent releases during 2018.

3.0 GASEOUS EFFLUENTS

The quantities of radioactive material released in gaseous effluents are summarized in Tables 9.3 and 9.4. All releases of radioactive material in gaseous form are considered to be ground level releases.

4.0 LIQUID EFFLUENTS

The quantities of radioactive material released in liquid effluents are summarized in Tables 9.5 and 9.6.

5.0 SOLID WASTES

The quantities of radioactive material released as solid wastes are summarized in Table 9.10.

6.0 RADIOLOGICAL IMPACT ON MAN

6.1 Dose Due to Liquid Effluents

The dose to an adult from the fish and cow-meat consumption pathways from Squaw Creek Reservoir was calculated in accordance with the methodology and parameters in the ODCM. The results of the calculations are summarized on a quarterly and annual basis in Table 9.7.

6.2 Dose Due to Gaseous Effluents

Air doses due to gaseous effluent gamma and beta emissions were calculated using the highest annual average atmospheric dispersion factor at the Site Boundary location, in accordance with the methodology and parameters in the ODCM. The results of the calculations are summarized on a quarterly and annual basis in Table 9.8.

6.3 Dose Due to Radioiodines, Tritium, and Particulates in Gaseous Releases

The dose to an adult, teen, child, and infant from radioiodines and particulates, for the pathways listed in Part II, Table 2.4 of the ODCM, were calculated using the highest dispersion and deposition factors, as appropriate, in accordance with the methodology and parameters in the ODCM. The results of the calculations are summarized on a quarterly and annual basis in Table 9.9. Because of pathway similarity, C-14 dose is included in this table.

6.4 40CFR190 Dose Evaluation

ODCM Radiological Effluent Control 3.11.4 requires dose evaluations to demonstrate compliance with 40 CFR Part 190 only if the calculated quarterly or yearly dose exceed two times the applicable quarterly or annual dose limits. At no time during 2018 were any of these limits exceeded; therefore, no evaluations are required.

6.5 Dose to a Member of the Public from Activities Inside the Site Boundary

Dose to a Member of the Public from activities inside the site boundary was evaluated. The highest dose resulted from recreational fishing on Squaw Creek Reservoir. A dose of 3.11E-03 mRem/yr was calculated based on an individual fishing twice a week, five hours each day, six months per year. Pathways included in the calculation were gaseous inhalation and submersion. Liquid pathways are not considered since all doses are calculated at the point of circulation water discharge into the reservoir.

7.0 METEROLOGICAL DATA

7.1 Meteorological Monitoring Program

In accordance with ODCM Administrative Control 6.9.1.4, a summary of hourly meteorological data, collected during 2018 is retained onsite. These data are available for review by the NRC upon request. Joint Frequency Tables are included in Attachment 10.1. During the year of this report, the goal of > 90% joint data recovery was met. The individual percent recoveries are listed below:

Meteorological Data Recovery	
Channel	**% Recovery**
10 m Wind Speed	98.8
10 m Wind Direction	99.8
Delta Temperature A	100.0
Delta Temperature B	98.2

8.0 RELATED INFORMATION

8.1 Operability of Liquid and Gaseous Monitoring Instrumentation

ODCM Radiological Effluent Controls 3.3.3.4 and 3.3.3.5 require an explanation of why designated inoperable liquid and gaseous monitoring instrumentation was not restored to operable status within thirty days.

During 2018, there were no instances where these instruments were inoperable for more than thirty days.

8.2 Changes to the Offsite Dose Calculation Manual

There were no changes to the ODCM during 2018.

8.3 New Locations for Dose Calculations or Environmental Monitoring

ODCM Administrative Control 6.9.1.4 requires any new locations for dose calculations and/or environmental monitoring, identified by the Land Use Census, to be included in the Radioactive Effluent Release Report. Based on the 2018 Land Use Census, no new receptor locations were identified which resulted in changes requiring a revision in current environmental sample locations. Values for the current nearest resident, milk animal, garden, X/Q and D/Q values in all sectors surrounding CPNPP were included in the 2018 Land Use Census.

8.4 Liquid Holdup and Gas Storage Tanks

ODCM Administrative Control 6.9.1.4 requires a description of the events leading to liquid holdup or gas storage tanks exceeding the limits required to be established by Technical Specification 5.5.12. Technical Requirements Manual 13.10.33 limits the quantity of radioactive material contained in each unprotected outdoor tank to less than or equal to 10 Curies, excluding tritium and dissolved or entrained noble gases. Technical Requirements Manual 13.10.32 limits the quantity of radioactive material contained in each gas storage tank to less than or equal to 200,000 Curies of noble gases (considered as Xe-133 equivalent). These limits were not exceeded during the period covered by this report.

8.5 Noncompliance with Radiological Effluent Control Requirements

This section provides a listing and description of Abnormal Releases, issues that did not comply with the applicable requirements of the Radiological Effluents Controls given in Part I of the CPNPP ODCM and/or issues that did not comply with associated Administrative Controls and that failed to meet CPNPP expectations regarding Station Radioactive Effluent Controls. Detailed documentation concerning evaluations of these events and corrective actions is maintained onsite.

8.5.1 Abnormal (Unplanned) Gaseous Effluent Release

No abnormal (unplanned) gaseous effluent releases occurred during 2018.

8.5.2 Abnormal (Unplanned) Liquid Effluent Releases

No abnormal (unplanned) liquid effluent releases occurred during 2018.

8.6 Resin Releases to the Low Volume Waste (LVW) Pond

A total of 232 ft^3 of powdex resin was transferred to the LVW pond during 2018. The cumulative activity deposited in the LVW pond since operations began through the end of 2018 is 1.90E-03 Curies, consisting of Co-58, Co-60, Cs-134, Cs-137, I-131, Sr-90 and Sb-125.

8.7 Changes to the Liquid, Gaseous, and Solid Waste Treatment Systems

In accordance with the CPNPP Process Control Program, Section 6.2.6.2, changes to the Radwaste Treatment Systems (liquid, gaseous, and solid) should be summarized and reported to the Commission in the Radioactive Effluent Release Report if the changes implemented required a 10CFR50.59 safety evaluation.

During 2018, no changes to the Radwaste Treatment Systems occurred meeting the reporting criteria of the Process Control Program.

8.8 Groundwater Tritium Monitoring Program

Water wells used to monitor CPNPP for tritium leaks into the groundwater all had results that were less than detectable during 2018. An initial sample collected from Well 11 had a slightly positive tritium result during the 2nd quarter of 2018. However, a subsequent verification sample collected from the same well two weeks later indicated less than detectable tritium activity.

Other areas also monitored, but not considered part of the ground monitoring program include the seepage sump, and Leachate Basins A, B, and C. These sample points are actually of perched (surface) water and not indicative of groundwater tritium.

Previous hydrogeology studies performed by Pastor, Behling and Wheeler LLC, showed that this perched water sits above an impermeable layer of bedrock. This layer keeps tritiated perched water from migrating to the Twin Mountain Aquifer, thereby preventing a potential new pathway to drinking water sources. The layer reroutes the water back to SCR.

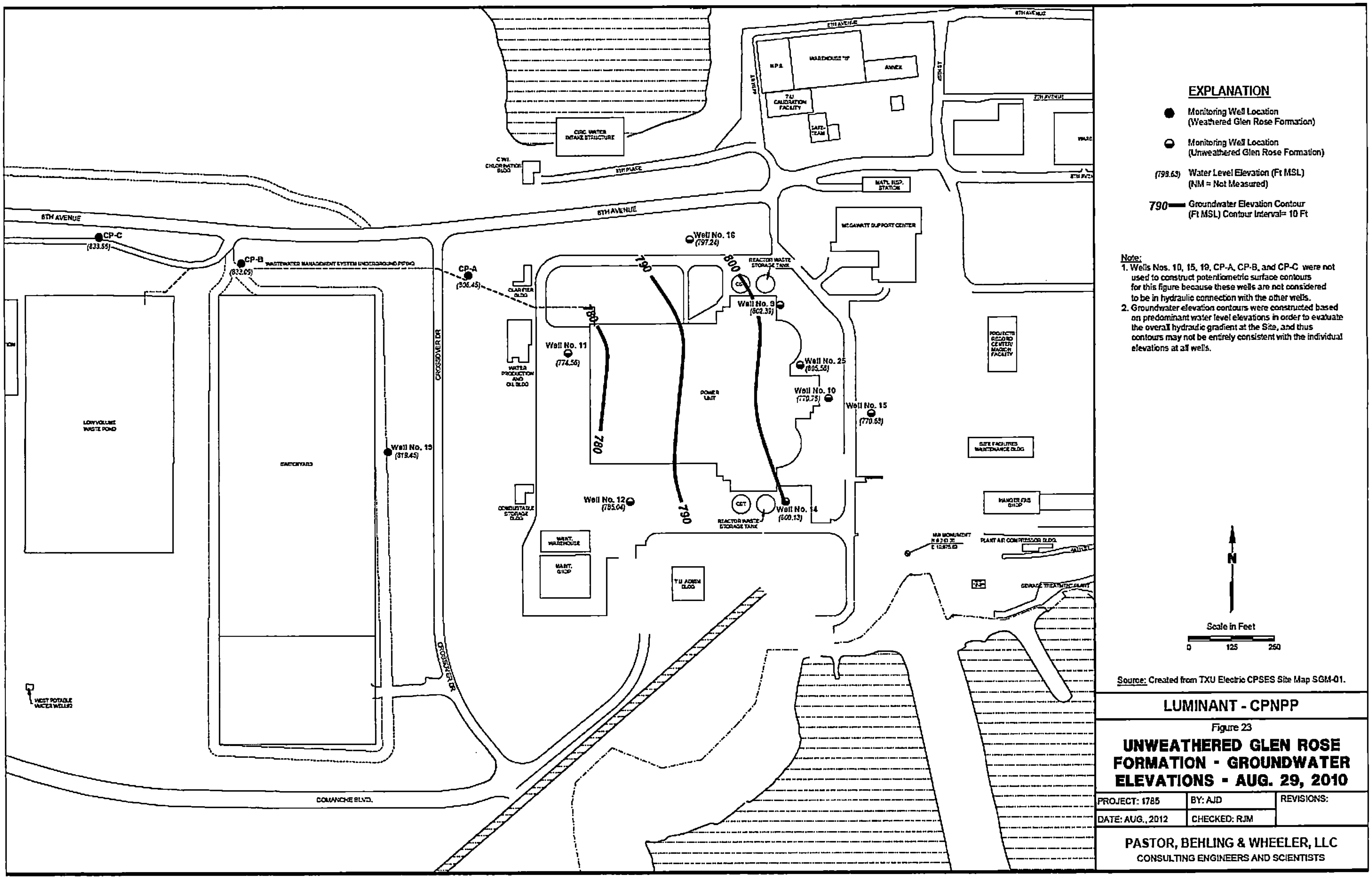
Groundwater monitoring wells below the perched layer have not identified any tritium above the MDA and confirm the claims of the hydrogeology study. Based on this information and the guidance in NEI 07-07, there is no requirement for notification to the NRC or local officials and no requirement for remediation as it is not considered licensed material. Continued monitoring of these perched water sample points will occur as part of the Groundwater Monitoring Program (STA-654) and any new sources of tritium or increase in the activity will be evaluated and remediated as necessary.

Groundwater Tritium Results (pCi/L)

MW Location	3/21/2018	6/20/2018	9/14/2018	11/29/2018
9	<649	<630	<562	<562
10	<649	<630	<562	<562
11	<649	835 (1)	<562	<562
12	<649	<630	<562	<562
14	<649	<630	<562	<562
15	<649	<630	<562	<562
16	<649	<630	<562	<562
19	<649	<630	<562	<562
25	<649	<630	<562	<562
CP-A	<649	<630	<562	<562
CP-B	<649	<630	<562	<562
CP-C	<649	<630	<562	<562

(1) CR-2018-004523; Initial sample from MW 11 had positive tritium results of 835 pCi/L. MW 11 was resampled later on 7/5/18 and the analysis results were less than detectable (<630 pCi/L).

Groundwater Tritium Monitoring Well Map



8.9 Independent Spent Fuel Storage Installation (ISFSI)

There are no radiological effluents released from the ISFSI. Direct dose from this installation is monitored using the normal environmental direct dose program and reported in the Annual Radiological Environmental Operating Report (AREOR).

SECTION 9.0
EFFLUENT TABLES

Table 9.1
Liquid and Gaseous Batch Release Summary

A. Liquid Releases	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Annual**
1. Number of batch releases		3	5	8	17	33
2. Total time period for Batch releases	Minutes	1.01E+03	1.59E+03	2.56E+03	5.51E+03	1.07E+04
3. Maximum time period for a batch release	Minutes	3.58E+02	3.30E+02	3.40E+02	3.60E+02	3.60E+02
4. Average time period for a batch release	Minutes	3.36E+02	3.17E+02	3.19E+02	3.24E+02	3.23E+02
5. Minimum time period for a batch release	Minutes	3.05E+02	3.00E+02	2.90E+02	2.90E+02	2.90E+02

B. Gaseous Releases	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Annual**
1. Number of batch releases		25	27	28	31	111
2. Total time period for batch releases	Minutes	9.13E+03	9.44E+03	9.07E+03	1.14E+04	3.91E+04
3. Maximum time period for a batch release	Minutes	4.82E+02	4.02E+02	3.66E+02	1.82E+03	1.82E+03
4. Average time period for a batch release	Minutes	3.65E+02	3.50E+02	3.24E+02	3.69E+02	3.52E+02
5. Minimum time period for a batch release	Minutes	2.30E+02	2.97E+02	2.85E+02	1.85E+02	1.85E+02

Table 9.2
Abnormal Liquid and Gaseous Batch Release Summary

A. Liquid Abnormal Release Totals	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Totals
1. Number of abnormal releases		0	0	0	0	0
2. Total activity of abnormal releases	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

B. Gas Abnormal Release Totals	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Totals
1. Number of abnormal releases		0	0	0	0	0
2. Total activity of abnormal releases	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 9.3
Gaseous Effluents - Summation of All Releases

Type of Effluent	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
A. Fission and Activation Gases						
1. Total Release	Curies	9.71E-02	8.18E-02	8.55E-02	1.54E-01	4.18E-01
2. Average Release rate for period	µCi/sec	1.25E-02	1.04E-02	1.08E-02	1.93E-02	1.33E-02
3. Percent of Applicable Limit	%	*	*	*	*	*
B. Radioiodines						
1. Total Iodine-131	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Average Release rate for period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Percent of Applicable Limit	%	*	*	*	*	*
C. Particulates						
1. Particulates (Half-Lives > 8 Days)	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Average Release rate for period	µCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Percent of Applicable Limit	%	*	*	*	*	*
D. Tritium						
1. H-3 Release	Curies	5.35E+00	8.30E+00	1.25E+01	6.47E+00	3.26E+01
2. Average Release rate for period	µCi/sec	6.88E-01	1.06E+00	1.57E+00	8.14E-01	1.03E+00
3. Percent of Applicable Limit	%	*	*	*	*	*
E. Carbon-14						
1. C-14 Release	Curies	6.48E+00	6.55E+00	6.53E+00	5.78E+00	2.53E+01
2. Average Release rate for period	µCi/sec	8.33E-01	8.36E-01	8.20E-01	7.27E-01	8.04E-01
3. Percent of Applicable Limit	%	*	*	*	*	*
F. Gross Alpha						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

*** Applicable limits are expressed in terms of dose.**
Estimated Total Error for All Values Reported Is < 1.0%

Table 9.4
Gaseous Effluents - Ground Level Releases

Continuous Mode **Nuclides Released**	**Units**	**Quarter 1**	**Quarter 2**	**Quarter 3**	**Quarter 4**	**Total**
Fission Gases						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Iodines						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium						
H-3	Curies	5.33E+00	8.28E+00	1.25E+01	6.43E+00	3.25E+01
Carbon-14						
C-14	Curies	1.94E+00	1.96E+00	1.96E+00	1.73E+00	7.60E+00
Gross Alpha						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not reported.
Zeros in this table indicates that no radioactivity was present at detectable levels.

Table 9.4 (continued)
Gaseous Effluents - Ground Level Releases

Batch Mode Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Fission Gases						
Ar-41	Curies	8.12E-02	8.14E-02	8.53E-02	1.30E-01	3.78E-01
Kr-85	Curies	1.33E-02	0.00E+00	0.00E+00	2.14E-02	3.47E-02
Xe-131m	Curies	0.00E+00	0.00E+00	0.00E+00	6.22E-06	6.22E-06
Xe-133m	Curies	0.00E+00	0.00E+00	0.00E+00	5.91E-05	5.91E-05
Xe-133	Curies	2.59E-03	4.16E-04	2.13E-04	1.55E-03	4.77E-03
Xe-135m	Curies	0.00E+00	0.00E+00	0.00E+00	7.34E-06	7.34E-06
Xe-135	Curies	0.00E+00	0.00E+00	0.00E+00	3.58E-04	3.58E-04
Total for Period	**Curies**	**9.71E-02**	**8.18E-02**	**8.55E-02**	**1.53E-01**	**4.18E-01**
Iodines						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Particulates						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium						
H-3	Curies	1.99E-02	2.36E-02	2.54E-02	3.83E-02	1.07E-01
Carbon-14						
C-14	Curies	4.53E+00	4.58E+00	4.57E+00	4.04E+00	1.77E+01
Gross Alpha						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not reported.
Zeros in this table indicates that no radioactivity was present at detectable levels.

Table 9.5
Liquid Effluents - Summation Of All Releases

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
A. Fission and Activation Products						
1. Total Release (excludes tritium, gases, alpha)	Curies	2.49E-05	3.54E-05	7.63E-05	2.88E-04	4.25E-04
2. Average diluted concentration during period	µCi/mL	8.77E-12	5.85E-12	7.97E-12	1.49E-11	1.12E-11
3. Percent of Applicable Limit	%	*	*	*	*	*
B. Tritium						
1. Total Release	Curies	1.00E+02	1.46E+02	6.12E+02	1.26E+03	2.12E+03
2. Average diluted concentration during period	µCi/mL	3.54E-05	2.41E-05	6.39E-05	6.50E-05	5.60E-05
3. Percent of Applicable Limit	%	*	*	*	*	*
C. Dissolved and Entrained Gases						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	4.25E-04	4.25E-04
2. Average diluted concentration during period	µCi/mL	0.00E+00	0.00E+00	0.00E+00	2.19E-11	1.12E-11
3. Percent of Applicable Limit	%	*	*	*	*	*
D: Gross Alpha Radioactivity						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Average diluted concentration during period	µCi/mL	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
E: Waste Vol Release (Pre-Dilution)	Liters	2.54E+05	3.79E+05	6.26E+05	1.37E+06	2.63E+06
F. Volume of Dilution Water Used	Liters	2.83E+09	6.05E+09	9.58E+09	1.94E+10	3.78E+10

*** Applicable limits are expressed in terms of dose.**
Estimated Total Error for All Values Reported is < 1.0%

Table 9.6
Liquid Effluents

Continuous Mode

Nuclides Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Fission and Activation Products						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Tritium						
H-3	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Dissolved and Entrained Gases						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Gross Alpha Radioactivity	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Batch Mode

Nuclides Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Fission and Activation Products						
Co-58	Curies	1.95E-05	0.00E+00	1.29E-06	2.68E-04	2.88E-04
Co-60	Curies	5.38E-06	0.00E+00	2.68E-06	2.05E-05	2.85E-05
Ni-63	Curies	0.00E+00	3.54E-05	7.23E-05	0.00E+00	1.08E-04
Total for Period	**Curies**	**2.49E-05**	**3.54E-05**	**7.63E-05**	**2.89E-04**	**4.25E-04**
Tritium						
H-3	Curies	1.00E+02	1.46E+02	6.12E+02	1.26E+03	2.12E+03
Dissolved and Entrained Gases						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	4.25E-04	4.25E-04
Gross Alpha Activity						
No Nuclides Found	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

If Not Detected, Nuclide is Not reported.
Zeros in this table indicates that no radioactivity was present at detectable levels.

Table 9.7
Dose Due to Liquid Releases

Organ Dose	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Bone	mRem	0.00E+00	4.90E-06	1.00E-05	0.00E+00	1.49E-05
Limit	mRem	5	5	5	5	10
Percent of Limit	%	0.000	0.000	0.000	0.000	0.000
Liver	mRem	3.64E-02	3.59E-02	3.44E-02	3.31E-02	1.40E-01
Limit	mRem	5	5	5	5	10
Percent of Limit	%	0.728	0.718	0.688	0.661	1.397
Total Body	mRem	3.64E-02	3.59E-02	3.44E-02	3.31E-02	1.40E-01
Limit	mRem	1.5	1.5	1.5	1.5	3
Percent of Limit	%	2.426	2.392	2.294	2.204	4.658
Thyroid	mRem	3.64E-02	3.59E-02	3.44E-02	3.31E-02	1.40E-01
Limit	mRem	5	5	5	5	10
Percent of Limit	%	0.728	0.718	0.688	0.661	1.397
Kidney	mRem	3.64E-02	3.59E-02	3.44E-02	3.31E-02	1.40E-01
Limit	mRem	5	5	5	5	10
Percent of Limit	%	0.728	0.718	0.688	0.661	1.397
Lung	mRem	3.64E-02	3.59E-02	3.44E-02	3.31E-02	1.40E-01
Limit	mRem	5	5	5	5	10
Percent of Limit	%	0.728	0.718	0.688	0.661	1.397
GI-Lli	mRem	3.64E-02	3.59E-02	3.44E-02	3.31E-02	1.40E-01
Limit	mRem	5	5	5	5	10
Percent of Limit	%	0.728	0.718	0.688	0.661	1.397

Table 9.8
Air Dose Due To Gaseous Releases

NG Dose	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Gamma Air	mRad	7.92E-05	7.92E-05	8.30E-05	1.27E-04	3.69E-04
Limit	mRad	5	5	5	5	10
Percent of Limit	%	0.002	0.002	0.002	0.003	0.004
Beta Air	mRad	3.09E-05	2.80E-05	2.93E-05	4.94E-05	1.38E-04
Limit	mRad	10	10	10	10	20
Percent of Limit	%	0.000	0.000	0.000	0.000	0.001
NG Total Body	mRem	7.53E-05	7.53E-05	7.89E-05	1.21E-04	3.50E-04
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.001	0.001	0.001	0.002	0.002
NG Skin	mRem	1.12E-04	1.10E-04	1.15E-04	1.80E-04	5.17E-04
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.001	0.001	0.002	0.002	0.003

Table 9.9
Dose Due to Radioiodines, Particulates, Tritium, and Carbon-14 in Gaseous Releases

Organ Dose	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Liver	mRem	1.94E-02	2.36E-02	2.95E-02	1.97E-02	9.22E-02
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.259	0.315	0.393	0.263	0.615
Total Body	mRem	1.94E-02	2.36E-02	2.95E-02	1.97E-02	9.22E-02
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.259	0.315	0.393	0.263	0.615
Thyroid	mRem	1.94E-02	2.36E-02	2.95E-02	1.97E-02	9.22E-02
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.259	0.315	0.393	0.263	0.615
Kidney	mRem	1.94E-02	2.36E-02	2.95E-02	1.97E-02	9.22E-02
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.259	0.315	0.393	0.263	0.615
Lung	mRem	1.94E-02	2.36E-02	2.95E-02	1.97E-02	9.22E-02
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.259	0.315	0.393	0.263	0.615
GI-Lli	mRem	1.94E-02	2.36E-02	2.95E-02	1.97E-02	9.22E-02
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.259	0.315	0.393	0.263	0.615
Bone	mRem	6.14E-02	6.20E-02	6.18E-02	5.47E-02	2.40E-01
Limit	mRem	7.5	7.5	7.5	7.5	15
Percent of Limit	%	0.818	0.827	0.824	0.730	1.600

Table 9.10
Solid Radwaste and Irradiated Fuel Shipments

A. Solid Waste Shipped Offsite for Burial or Disposal (Not Irradiated Fuel)

1. Type of Waste	Shipped m^3	Shipped Ci	Buried m^3	Buried Ci	Percent Error
a. Spent resins/filters	1.70E+01	1.03E+03	1.70E+01	1.03E+03	± 25%
b. Dry active waste	1.46E+02	1.17E-01	1.19E+01	2.34E-02	± 25%
c. Irradiated components	0	0	0	0	N/A
d. Other (oil/miscellaneous liquids sent to processor for volume reduction)	0	0	0	0	N/A
TOTAL	1.63E+02	1.03E+03	2.89E+01	1.03E+03	± 25%

Note: Shipped volumes and curies are not always equal to the buried volumes and curies as a result of volume reducing processing, and some disposal occurs outside the twelve-month time period in which shipments occurred.

Dry active waste also includes some low-level radioactive resins, tank sediments, and filters that are handled and processed in a manner that is consistent with this waste stream.

2. Estimate of Major Nuclide Composition (by type of waste)	Nuclide	% Abundance	Activity Ci
a. Spent resins/filters	Ni-63	82.41	8.47E+02
	Fe-55	9.16	9.42E+01
	Co-60	6.04	6.20E+01
	Co-58	0.00	5.08E-03
	Cs-137d	0.92	9.49E+00
	Ni-59	0.58	5.93E+00
	Mn-54	0.15	1.51E+00
	C-14	0.35	3.62E+00
	H-3	0.01	8.04E-02
	Tc-99	<0.01	2.87E-02
	I-129	LLD	-0-
	Other (1)	0.38	6.20E+00
	Total	100.00	1.03E+03
b. Dry active waste	Fe-55	38.40	4.50E-02
	Ni-63	22.64	2.65E-02
	Co-60	17.13	2.01E-02
	Co-58	16.02	1.88E-02
	Mn-54	1.89	2.22E-03
	Nb-95	1.21	1.42E-03
	Sb-125	0.82	9.57E-04
	Zr-95	0.65	7.57E-04
	Co-57	0.29	3.43E-04
	Cr-51	0.26	3.09E-04
	H-3	LLD	-0-
	Tc-99	LLD	-0-
	I-129	LLD	-0-
	Other (2)	0.69	8.08E-04
	Total	100.00	1.17E-01

(1) Nuclides representing <1% of total shipped activity: Co-57, Sr-90, Zr-95, Nb-95, Sn-113, Sb-125, Cs-134, Ce-144, Pu-238, Pu-239/40, Pu-241, Am-241, Cm-242, Cm-243/44.
(2) Nuclides representing <1% of total shipped activity: C-14, Sr-90d, Nb-94, Sn-113, Cs-134, Cs-137d, Ce-144d.

Table 9.10 (continued)
Solid Radwaste and Irradiated Fuel Shipments

3. Solid Waste Disposition (Mode of Transportation: Truck)				
Waste Type	**Waste Class**	**Container Type**	**Number of Shipments**	**Destination**
a. Resin/filters	B	Poly HIC*	3	Waste Control Specialists, Andrews, TX
	C	Poly HIC*	2	
b. Dry active waste	A	General Design	2	Energy Solutions Oak Ridge, TN

*High Integrity Container

B. Irradiated Fuel Shipments (Disposition)

Number of Shipments	Mode of Transportation	Destination
0	N/A	N/A

Attachment 10.1
Meteorological Joint Frequency Distribution Tables

Reg. Guide 1.21 Joint Frequency Table

CPNPP

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 1-JAN-2018 00:00 to 31-DEC-2018 23:59

STABILITY CLASS **A**

ELEVATION: 10 m

WIND DIRECTION	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	12	32	33	4	0	82
NNE	2	13	19	1	0	0	35
NE	3	26	8	0	0	0	37
ENE	6	49	7	3	0	0	65
E	1	20	5	0	0	0	26
ESE	2	32	36	4	0	0	74
SE	2	34	33	12	0	0	81
SSE	2	59	94	49	4	0	208
S	1	23	70	70	19	0	183
SSW	1	14	10	11	4	0	40
SW	0	8	6	0	0	0	14
WSW	0	0	2	0	0	0	2
W	0	2	0	0	0	0	2
WNW	0	0	0	0	0	0	0
NW	0	2	7	9	5	3	26
NNW	0	9	24	19	3	2	57
VARIABLE	17	4	1	0	0	0	22
TOTAL	38	307	354	211	39	5	954
Periods of calm (hours):		0					
Hours of missing data:		11					

Reg. Guide 1.21 Joint Frequency Table

CPNPP

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 1-JAN-2018 00:00 to 31-DEC-2018 23:59

STABILITY CLASS **B**

ELEVATION: 10 m

WIND DIRECTION	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	8	20	17	2	0	47
NNE	0	7	7	5	0	0	19
NE	3	16	3	1	0	0	23
ENE	11	13	1	0	0	0	25
E	5	12	1	0	0	0	18
ESE	1	24	10	0	0	0	35
SE	1	19	21	3	0	0	44
SSE	1	17	31	24	8	0	81
S	2	9	39	59	13	0	122
SSW	0	9	26	19	4	0	58
SW	1	5	11	1	0	0	18
WSW	0	3	6	2	0	0	11
W	0	0	3	2	0	0	5
WNW	0	1	1	1	0	0	3
NW	0	4	5	9	3	1	22
NNW	4	14	20	13	6	1	58
VARIABLE	8	3	1	0	0	0	12
TOTAL	37	164	206	156	36	2	601
Periods of calm (hours):	0						
Hours of missing data:	5						

Reg. Guide 1.21 Joint Frequency Table

CPNPP

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 1-JAN-2018 00:00 to 31-DEC-2018 23:59

STABILITY CLASS **C**

ELEVATION: 10 m

WIND DIRECTION	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	4	29	38	7	0	80
NNE	1	15	12	4	0	0	32
NE	6	6	7	1	0	0	20
ENE	9	6	2	0	0	0	17
E	8	7	5	1	0	0	21
ESE	4	26	16	0	0	0	46
SE	6	25	19	5	0	0	55
SSE	2	25	31	27	4	0	89
S	1	13	45	57	9	0	125
SSW	1	11	25	28	6	0	71
SW	0	10	16	8	0	0	34
WSW	1	7	5	2	1	0	16
W	1	0	4	4	0	0	9
WNW	0	1	2	0	1	0	4
NW	1	5	11	12	8	3	40
NNW	1	19	24	44	22	4	114
VARIABLE	10	2	2	0	0	0	14
TOTAL	54	182	255	231	58	7	787
Periods of calm (hours):	1						
Hours of missing data:	13						

Reg. Guide 1.21 Joint Frequency Table

CPNPP

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 1-JAN-2018 00:00 to 31-DEC-2018 23:59

STABILITY CLASS **D**

ELEVATION: 10 m

WIND DIRECTION	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	17	124	196	85	13	1	436
NNE	4	89	89	26	8	0	216
NE	8	43	35	4	0	0	90
ENE	15	38	40	0	0	0	93
E	22	80	12	2	0	0	116
ESE	37	113	40	3	0	0	193
SE	18	250	202	31	3	0	504
SSE	14	145	388	218	18	1	784
S	7	76	264	210	25	1	583
SSW	5	58	79	47	5	1	195
SW	5	29	25	7	0	0	66
WSW	6	19	15	3	0	0	43
W	6	4	10	4	0	0	24
WNW	10	30	26	8	0	0	74
NW	9	29	61	45	11	1	156
NNW	16	42	105	130	31	1	325
VARIABLE	66	16	3	1	0	0	86
TOTAL	265	1185	1590	824	114	6	3984
Periods of calm (hours):	3						
Hours of missing data:	121						

Reg. Guide 1.21 Joint Frequency Table

CPNPP

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 1-JAN-2018 00:00 to 31-DEC-2018 23:59

STABILITY CLASS **E**

ELEVATION:
10 m

WIND DIRECTION	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	14	41	19	2	0	0	76
NNE	6	46	21	1	0	0	74
NE	1	10	1	1	0	0	13
ENE	4	6	0	0	0	0	10
E	9	22	1	0	0	0	32
ESE	17	74	2	0	0	0	93
SE	24	263	78	2	0	0	367
SSE	19	167	231	7	1	0	425
S	13	63	87	3	0	0	166
SSW	14	34	45	9	0	0	102
SW	12	17	11	3	0	0	43
WSW	18	13	15	3	0	0	49
W	8	7	6	0	0	0	21
WNW	9	23	9	2	0	0	43
NW	7	63	28	2	0	0	100
NNW	8	12	7	2	0	0	29
VARIABLE	54	13	2	0	0	0	69
TOTAL	237	874	563	37	1	0	1712
Periods of calm (hours):	5						
Hours of missing data:	14						

Reg. Guide 1.21 Joint Frequency Table

CPNPP

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 1-JAN-2018 00:00 to 31-DEC-2018 23:59

STABILITY CLASS **F**

ELEVATION: 10 m

WIND DIRECTION	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	2	1	0	0	0	0	3
NNE	1	3	1	0	0	0	5
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	1	0	0	0	0	1
ESE	2	2	0	0	0	0	4
SE	4	36	3	0	0	0	43
SSE	13	13	2	0	0	0	28
S	12	14	8	0	0	0	34
SSW	18	21	9	0	0	0	48
SW	21	24	7	0	0	0	52
WSW	19	12	11	0	0	0	42
W	8	12	3	0	0	0	23
WNW	9	7	0	0	0	0	16
NW	5	15	2	0	0	0	22
NNW	5	5	0	0	0	0	10
VARIABLE	24	4	0	0	0	0	28
TOTAL	143	170	46	0	0	0	359
Periods of calm (hours):	5						
Hours of missing data:	1						

Reg. Guide 1.21 Joint Frequency Table

CPNPP

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 1-JAN-2018 00:00 to 31-DEC-2018 23:59

STABILITY CLASS **G**

ELEVATION: 10 m

WIND DIRECTION	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0
E	0	0	0	0	0	0	0
ESE	0	0	0	0	0	0	0
SE	1	0	0	0	0	0	1
SSE	3	0	0	0	0	0	3
S	6	1	0	0	0	0	7
SSW	11	12	3	0	0	0	26
SW	13	16	4	0	0	0	33
WSW	17	25	6	0	0	0	48
W	10	6	1	0	0	0	17
WNW	8	1	0	0	0	0	9
NW	16	13	1	0	0	0	30
NNW	0	2	0	0	0	0	2
VARIABLE	4	0	0	0	0	0	4
TOTAL	89	76	15	0	0	0	180
Periods of calm (hours):		3					
Hours of missing data:		0					

Reg. Guide 1.21 Joint Frequency Table

CPNPP

HOURS AT EACH WIND SPEED AND DIRECTION

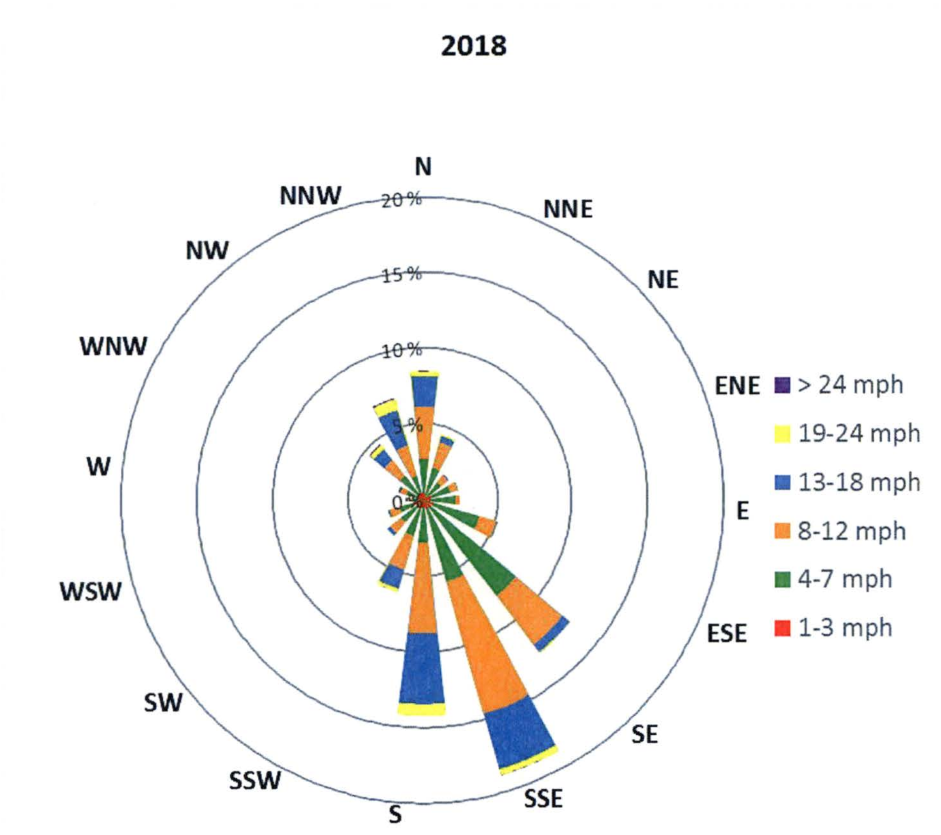
PERIOD OF RECORD: 1-JAN-2018 00:00 to 31-DEC-2018 23:59

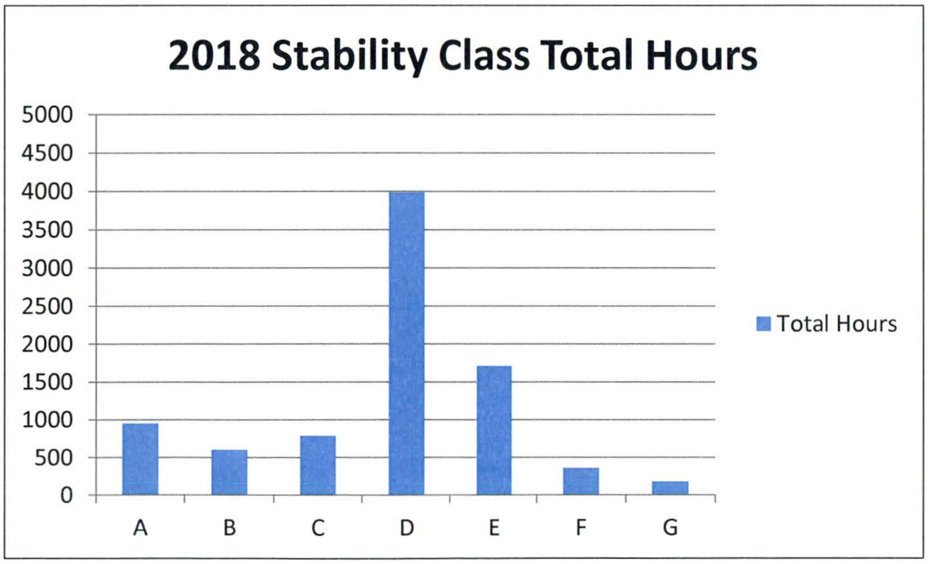
STABILITY CLASS **ALL**

ELEVATION: 10 m

WIND DIRECTION	Wind Speed (mph)						
	1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	36	190	296	175	26	1	724
NNE	14	173	149	37	8	0	381
NE	21	101	54	7	0	0	183
ENE	45	112	50	3	0	0	210
E	45	142	24	3	0	0	214
ESE	63	271	104	7	0	0	445
SE	56	627	356	53	3	0	1095
SSE	54	426	777	325	35	1	1618
S	42	199	513	399	66	1	1220
SSW	50	159	197	114	19	1	540
SW	52	109	80	19	0	0	260
WSW	61	79	60	10	1	0	211
W	33	31	27	10	0	0	101
WNW	36	63	38	11	1	0	149
NW	38	131	115	77	27	8	396
NNW	34	103	180	208	62	8	595
VARIABLE	183	42	9	1	0	0	235
TOTAL	863	2958	3029	1459	248	20	8577
Periods of calm (hours):	17						
Hours of missing data:	166						

2018 Wind Rose and Stability Class Graphs





Attachment 10.2
Atmospheric Dispersion (X/Q) and Deposition (D/Q) Calculation Methodology Discussion

Introduction

CR-2013-001059 evaluated the atmospheric dispersion (X/Q) and deposition (D/Q) calculation methodology and frequency as they relate to the meteorological data to ensure they are up to date. The CPNPP ODCM does not require a re-evaluation on any frequency or specific criteria for comparison. The NRC guidance documents cited in the ODCM also do not provide any requirements for re-evaluation. Revision 2 of Regulatory Guide 1.21, to which we are not committed, recommends that 5 years of meteorological data be used to evaluate the dispersion factors and that variation in the factors be within 10% in the non-conservative direction. The evaluation of our meteorological data included 6 years of data and meets the criteria.

Discussion

Meteorological data collected for the original FSAR, the NuBuild FSAR and historical Radiological Effluent Reports were reviewed. The data list the predominant wind direction, as a percentage, averaged for all speeds and stability classes within the period. For periods not summarized and when the plant was operable (1990-2000) only 1990, 1995 and 1996 show the predominant wind direction to be from the SSE. This information was not included, however, since the data should include a summary of at least 5 years of data. The original dispersion and deposition factors were calculated based on meteorological data collected and summarized from 1972 through 1976 at Comanche Peak. Data show the predominant wind direction to be from the South but only slightly more than winds originating from the SSE. The historical data from 1957-1976 was included in the original FSAR for comparison and show more bias toward the southerly direction but was collected from the Dallas-Fort Worth Airport location. Wind patterns for the DFW Airport were reviewed on the National Weather Service website for 1981-2010 and show that the prevailing wind direction remains from the South. This accounts for the slight variation in prevailing winds between historical and current data collected on site. During the New Build project for Units 3&4 and from OE 25286 the meteorological data were again summarized from 1997-2006, for Comanche Peak, and showed that the predominant wind direction shifted to the SSE. Using this data, new dispersion and deposition factors were calculated. The new factors were less conservative when compared to the original dispersion and deposition factors at the Exclusion Area Boundary (See Reference 3). The conclusion was to continue reporting offsite exposures based on the original values. The last column of data in Table 1 is summarized for the purposes of this evaluation and includes meteorological data since the New Build evaluation through 2012. This data, like the NuBuild data, show the predominant wind direction to be from the SSE.

Conclusion

Although the predominant wind direction frequency changes slightly from SSE to S when comparing the NuBuild Data to the original FSAR and Historical Data, the NuBuild calculations show that dispersion and deposition factors do not increase. Following the NuBuild evaluation, the wind direction remains the same and does not impact the calculation of the dispersion and deposition. Using the original factors would be conservative when calculating doses to the public.

TR-2019-001642 was initiated to document the evaluation of prevailing wind directions for all stability classes over the calendar year 2018. This evaluation is performed annually in accordance with Chemistry Guideline 25 to ensure the predominant wind direction has not changed based on the last 5 years of meteorological data including the current year. The 2018 predominant wind direction (SSE) and stability class category (Pasquill Class D) did not change when compared with the five year rolling average which includes 2018. No recalculations of X/Q or D/Q values are required at this time.

Attachment 10.3
Carbon-14 Supplemental Information

Carbon-14 (C-14) is a naturally occurring isotope of carbon produced by interactions with cosmic radiation in the atmosphere with a half-life of 5730 years. Nuclear weapons testing in the 1950s and 1960s significantly increased the amount of C-14 in the atmosphere. C-14 is also produced in commercial nuclear reactors, but the amounts are much less than the amounts produced from natural formation or from weapons testing.

In June 2009, the NRC provided revised guidance in Regulatory Guide 1.21, *Measuring, Evaluating and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste, Revision 2*, establishing an updated approach for identifying principal radionuclides. Because the overall quantity of radioactive releases has steadily decreased due to improvements in power plant operations, C-14 now qualifies as a "principal radionuclide" (anything greater than one percent of overall radioactivity in effluents) under federal regulations at many plants. In other words, C-14 has not increased and C-14 is not a new nuclear plant emission. Rather, the improvements in the mitigation of other isotopes have made C-14 more prominent.

The dose contribution of C-14 from liquid radioactive waste is essentially insignificant compared to that contributed by gaseous radioactive waste. Therefore, the evaluation of C-14 in liquid radioactive waste is not required by the new Reg. Guide 1.21, Rev. 2. The Reg. Guide 1.21, Rev. 2 also states that the quantity of gaseous C-14 released to the environment can be estimated by use of a C-14 source term production model.

A recent study produced by EPRI (*Estimation of Carbon-14 in Nuclear Power Plant Gaseous Effluents,* EPRI, Palo Alto, CA: 2010, 1021106) developed a model for estimation of C-14 source production. This model was used by CPNPP for the 2010 Radioactive Effluent Release Report. Also in the CPNPP report, the assumption that 70% of the C-14 gaseous effluent is estimated to be from batch releases (e.g. WGDTs), and 30% of C-14 gaseous effluent is estimated to be from continuous releases through the unit vents (Ref. IAEA Technical Reports Series no. 421, "Management of Waste Containing Tritium and Carbon-14", 2004).

The C-14 released from PWR's is primarily a mix of organic carbon and carbon dioxide released from the waste gas system. The C-14 species initially produced are primarily in the organic form, such as methane. The C-14 in the primary coolant can be converted to an inorganic chemical form of primarily carbon dioxide through a chemical transformation. Studies documented by the EPRI Report *Characterization of Carbon-14 Generated by the Nuclear Power Industry,* EPRI Palo Alto, CA: 1995, TR-105715, measured C-14 releases from PWRs indicating a range of 70% to 95% organic. The average value was indicated to be 80% organic with the remainder being carbon dioxide. As a result, a value of 80% organic C-14 is assumed by the CPNPP Radioactive Effluent Release Report methodology.

The public dose estimates from airborne C-14 in the CPNPP Effluent report are performed using dose models from NUREG-0133 and Regulatory Guide 1.109. The dose models and assumptions used for the dose estimates of C-14 are documented in the 2011 ODCM changes. The estimated C-14 dose impact on the maximum organ dose from airborne effluents released during 2011 is well below the 10CFR50, Appendix I, ALARA design objective of 15 mRem/yr per unit.

Attachment 10.4
Putting Radiation Dose in Context

Humans are exposed to radiation every day. The majority comes from natural sources including the earth, food and water consumption, the air, the sun and outer space. A smaller fraction radiation comes from man-made source such as X-rays, nuclear medical treatments, building materials, nuclear power plants, smoke detectors and televisions.

Radiation is measured in units called millirem (mRem). One mRem is a very small amount of exposure. On average, Americans receive 620 mRem of radiation dose every year. Approximately one-half of the dose comes from natural sources and the other half comes from medical procedures such as CAT scans.

The table below can help to give some perspective to dose from various sources.

Source	Average Annual Dose
Smoke detector in the home	0.008 mRem
Live within 50 miles of a nuclear power plant	0.009 mRem
Live within 50 miles of a coal-fired power plant*	0.03 mRem
NRC guideline for keeping radiation dose from nuclear power plants as low as reasonably achievable (ALARA)	5 mRem
Round trip flight from New York City to Los Angeles	5 mRem
Medical X-ray	10 mRem
EPA limit for dose to the public from the commercial nuclear fuel cycle	25 mRem
Food and water consumed throughout the course of one year	30 mRem
NRC limit for dose to the public from nuclear power plants	100 mRem
Mammogram	100 mRem
Average annual exposure for a nuclear power plant worker	120 mRem
Average annual exposure from background radiation	300 mRem
CT scan	1,000 mRem
NRC's annual limit for occupational exposure	5,000 mRem
Cardiac catheterization or coronary angiogram	5,000 mRem

*Coal is naturally radioactive.

Sources: U.S. Environmental Protection Agency, Health Physics Society.

Attachment 10.5
Errata from Previous Annual Radioactive Effluent Release Reports

1. The 2015 ARERR has a typographical error in Table 9.4 on page 30. The total tritium for the year was shown as 1.64e+01. It should have read 1.64E-01 Tritium value for the dose calculations was the correct value. AI-TR-2017-009339

2. The 2016 ARERR has an incorrect title on page 13 in the comments section. The title reads: "Total Body Dose due to Gaseous Activity Released Comments" and should read "Total Volume Liquid Effluents Released Comments" Comments in the box regarding the graph on page 13 were correct. IR-2018-001484

3. 2017 ARERR: p. 9- CPNPP should be added to "Water Plant" to clarify that it is the Comanche Peak water plant and not a public facility; p. 18- Comments Table should read "Total Volume of Solid Radwaste Buried" rather than "Total Body Dose due to Liquid Effluents Released"; p. 26- Third paragraph needs to be reworded for clarification. The 2018 ARERR was updated with these comments from TR-2019-000972.