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Ref. # Tech. Spec. 5.6.3
10CFR50.36a

April 11, 2013

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

SUBJECT: COMANCHE PEAK NUCLEAR POWER PLANT
DOCKET NOS. 50-445 AND 50-446
TRANSMITTAL OF YEAR 2012 RADIOACTIVE EFFLUENT RELEASE REPORT

Dear Sir or Madam:

In accordance with Comanche Peak Nuclear Power Plant Unit 1 and 2 Technical Specifications (TS) 5.6.3 and Section 6.9.1.4 of the Comanche Peak Offsite Dose Calculation Manual (ODCM), enclosed is the Radioactive Effluent Release Report which covers the reporting period from January 1, 2012 through December 31, 2012.

The tabular summaries of radioactive liquid and gaseous releases are provided in the format defined in Appendix B of Regulatory Guide 1.21, Rev. 1, dated June, 1974.

During this reporting period there were no revisions to the ODCM.

If there are any questions regarding this report, please contact Steve Dixon at (254) 897-5482 or Kerry Cooper at (254) 897-0462.

Sincerely,

Luminant Generation Company LLC

Rafael Flores

By: Fred W. Madden
Fred W. Madden
Director, Oversight & Regulatory Affairs

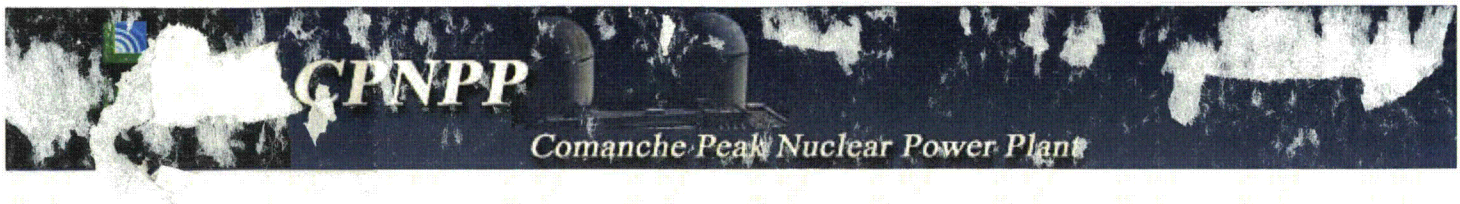
IE48
NRR

Enclosures - 1. 2012 Radioactive Effluent Release Report

c - A. T. Howell, Region IV
L. K. Gibson, NRR
Resident Inspectors, Comanche Peak

Enclosure 1

Comanche Peak 2012 Radioactive Effluent Release Report



2012 RADIOACTIVE EFFLUENT RELEASE REPORT

January 1, 2012 - December 31, 2012

Prepared By: David Valentine Date 3/20/13

Reviewed By: Don Rebstock Date 3/20/13

Approved By: Kerry Cooper Date 3/20/13

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ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
CPNPP	Comanche Peak Nuclear Power Plant
ECL	Effluent Concentration Limit
IFSFI	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
PET	Primary Effluent Tanks
pCi	Picocurie
REC	Radiological Effluent Control
SORC	Station Operations Review Committee
uCi	Microcurie
WMT	Waste Monitor Tanks
WWHT	Waste Water Holdup Tanks

1.0 Introduction

This Radioactive Effluent Release Report, for Comanche Peak Nuclear Power Plant 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, 2012, through December 31, 2012.

1.1 Executive Summary

The radioactive effluent monitoring program for the year 2012 was conducted as described in the following report. The results of the monitoring program indicate the 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, the improvements in the mitigation of other isotopes have made C-14 more prominent.

Attachment 10.2 on page 46 provides more detail about C-14.

Gaseous Effluents:

A summary of all the radioactive gaseous releases to the environment during 2012:

Gaseous Waste	2011	2012	Comments
Tritium	48.12 Ci	51.6 Ci	1
C-14 Activity	23.32 Ci	23.46 Ci	2
Total Fission and Activation Activity	3.73 Ci	1.27 Ci	
Total Particulate Activity	0 Ci	0 Ci	3
Gross Alpha Activity	0 Ci	0 Ci	3
Iodine Activity	0 Ci	0 Ci	3
Calculated Gamma Air Dose	6.21E-5 mRad	4.15E-04 mRad	4
Calculated Beta Air Dose	7.54E-05 mRad	3.08e-4 mRad	4
Total Whole body dose	0.10 mRem	0.11 mRem	5

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 is related to the type of fuel used (i.e., 18-month fuel) the core life and power output and number of core cycles.

2. Because the industry as a whole has minimized effluents, C-14 is now a principle isotope. The majority of the gaseous activity and dose increase is from the addition of C-14.

3. No alpha, iodine or particulate activity was released.

4. The increase in dose is due to dry cask spent fuel storage operations.

5. Despite the inclusion of C-14, total whole body dose is very low (0.44% of Technical Specification).

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 2012.

Liquid Effluents:

A summary of all the radioactive liquid releases to the environment during 2012:

Liquid Waste	2011	2012	Comments
Total Activity (excluding tritium)	6.56 mCi	13.8 mCi	1
Tritium Activity	2790 Ci	2430 Ci	
Total Whole Body Dose	0.149 mRem	0.171 mRem	1
Total Volume Released	1,155,673 Gal	18,733,509 Gal	2

Comments

1. The increased activity and dose for 2012 is attributed to waste water processing for 1 refueling outage, 1 forced outage, and dry cask storage operations. The slight increase in dose is consistent with the small increase in total activity released.

2. Explanation for the larger than normal total volume released during 2012: CPNPP processes many millions of gallons of non-radioactive water each year from the secondary portion of the plant. Water plant waste, turbine building sumps and other sources all contribute to these totals. This waste water is processed through the low volume waste (LVW) system which then discharges to Squaw Creek Reservoir. A quarterly composite sample from the LVW is analyzed quarterly for activity. Normally, this waste water does not contain any radionuclides.

   Analysis of the Q2 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.

Meteorological Data

The CPNPP meteorological system achieved a greater than 90% 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 2012 there were no Technical Specification/ODCM effluent radiation monitors out of service for >30 days.

ODCM Changes

There were no changes made to the ODCM during 2012.

Solid Waste

Summary of the solid waste production

Total Waste	2011	2012	% Error
Shipped (m3)	667	230	25%
Shipped (Ci)	0.215	2.97	25%
Buried (m3)	70.7	46.8	25%
Buried (Ci)	0.149	2.98	25%

Comments

The decrease in dry waste shipped was from the expiration of the Class A waste export permit (that allows the site to ship waste out of state) just prior to the U2 refueling outage. Consequently, much of the low level waste generated during the outage will not be shipped until 2013.

The increased curies were from the shipment of two containers of Class A resin. These resins contain significantly more activity than dry active waste (DAW). In 2011, only DAW was shipped.

Groundwater Tritium

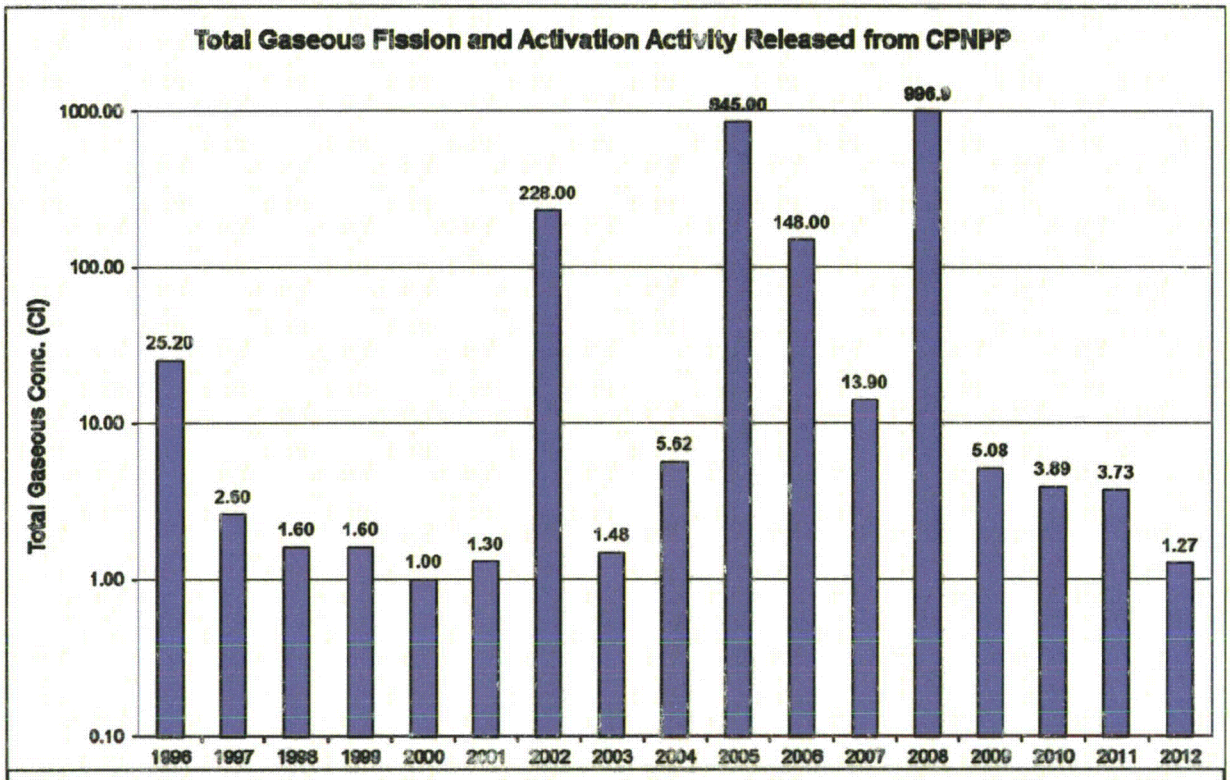
There were some positive indications of tritium in the seepage sump near the water treatment plant and in the LVW Pond A, B, and C Leachates. All of these samples were well below the state drinking water reportable criteria of 20,000 pCi/L and the environmental reportable criteria of 30,000 pCi/L. Because Squaw Creek Reservoir (SCR) water contains a low background concentration of tritium, SCR water used in the plant will contain similar concentrations.

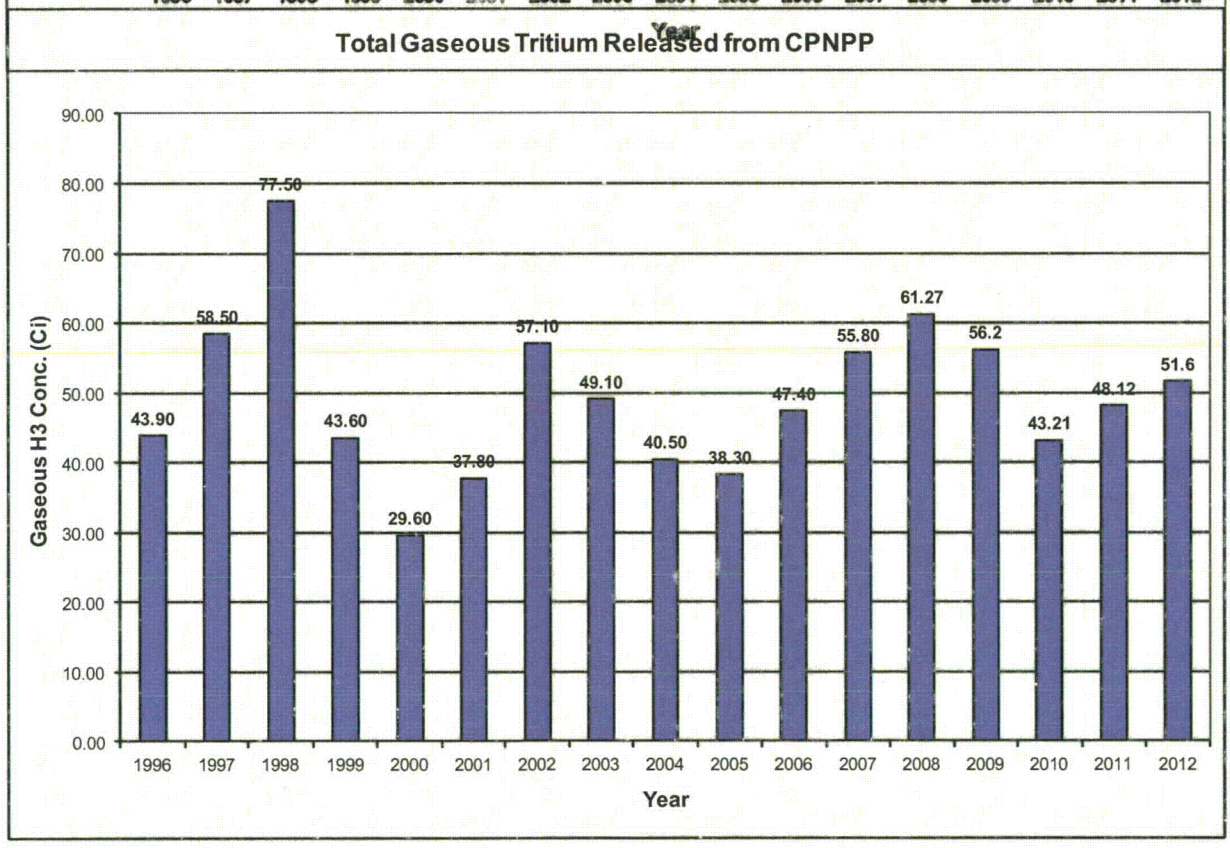
See section 8.8 for details.

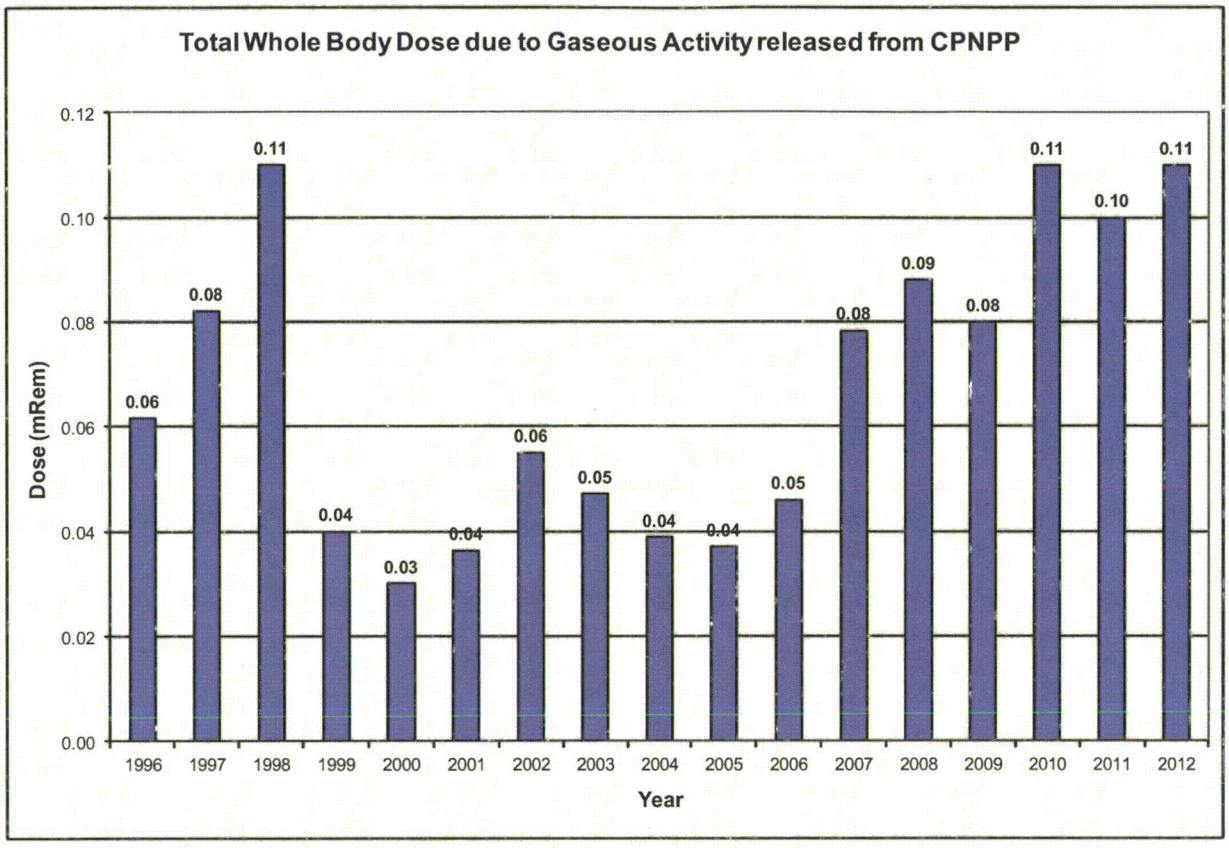
Conclusion

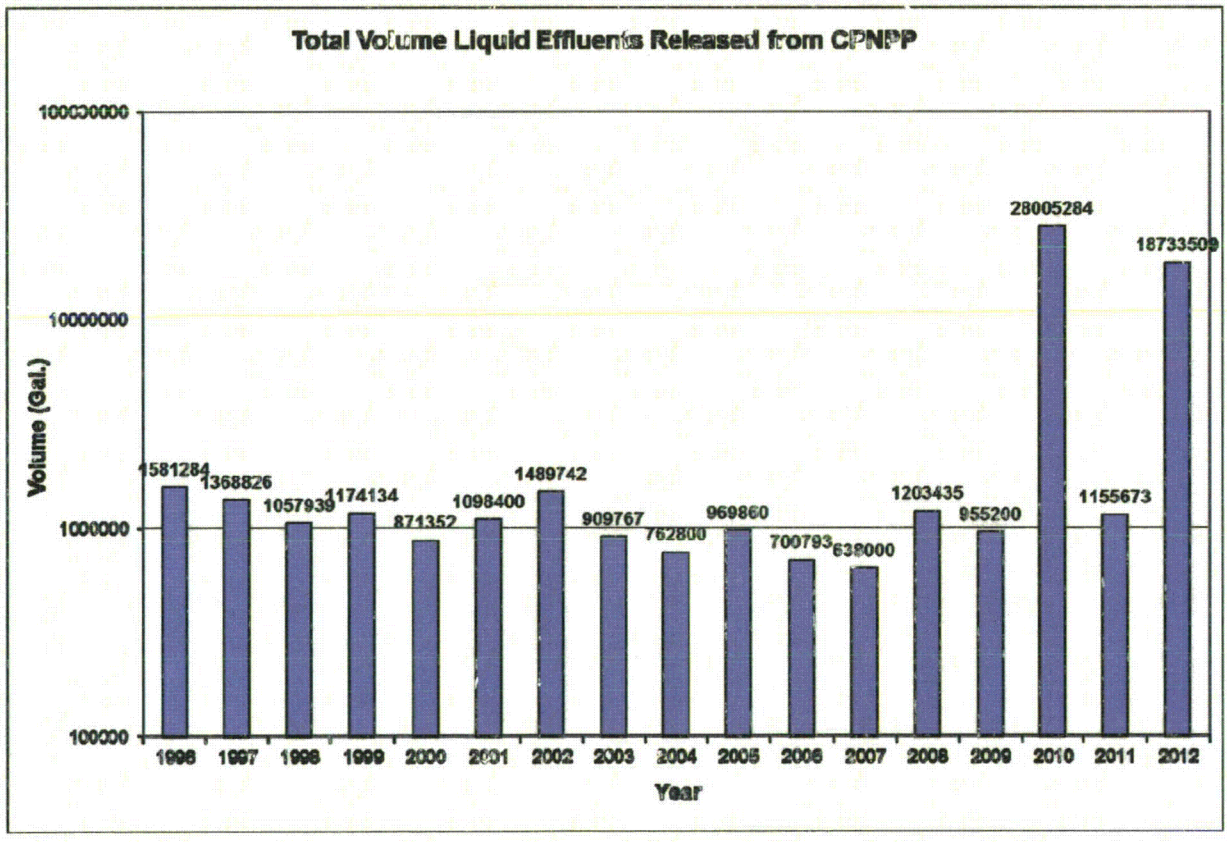
Overall, the radioactive effluent monitoring program has been conducted in an appropriate manner to ensure the activity released and associated dose to the public has been maintained as low as reasonably achievable (ALARA).

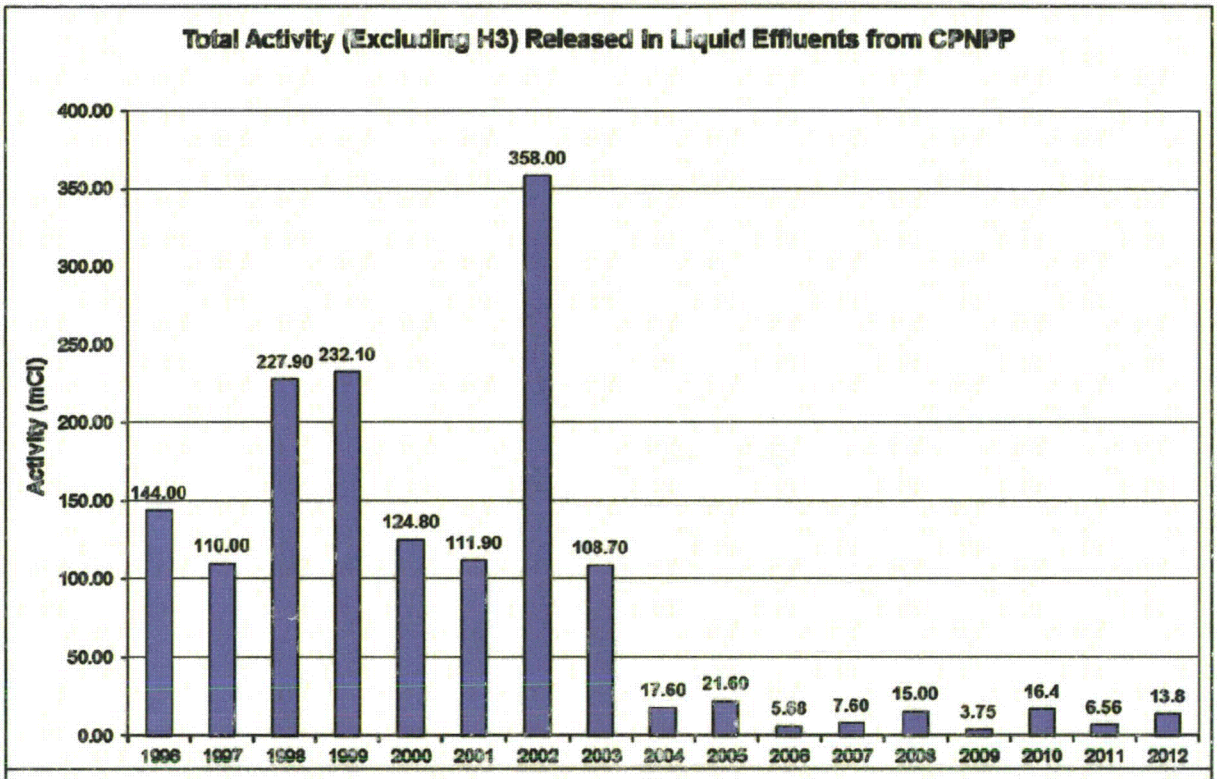
1.2 Historical Trend Graphs

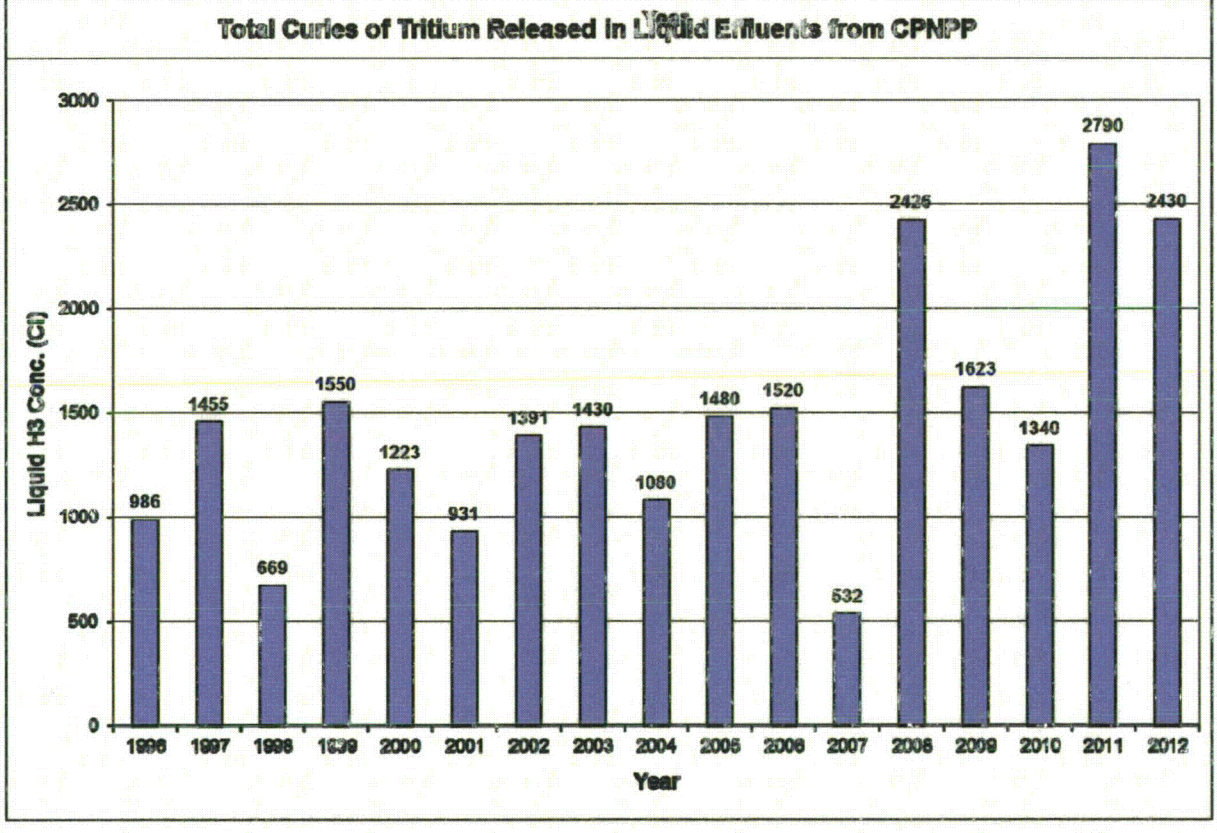





Total Whole Body Dose due to Gaseous Activity released from CPNPP
Dose (mRem)
0.12
0.10
0.08
0.06
0.04
0.02
0.00
0.06
0.08
0.11
0.04
0.03
0.04
0.06
0.05
0.04
0.04
0.05
0.08
0.09
0.08
0.11
0.10
0.11
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


Total Volume Liquid Effluents Released from CPNPP
Volume (Gal.)
100000000
10000000
1000000
100000
1581284
1368826
1057939
1174134
871352
1098400
1489742
909767
762800
969860
700793
639000
1203435
955200
28005284
1155673
18733509
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


Total Activity (Excluding H3) Released in Liquid Effluents from CPNPP
Activity (mCi)
400.00
350.00
300.00
250.00
200.00
150.00
100.00
50.00
0.00
144.00
110.00
227.90
232.10
124.80
111.90
358.00
108.70
17.60
21.60
5.68
7.60
15.00
3.75
16.4
6.56
13.8
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012


Total Curies of Tritium Released in Liquid Effluents from CPNPP
Liquid H3 Conc. (Ci)
3000
2500
2000
1500
1000
500
0
986
1455
669
1550
1223
931
1391
1430
1080
1480
1520
532
2426
1623
1340
2790
2430
1996
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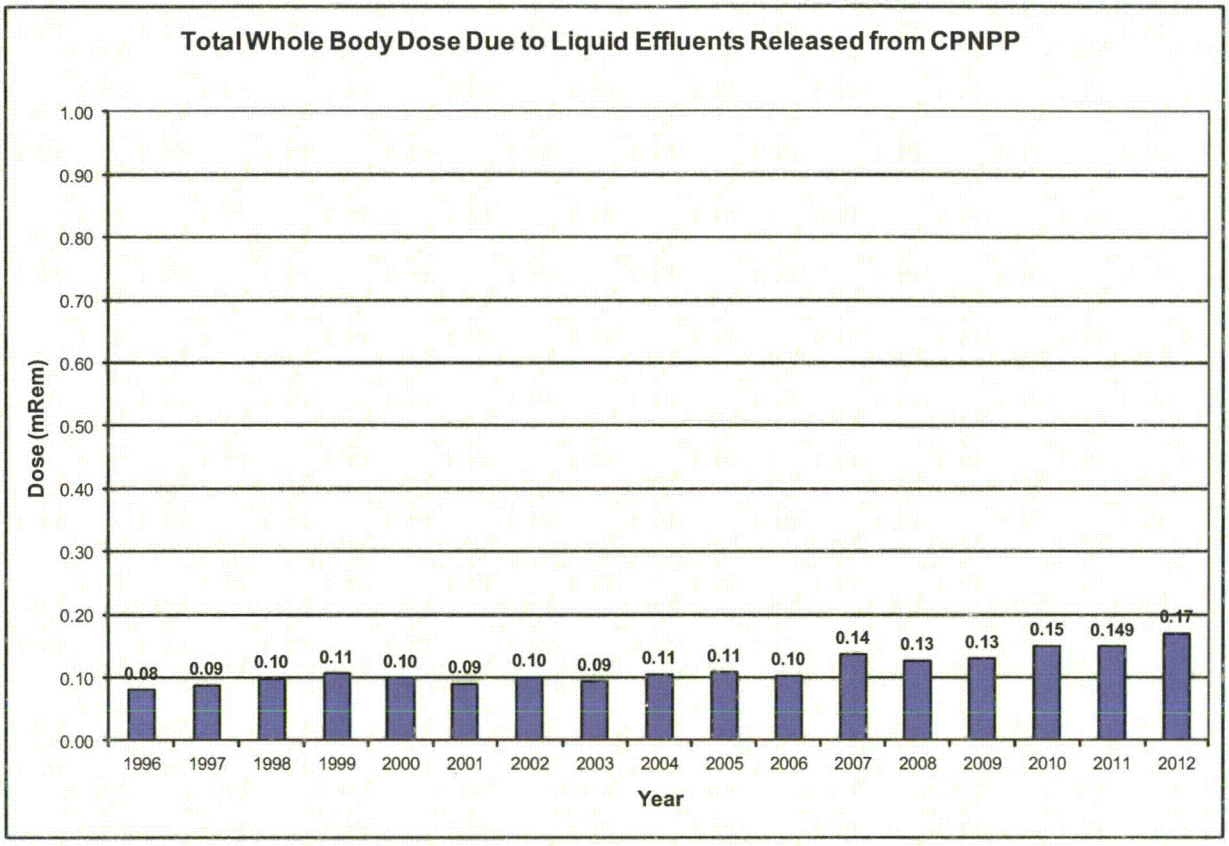
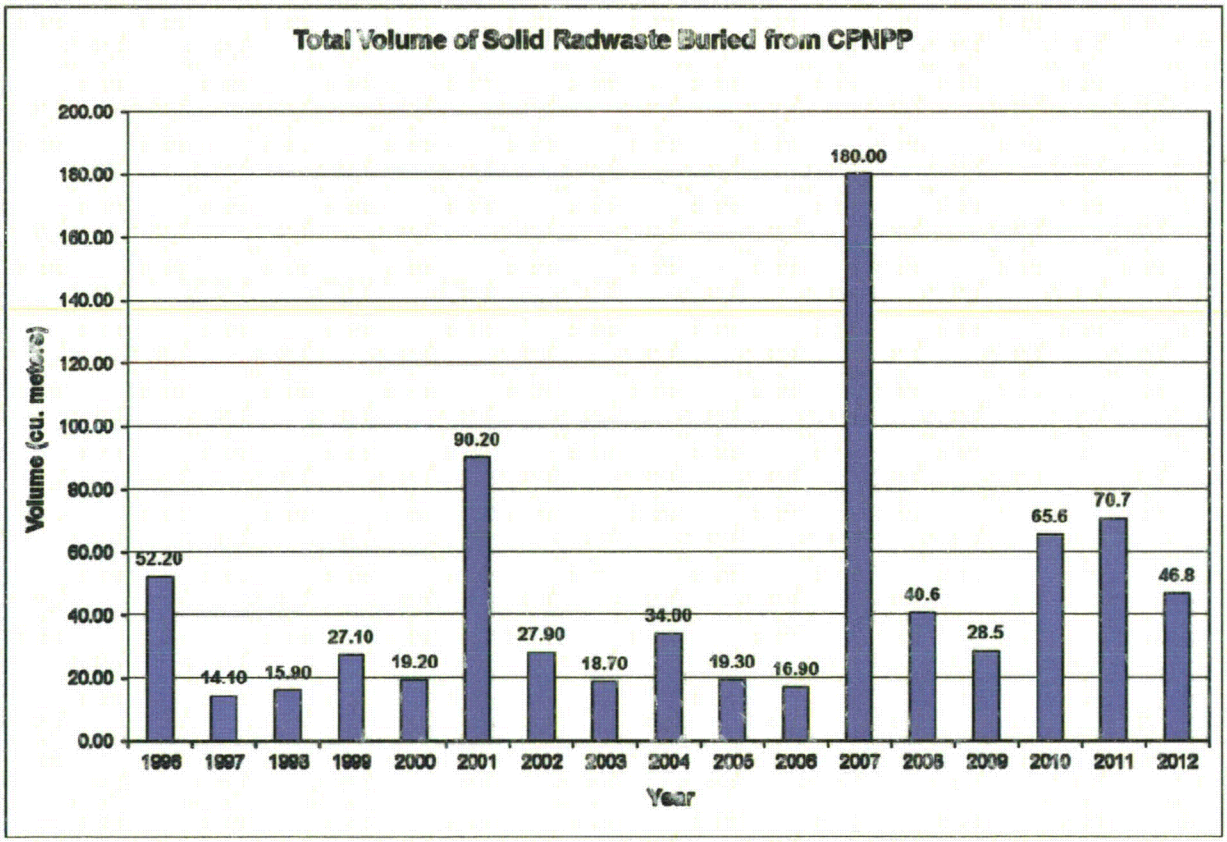
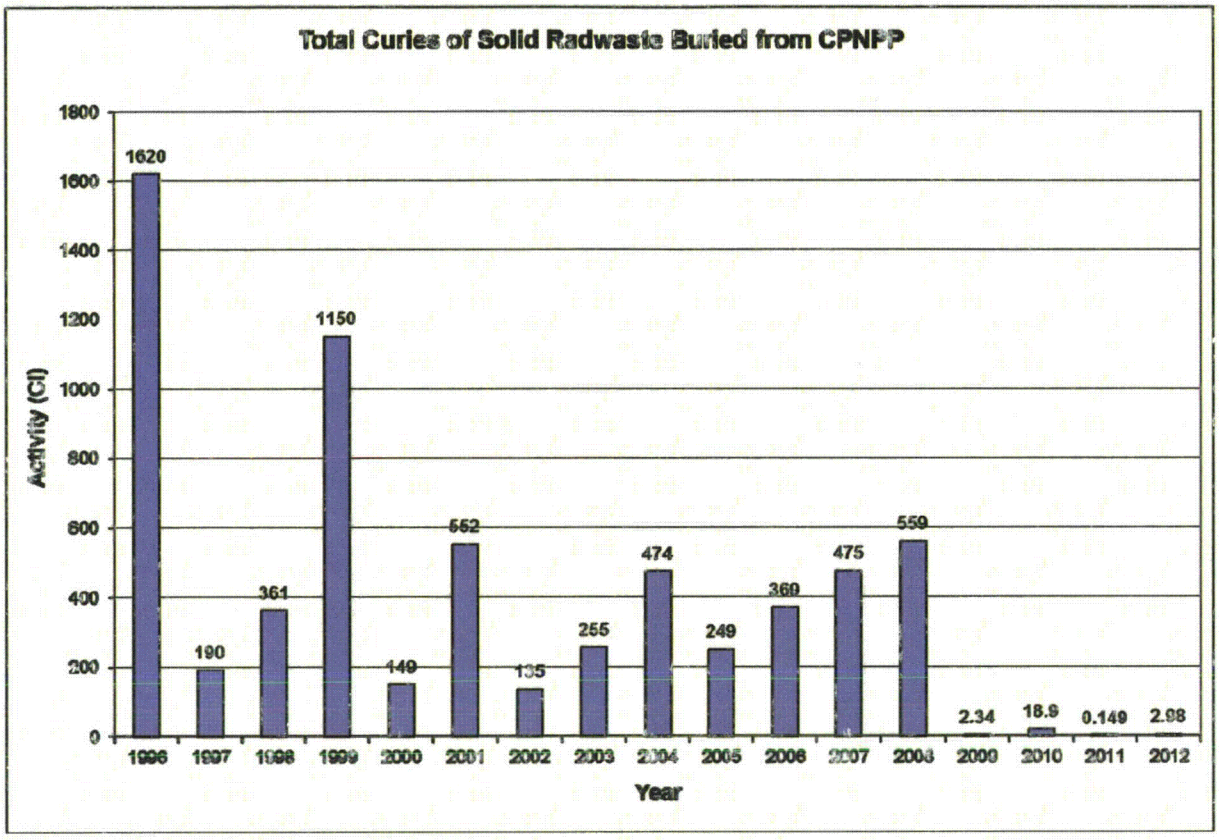
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


Total Whole Body Dose Due to Liquid Effluents Released from CPNPP
Dose (mRem)
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
0.08
0.09
0.10
0.11
0.10
0.09
0.10
0.09
0.11
0.11
0.10
0.14
0.13
0.13
0.15
0.149
0.17
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


Total Volume of Solid Radwaste Buried from CPNPP
Volume (cu. meters)
200.00
180.00
160.00
140.00
120.00
100.00
80.00
60.00
40.00
20.00
0.00
52.20
14.10
15.90
27.10
19.20
90.20
27.90
18.70
34.00
19.30
16.90
180.00
40.6
28.5
65.6
70.7
46.8
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
Year


Total Curies of Solid Radwaste Buried from CPNPP
Activity (Ci)
Year
1800
1600
1400
1200
1000
800
600
400
200
0
1620
190
361
1150
149
552
135
255
474
249
369
475
559
2.34
18.9
0.149
2.88
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012

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)

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, prior to release. 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 prior to release. 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 using gamma spectroscopy. 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 gamma emitting radionuclides 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 for gamma emitting radionuclides by gamma spectroscopy and liquid scintillation counting techniques, respectively. 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 10.2 on page 46 for more information on C-14.

2.4 Batch Releases

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

2.5 Abnormal or Unplanned Releases

Abnormal or unplanned releases are defined as the unintended discharge of a volume of liquid or airborne radioactivity to the environment. There were no abnormal (monitored) unplanned gaseous effluent releases during 2012.

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 effluents 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 were 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

The air dose due to gamma emissions and the air dose due to 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

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 2012 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

Three activities are considered in this evaluation: fishing on Squaw Creek Reservoir, recreation activities at the CPNPP employee recreational area and site tours through the CPNPP Visitors Center.

The highest dose occurred in the evaluation for fishing, resulting in a dose of 3.54E-03 mRem/yr. The dose to a MEMBER OF THE PUBLIC (fisherman) on Squaw Creek Reservoir was calculated based on 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 dose is calculated at the point of circ water discharge into the reservoir.

The dose to a MEMBER OF THE PUBLIC engaged in recreational activities at the CPNPP employee recreational park was calculated based on one visit a week, five hours each day, six months per year. Pathways included in the calculation were gaseous inhalation, submersion and ground plane.

The dose to a MEMBER OF THE PUBLIC during site tours through the CPNPP Visitors Center was calculated based on two visits per year, thirty minutes each visit. Pathways included in the calculation were gaseous inhalation and submersion.

All calculations were performed in accordance with the methodology and parameters in the ODCM.

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 2012, is retained onsite. This data is available for review by the NRC upon request. Joint Frequency Tables are included in Attachment 10. During 2012, the goal of >90% joint data recovery was met. The individual percent recoveries are listed below:

Meteorological Data Recovery	
Channel	**% Recovery**
Wind Speed	99.8
Wind Direction	99.5
Delta Temperature A	99.7
Delta Temperature B	99.7

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 the period covered by this report, there were no instances where these instruments were inoperable for more than thirty days.

8.2 Changes to the Offsite Dose Calculation Manual

During the period covered by this report, there were no revisions to the ODCM:

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 2012 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 2012 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 ten 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 Normal, Unplanned Gaseous Release

There were no normal, unplanned gaseous effluent releases occurred during 2012.

8.5.2 Abnormal, Unplanned Gaseous Effluent Release

No abnormal, unplanned gaseous effluent releases occurred during 2012.

8.5.3 Abnormal, Unplanned Liquid Effluent Releases

No abnormal, unplanned liquid effluent releases occurred during 2012.

8.6 Resin Releases to the LVW Pond

A total of 676 ft^3 of powdex resin was transferred to the LVW pond during the period covered by this report. The cumulative activity deposited in the LVW pond since operations began through the end of 2012 is 2.08e-3 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.

For the reporting period of this report, no changes to the Radwaste Treatment Systems occurred that meet the reporting criteria of the Process Control Program.

8.8 Groundwater Tritium monitoring Program

Seepage Sump
Samples of perched groundwater are taken quarterly in accordance with the site groundwater tritium monitoring program. During 2012, samples from the Water Production Plant seepage sump (storm drain) had positive values for tritium as listed in the table below.

During 2012, considerable effort was made to locate the source of the seepage sump tritium and is documented in CR-2012-005813. Because CPNPP discharges its effluents into Squaw Creek Reservoir (SQR), there is always a low level background concentration of tritium in the SQR water. Essentially the seepage sump is discharging diluted Squaw Creek Reservoir water back to Squaw Creek Reservoir.

CR-2012-005813 summarized the response to an INPO AFI regarding a long standing unidentified leak of tritium into a storm water collection basin. The investigation into the source of the leak revealed that it was most likely due to contaminated soil from rainout/washout from permitted gaseous releases, processed water leaks from 2000 and lake water being used on site during post construction activities. An analysis of rainwater performed in EV-CR-2010-008111-8 did not show tritium values above MDA and is not proved to be a source. The remaining two likely sources are from processed water already permitted for release to the lake. As such, they do not exceed any regulatory limits and are not considered licensed material per NEI 07-07.

Previous hydrogeology studies performed by Pastor, Behling and Wheeler LLC, showed that this perched water sits above an impermeable layer of bedrock. This prevents the migration of the tritiated perched water into the Twin Mountain Aquifer and a potential new pathway to drinking water sources but is re-routed back to Squaw Creek Lake. 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 the catch basin 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.

Leachate Basins A,B, & C
Variations in the tritium values from the Pond A Leachate are thought to come from pockets of water trapped in between the inner and outer liner by many inches of lake sediment resting on top of the liner. These pockets of water are from basin water previously transferred to the space between the liners to test for liner repair work effectiveness.

These basins receive Surface Water Treatment System wastewater; therefore, there is a high level of confidence the source of the tritium is Squaw Creek Reservoir water. Also, there is no indication of a release from the secondary liner, since tritium was not detected in down gradient monitoring wells.

In both of these cases, the tritium concentrations are well below the state reportable limit of 20,000 pCi/L for drinking water and 30,000 pCi/L for environmental. The source of the tritium is from SQR.

Tritium Results in pCi/L

Date	Seepage Sump	Pond A Leachate	Pond B Leachate	Pond C Leachate
13-Mar	2210	<MDA	<MDA	<MDA
13-Jun	2460	5320	2030	<MDA
15-Aug	2570	7740	OOS	1170
5-Dec	4550	17900	OOS	< MDA

SECTION 9.0
EFFLUENT TABLES

Table 9.1
Site Liquid and Gaseous Batch Release Summary (2012)

A. Liquid Releases

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of batch releases		5	9	10	23	47
2. Total time period for Batch releases	(Minutes)	1.59E+03	2.83E+03	3.11E+03	7.19E+03	1.47E+04
3. Maximum time period for a batch release	(Minutes)	3.30E+02	3.53E+02	3.45E+02	3.50E+02	3.53E+02
4. Average time period for a batch release	(Minutes)	3.17E+02	3.14E+02	3.11E+02	3.12E+02	3.13E+02
5. Minimum time period for a batch release	(Minutes)	3.00E+02	2.80E+02	2.60E+02	2.65E+02	2.60E+02
6. Average stream flow during periods of release of liquid Effluent into a flowing stream	(GPM)	1.78E+04	3.55E+05	4.33E+04	9.89E+04	1.22E+05

B. Gaseous Releases

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
1. Number of batch releases		30	27	30	38	125
2. Total time period for batch releases	(Minutes)	1.09E+04	8.96E+03	9.47E+03	1.45E+04	4.38E+04
3. Maximum time period for a batch release	(Minutes)	4.53E+02	3.92E+02	3.59E+02	1.15E+03	1.15E+03
4. Average time period for a batch release	(Minutes)	3.62E+02	3.32E+02	3.16E+02	3.82E+02	3.51E+02
5. Minimum time period for a batch release	(Minutes)	3.04E+02	2.41E+02	2.00E+02	1.48E+02	1.48E+02

Table 9.2
Site Abnormal Liquid and Gaseous Batch Release Summary (2012)

A. Liquid Releases	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Totals
1. Number of Releases		0	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

B. Gaseous Releases

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Totals
1. Number of Releases		1	0	0	0	0
2. Total Time For All Releases	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Maximum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
4. Average Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
5. Minimum Time For A Release	(Minutes)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
6. Total activity for all releases	(Curies)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

Table 9.3
Site Gaseous Effluents - Summation of All Releases (2012)

Type of Effluent	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
A. Fission And Activation Gases						
1. Total Release	Curies	5.69E-01	1.01E-01	2.46E-01	3.53E-01	1.27E+00
2. Average Release rate for period	uCi/sec	7.22E-02	1.28E-02	3.12E-02	4.47E-02	1.61E-01
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	uCi/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	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
3. Percent of Applicable Limit	%	*	*	*	*	*
D. Tritium & C14						
1. Total Release	Curies	1.47E+01	2.11E+01	2.26E+01	1.68E+01	7.51E+01
2. Average Release rate for period	uCi/sec	1.86E+00	2.67E+00	1.48E+00	2.68E+00	8.64E+00
3. Percent of Applicable Limit	%	*	*	*	*	*
E. Gross Alpha						
1. Total Release	Curies	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
2. Average Release rate for period	uCi/sec	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
Site Gaseous Effluents - Ground Level Releases (2012)

Continuous Mode

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Fission Gases						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A
Iodines						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A
Particulates						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A
Tritium & C-14						
H-3	Curies	8.37	14.90	16.22	11.78	51.26
C-14	Curies	1.87	1.83	1.88	1.46	7.04
Gross Alpha						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A

Table 9.4 (cont)
Site Gaseous Effluents - Ground Level Releases (2012)

Batch Mode

Nuclides Released	Unit	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Fission Gases						
Ar-41	Curies	9.46E-02	9.38E-02	1.04E-01	1.27E-01	4.20E-01
Kr-85m	Curies	0.00E+00	0.00E+00	0.00E+00	5.70E-05	5.70E-05
Kr-85	Curies	4.68E-01	0.00E+00	1.35E-01	1.38E-01	7.41E-01
Xe-131m	Curies	0.00E+00	0.00E+00	0.00E+00	8.36E-05	8.36E-05
Xe-133m	Curies	0.00E+00	0.00E+00	0.00E+00	1.81E-03	1.81E-03
Xe-133	Curies	6.53E-03	6.96E-03	7.00E-03	7.95E-02	1.00E-01
Xe-135	Curies	0.00E+00	0.00E+00	0.00E+00	6.30E-03	6.30E-03
Total For Period	Curies	5.70E-01	1.01E-01	2.46E-01	3.53E-01	1.27E+00
Iodines						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A
Particulates						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A
Tritium & C-14						
H-3	Curies	5.91E-02	7.48E-02	9.05E-02	1.44E-01	3.68E-01
C-14	Curies	4.36	4.26	4.39	3.41	16.42
Gross Alpha						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A

* Zeroes in this table indicate that no radioactivity was present at detectable levels.

Table 9.5
Site Liquid Effluents - Summation Of All Releases (2012)

	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
A. Fission And Activation Products						
1. Total Release (not including tritium, gases, alpha)	Curies	5.88E-04	2.25E-03	2.62E-03	8.37E-03	1.38E-02
2. Average diluted concentration during period	uCi/ml	1.25E-10	2.39E-11	2.26E-10	3.11E-10	6.86E-10
3. Percent of Applicable Limit	%	*	*	*	*	*
B. Tritium						
1. Total Release	Curies	1.54E+02	5.94E+02	5.46E+02	1.14E+03	2.43E+03
2. Average diluted concentration during period	uCi/ml	3.27E-05	6.31E-06	4.70E-05	4.24E-05	1.28E-04
3. Percent of Applicable Limit	%	*	*	*	*	*
C. Dissolved and Entrained Gases						
1. Total Release	Curies	0.00E+00	0.00E+00	1.89E-04	1.53E-03	1.72E-03
2. Average diluted concentration during period	uCi/ml	0.00E+00	0.00E+00	1.62E-11	5.67E-11	7.29E-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
E: Waste Vol Release (Pre-Dilution)	Liters	3.66E+05	6.82E+07	7.31E+05	1.66E+06	7.10E+07
F. Volume of Dilution Water Used	Liters	4.70E+09	9.41E+10	1.16E+10	2.69E+10	1.37E+11

*** Applicable limits are expressed in terms of dose.**

Estimated Total Error For All Values Reported Is < 1.0%

Table 9.6
Site Liquid Effluents (2012)

Continuous Mode

Nuclides Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Fission & Activation Products						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A
Tritium						
H-3	Curies	0.00E+00	3.69E-01	0.00E+00	0.00E+00	3.69E-01
Dissolved And Entrained Gases						
No Nuclides Found	Curies	N/A	N/A	N/A	N/A	N/A
Gross Alpha Radioactivity	Curies	0	0	0	0	0

Table 9.6 (cont.)
Site Liquid Effluents (2012)

Batch Mode

Nuclides Released	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Annual
Fission & Activation Products						
Mn-54	Curies	6.44E-06	7.97E-06	0.00E+00	0.00E+00	1.44E-05
Fe-55	Curies	3.28E-04	3.20E-04	7.28E-04	2.33E-03	3.71E-03
Co-57	Curies	0.00E+00	3.02E-05	6.41E-06	3.15E-06	3.98E-05
Co-58	Curies	1.94E-04	1.61E-03	3.47E-04	2.54E-03	4.69E-03
Co-60	Curies	5.14E-05	2.69E-04	1.35E-04	4.01E-05	4.96E-04
Ni-63	Curies	0.00E+00	0.00E+00	1.38E-03	3.34E-03	4.72E-03
Nb-95	Curies	7.38E-06	0.00E+00	0.00E+00	0.00E+00	7.38E-06
Sb-125	Curies	0.00E+00	9.97E-06	3.08E-05	1.20E-04	1.61E-04
Total For Period	Curies	5.88E-04	2.25E-03	2.62E-03	8.37E-03	1.38E-02
Tritium						
H-3	Curies	1.54E+02	5.94E+02	5.46E+02	1.14E+03	2.43E+03
Dissolved And Entrained Gases						
Xe-133	Curies	0.00E+00	0.00E+00	1.89E-04	1.49E-03	1.68E-03
Xe-135	Curies	0.00E+00	0.00E+00	0.00E+00	3.33E-05	3.33E-05
Total For Period	Curies	0.00E+00	0.00E+00	1.89E-04	1.53E-03	1.72E-03

* Zeroes in this table indicate that no radioactivity was present at detectable levels

Table 9.7

Dose to a member of the public due to Liquid Releases (2012)

Cumulative Doses per Quarter

Organ	Limit	Units	Quarter 1	% of Tech Spec Limit	Quarter 2	% of Tech Spec Limit	Quarter 3	% of Tech Spec Limit	Quarter 4	% of Tech Spec Limit
Total Body	1.50E+00	mRem	4.34E-02	2.90E+00	4.38E-02	2.92E+00	4.29E-02	2.86E+00	4.11E-02	2.74E+00
Thyroid	5.00E+00	mRem	4.34E-02	8.69E-01	4.38E-02	8.77E-01	4.29E-02	8.58E-01	4.11E-02	8.21E-01
Organ*	5.00E+00	mRem	4.35E-02	8.70E-01	4.39E-02	8.77E-01	4.29E-02	8.58E-01	4.11E-02	8.22E-01
Bone	5.00E+00	mRem	1.19E-06	2.38E-05	9.37E-07	1.87E-05	1.92E-04	3.85E-03	4.69E-04	9.37E-03

Cumulative Doses per Year

Organ	Tech Spec Limit	Units	Year to Ending Date	% of Tech Spec Limit	Receptor	Limit
Total Body	2.50E+01	mRem	1.71E-01	6.85E-01	Liquid Receptor - Adult	40CFR190.10 (a) TB
Thyroid	7.50E+01	mRem	1.71E-01	2.28E-01	Liquid Receptor - Adult	40CFR190.10 (a) Thyroid
Organ*	2.50E+01	mRem	1.71E-01	6.86E-01	Liquid Receptor - Adult	40CFR190.10 (a) Organ
Bone	2.50E+01	mRem	6.63E-04	2.65E-03	Liquid Receptor - Adult	40CFR190.10 (a) Organ
Total Body	3.00E+00	mRem	1.71E-01	5.71E+00	Liquid Receptor - Adult	Liq Annual TB Dose
Thyroid	1.00E+01	mRem	1.71E-01	1.71E+00	Liquid Receptor - Adult	Liq Annual Organ Dose
Organ*	1.00E+01	mRem	1.71E-01	1.71E+00	Liquid Receptor - Adult	Liq Annual Organ Dose
Bone	1.00E+01	mRem	6.63E-04	6.63E-03	Liquid Receptor - Adult	Liq Annual Organ Dose

Total Dilution Volume for 1st Quarter	4.70E+09
Total Dilution Volume for 2nd Quarter	9.41E+10
Total Dilution Volume for 3rd Quarter	1.16E+10
Total Dilution Volume for 4th Quarter	2.69E+10

*Organ = GI-Lii, Kidney, Liver, or Lung

Table 9.8
Air Dose Due To Gaseous Releases – Site (2012)

Cumulative Doses Per Quarter

Type of Radiation	Tech Spec Limit	Units	Quarter 1	% of Tech Spec Limit	Quarter 2	% of Tech Spec Limit	Quarter 3	% of Tech Spec Limit	Quarter 4	% of Tech Spec Limit
Gamma Air	5.00E+00	mRad	9.32E-05	1.86E-03	9.15E-05	1.83E-03	1.02E-04	2.03E-03	1.28E-04	2.57E-03
Beta Air	1.00E+01	mRad	1.29E-04	1.29E-03	3.29E-05	3.29E-04	6.40E-05	6.40E-04	8.24E-05	8.24E-04

Cumulative Doses Per Year

Type of Radiation	Tech Spec Limit	Units	Year to Ending Date	% of Tech Spec Spec Limit	Receptor	Limit
Gamma Air	1.00E+01	mRad	4.15E-04	4.15E-03	Gas Receptor SB - Adult	NG Annual Gamma Air Dose
Gamma Air	1.00E+01	mRad	4.15E-04	4.15E-03	Gas Receptor SB - Teen	NG Annual Gamma Air Dose
Gamma Air	1.00E+01	mRad	4.15E-04	4.15E-03	Gas Receptor SB - Child	NG Annual Gamma Air Dose
Gamma Air	1.00E+01	mRad	4.15E-04	4.15E-03	Gas Receptor SB - Infant	NG Annual Gamma Air Dose
Beta Air	2.00E+01	mRad	3.08E-04	1.54E-03	Gas Receptor SB - Adult	NG Annual Beta Air Dose
Beta Air	2.00E+01	mRad	3.08E-04	1.54E-03	Gas Receptor SB - Teen	NG Annual Beta Air Dose
Beta Air	2.00E+01	mRad	3.08E-04	1.54E-03	Gas Receptor SB - Child	NG Annual Beta Air Dose
Beta Air	2.00E+01	mRad	3.08E-04	1.54E-03	Gas Receptor SB - Infant	NG Annual Beta Air Dose

Table 9.9

Dose to A Member Of The Public Due To Radioiodines, Tritium, and Particulates in Gaseous Releases (2012)

Cumulative Doses Per Quarter

Organ	Tech Spec Limit	Units	Quarter 1	% of Tech Spec Limit	Quarter 2	% of Tech Spec Limit	Quarter 3	% of Tech Spec Limit	Quarter 4	% of Tech Spec Limit
Total Body	7.5	mRem	2.27E-02	3.03E-01	3.28E-02	4.37E-01	3.31E-02	4.41E-01	2.11E-02	2.81E-01
Thyroid	7.5	mRem	1.46E-02	1.95E-01	2.38E-02	3.17E-01	2.18E-02	2.91E-01	1.23E-02	1.64E-01
Organ	7.5	mRem	2.27E-02	3.03E-01	3.28E-02	4.37E-01	3.31E-02	4.41E-01	2.11E-02	2.81E-01
Skin	7.5	mRem	6.40E-08	8.54E-07	4.10E-08	5.46E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Bone	7.5	mRem	5.79E-02	7.72E-01	5.66E-02	7.54E-01	5.82E-02	7.77E-01	4.53E-02	6.03E-01

Quarterly limit values are the same for both 40CFR190.10 (a) and Gas Annual Organ Dose limits

Cumulative Doses per Year

Organ	Tech Spec Limit	Units	Year to Ending Date	% of Tech Spec Limit	Receptor	Limit
Total Body	25	mRem	1.10E-01	4.39E-01	Gas Receptor SB - Child	40CFR190.10 (a) TB
Thyroid	75	mRem	7.26E-02	9.67E-02	Gas Receptor SB - Child	40CFR190.10 (a) Thyroid
Organ	25	mRem	1.10E-01	4.39E-01	Gas Receptor SB - Child	40CFR190.10 (a) Organ
Skin	25	mRem	1.05E-07	4.20E-07	Gas Receptor SB - Child	40CFR190.10 (a) Organ
Bone	25	mRem	2.18E-01	8.72E-01	Gas Receptor SB - Child	40CFR190.10 (a) Organ
Total Body	15	mRem	1.10E-01	7.31E-01	Gas Receptor SB - Child	Gas Annual Organ Dose
Thyroid	15	mRem	7.26E-02	4.84E-01	Gas Receptor SB - Child	Gas Annual Organ Dose
Organ	15	mRem	1.10E-01	7.31E-01	Gas Receptor SB - Child	Gas Annual Organ Dose
Skin	15	mRem	1.05E-07	7.00E-07	Gas Receptor SB - Child	Gas Annual Organ Dose
Bone	15	mRem	2.18E-01	1.45E+00	Gas Receptor SB - Child	Gas Annual Organ Dose

Organ = GI-LIi, Kidney, Liver, or Lung

TABLE 9.10
SOLID RADWASTE AND IRRADIATED FUEL SHIPMENTS -2012

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	1.17E+01	2.88E+00	1.17E+01	2.88E+00	25%
b. Dry active waste	2.18E+02	8.83E-02	3.51E+01	1.01E-01	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	2.30E+02	2.97E+00	4.68E+01	2.98E+00	25%

Note: Shipped volumes and curies are not always equal to the buried volumes and curies since 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	% Abund.	Activity (Ci)
a. Spent resins/filters	Ni-63	21.80	6.27E-01
	H-3	20.72	5.96E-01
	Cs-137	17.41	5.01E-01
	Fe-55	16.44	4.73E-01
	Cs-134	11.88	3.42E-01
	Co-60	4.22	1.22E-01
	Sb-125	2.47	7.11E-02
	C-14	2.15	6.19E-02
	Co-58	1.68	4.83E-02
	Tc-99	0.08	2.33E-03
	I-129	LLD	-0-
	Other*	1.15	3.30E-02
	Total	100.00	2.88E+00

*Nuclides representing <1% of total shipped activity: Be-7,Cr-51,Mn-54,Co-57,Fe-59,Zn-65,Sr-90,Zr-95,Nb-95,Ag-110m,Sn-113, Sb-124

TABLE 9.10 (cont.)
SOLID RADWASTE AND IRRADIATED FUEL SHIPMENTS -2012
A. Solid Waste Shipped Offsite for Burial or Disposal (Not Irradiated Fuel) cont

2. **Estimate of Major Nuclide Composition (by type of waste)**	Nuclide	% Abund.	Activity (Ci)
b. Dry active waste	Fe-55	28.97	2.56E-02
	Co-60	21.55	1.90E-02
	Ni-63	21.54	1.90E-02
	Co-58	19.93	1.76E-02
	Nb-95	1.96	1.73E-03
	Zr-95	1.26	1.11E-03
	Mn-54	1.13	1.00E-03
	Cr-51	1.07	9.44E-04
	C-14	0.20	1.78E-04
	H-3	0.04	3.27E-05
	Tc-99	LLD	-0-
	I-129	LLD	-0-
	Other*	2.35	2.07E-03
	Total	100.00	8.83E-02

*Nuclides representing <1% of total shipped activity: Co-57,Sn-113,Sb-125,Cs-134,Cs-137,Ce-144,Pu-238,Pu-239/240, Am-241,Am-243,Cm-242,Cm-243/244

2. **Estimate of Major Nuclide Composition (by type of waste)**	Nuclide	% Abund.	Activity (Ci)
d. Other (oil/miscellaneous liquids sent to processor for volume reduction)	N/A	N/A	N/A

3. Solid Waste Disposition (Mode of Transportation: Truck)

Waste Type	Waste Class	Container Type	Solidification Agent(s)	Number of Shipments	Destination
a. Resin/filters	A	A	N/A	2	Energy Solutions, Clive UT
b. Dry active waste	A	General Design	N/A	3	Energy Solutions Oak Ridge, TN
d. Other	N/A	N/A	N/A	N/A	N/A

*Note: Solid Waste "Other" was included as part of a Dry Active Waste Shipment

B. Irradiated Fuel Shipments (Disposition)

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

Attachment 10.1

2012 Meteorological Joint Frequency Table

B.G. 1.21 JOINT FREQUENCY TABLE

T. U. ELECTRIC COMPANY

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 01-JAN-12 00:00 TO 31-DEC-12 23:..

STABILITY CLASS: A
ELEVATION: 10 m.

Wind Direction	Wind Speed (mph) at 10 m. level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	1	11	22	13	2	0	49
NNE	2	9	25	8	4	0	48
NE	0	22	14	1	0	0	37
ENE	5	26	4	1	0	0	36
E	3	7	2	0	0	0	12
ESE	2	20	22	4	0	0	48
SE	0	14	28	10	0	0	52
SSE	1	13	56	32	6	0	108
S	1	11	55	31	6	0	104
SSW	1	3	6	0	0	0	10
SW	0	3	1	0	0	0	4
WSW	0	1	0	0	0	0	1
W	0	0	0	0	0	0	0
WNW	0	1	0	0	0	0	1
NW	1	2	0	0	1	2	6
NNW	0	6	11	7	5	0	29
VARIABLE	18	5	0	0	0	0	23
Total	35	154	246	107	24	2	568

Periods of calm(hours): 1
Hours of missing data: 1

R.G. 1.21 JOINT FREQUENCY TABLE

T. U. ELECTRIC COMPANY

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 01-JAN-12 00:00 TO 31-DEC-12 23:59

STABILITY CLASS: B
ELEVATION: 10 m.

Wind Direction	Wind Speed (mph) at 10 m. level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	3	2	16	13	3	0	37
NNE	1	5	13	6	3	0	28
NE	3	14	5	0	0	0	22
ENE	6	8	7	0	0	1	22
E	5	5	2	0	0	0	12
ESE	3	19	10	1	0	0	33
SE	0	20	11	3	2	0	36
SSE	1	21	29	44	7	0	102
S	1	21	50	72	17	0	161
SSW	0	5	17	10	5	0	37
SW	1	7	4	0	0	0	12
WSW	0	7	2	0	0	0	9
W	1	2	2	1	0	0	6
WNW	1	2	1	1	0	0	5
NW	0	4	6	4	3	0	17
NNW	1	9	15	11	7	3	46
VARIABLE	34	3	1	0	0	0	38
Total	61	154	191	166	47	4	623

Periods of calm(hours): 1
Hours of missing data: 0

R.G. 1.21 JOINT FREQUENCY TABLE

T. U. ELECTRIC COMPANY

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 01-JAN-12 00:00 TO 31-DEC-12 23:59

STABILITY CLASS: C
ELEVATION: 10 m.

Wind Direction	Wind Speed (mph) at 10 m. level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	4	11	18	14	2	0	49
NNE	4	7	9	6	1	0	27
NE	11	10	2	2	0	0	25
ENE	4	10	2	1	0	0	17
E	2	6	1	0	0	0	9
ESE	2	25	9	1	0	0	37
SE	3	16	19	11	0	0	49
SSE	0	28	34	40	8	1	111
S	2	8	58	72	28	5	173
SSW	0	18	32	29	11	0	90
SW	2	6	12	4	0	0	24
WSW	0	6	5	6	0	0	17
W	1	3	2	2	0	0	8
WNW	0	3	1	1	0	0	5
NW	0	8	12	12	1	3	36
NNW	0	22	17	9	5	5	58
VARIABLE	21	1	1	0	0	0	23
Total	56	188	234	210	56	14	758

Periods of calm(hours): 0
Hours of missing data: 6

R.G. 1.21 JOINT FREQUENCY TABLE

T. U. ELECTRIC COMPANY

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 01-JAN-12 00:00 TO 31-DEC-12 23:59

STABILITY CLASS: D
ELEVATION: 10 m.

Wind Direction	Wind Speed (mph) at 10 m. level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	6	77	118	115	31	2	349
NNE	7	68	79	58	10	0	222
NE	8	40	51	19	1	0	119
ENE	14	27	22	3	0	0	66
E	23	72	11	1	0	0	107
ESE	20	87	55	1	0	0	163
SE	12	134	236	39	1	0	422
SSE	6	87	399	331	59	17	899
S	7	68	289	299	61	11	735
SSW	5	36	98	67	16	0	222
SW	14	44	54	24	3	0	139
WSW	10	32	25	4	3	1	75
W	5	18	7	3	0	0	33
WNW	4	25	38	16	0	4	87
NW	4	30	61	58	9	6	168
NNW	10	32	87	141	24	6	300
VARIABLE	55	14	7	0	0	0	76
Total	210	891	1637	1179	218	47	4182

Periods of calm(hours): 2
Hours of missing data: 18

R.G. 1.21 JOINT FREQUENCY TABLE

T. U. ELECTRIC COMPANY

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 01-JAN-12 00:00 TO 31-DEC-12 23:59

STABILITY CLASS: E
ELEVATION: 10 m.

Wind Direction	Wind Speed (mph) at 10 m. level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	5	39	50	5	0	0	99
NNE	7	28	22	0	0	0	57
NE	5	6	2	0	0	0	13
ENE	3	10	1	0	0	0	14
E	10	21	1	0	0	1	33
ESE	19	76	5	0	0	0	100
SE	29	174	133	2	0	0	338
SSE	23	129	185	14	1	0	352
S	13	69	119	5	1	1	208
SSW	20	48	76	11	0	0	155
SW	16	29	22	10	1	0	78
WSW	17	23	7	0	0	0	47
W	10	13	5	2	0	0	30
WNW	6	17	18	1	0	0	42
NW	13	63	21	3	0	0	100
NNW	14	27	21	2	0	0	64
VARIABLE	77	18	3	2	0	0	100
Total	287	790	691	57	3	2	1830

Periods of calm(hours): 8
Hours of missing data: 19

R.G. 1.21 JOINT FREQUENCY TABLE

T. U. ELECTRIC COMPANY

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 01-JAN-12 00:00 TO 31-DEC-12 23:59

STABILITY CLASS: F
ELEVATION: 10 m.

Wind Direction	Wind Speed (mph) at 10 m. level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	0	1	2	0	0	0	3
NNE	1	3	2	0	0	0	6
NE	0	1	0	0	0	0	1
ENE	0	0	0	0	0	0	0
E	2	0	0	0	0	0	2
ESE	3	2	1	0	0	0	6
SE	13	63	4	0	0	0	80
SSE	15	28	10	0	0	0	53
S	18	22	7	0	0	0	47
SSW	24	28	25	2	0	0	79
SW	26	21	10	2	0	0	59
WSW	20	22	8	0	0	0	50
W	12	11	2	0	0	0	25
WNW	15	9	2	0	0	0	26
NW	10	22	4	0	0	0	36
NNW	4	2	0	0	0	0	6
VARIABLE	36	1	0	0	0	0	37
Total	199	236	77	4	0	0	516

Periods of calm(hours): 4
Hours of missing data: 8

R.G. 1.21 JOINT FREQUENCY TABLE

T. U. ELECTRIC COMPANY

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 01-JAN-12 00:00 TO 31-DEC-12 23:59

STABILITY CLASS: G
ELEVATION: 10 m.

Wind Direction	Wind Speed (mph) at 10 m. level 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	1	0	0	0	0	1
SE	1	4	0	0	0	0	5
SSE	5	2	0	0	0	0	7
S	9	6	0	0	0	0	15
SSW	24	14	2	0	0	0	40
SW	15	26	3	0	0	0	44
WSW	16	28	7	0	0	0	51
W	14	2	1	0	0	0	17
WNW	15	5	0	0	0	0	20
NW	8	8	2	0	0	0	18
NNW	3	5	0	0	0	0	8
VARIABLE	8	0	0	0	0	0	8
Total	118	101	15	0	0	0	234

Periods of calm(hours): 1
Hours of missing data: 0

R.G. 1.21 JOINT FREQUENCY TABLE

T. U. ELECTRIC COMPANY

HOURS AT EACH WIND SPEED AND DIRECTION

PERIOD OF RECORD: 01-JAN-12 00:00 TO 31-DEC-12 23:59

STABILITY CLASS: ALL
ELEVATION: 10 m.

Wind Direction	Wind Speed (mph) at 10 m. level 1-3	4-7	8-12	13-18	19-24	>24	TOTAL
N	19	141	226	160	38	2	586
NNE	22	120	150	78	18	0	388
NE	27	93	74	22	1	0	217
ENE	32	81	36	5	0	1	155
E	45	111	17	1	0	1	175
ESE	49	230	102	7	0	0	388
SE	58	425	431	65	3	0	982
SSE	51	308	713	461	81	18	1632
S	51	205	578	479	113	17	1443
SSW	74	152	256	119	32	0	633
SW	74	136	106	40	4	0	360
WSW	63	119	54	10	3	1	250
W	43	49	19	8	0	0	119
WNW	41	62	60	19	0	4	186
NW	36	137	106	77	14	11	381
NNW	32	103	151	170	41	14	511
VARIABLE	249	42	12	2	0	0	305
Total	966	2514	3091	1723	348	69	8711

Periods of calm(hours): 17
Hours of missing data: 56

Attachment 10.2

Carbon 14 Supplemental Information

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.

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.