

April 30, 2013

ZS-2013-0176

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

Zion Nuclear Power Station, Unit 1 and 2
Facility Operating License Nos. DPR-39 and DPR-48
NRC Docket Nos. 50-295 and 50-304

Subject: Radioactive Effluent Release Report for 2012, Offsite Dose Calculation Manual for 2012, and Process Control Program for 2012.


In accordance with Technical Specification 5.7.3, "Radioactive Effluent Release Report," for Zion Nuclear Power Station, Units 1 and 2, this is the submittal of a Radioactive Effluent Release Report for the year 2012. The report is required to be submitted prior to May 1, 2013 and is provided as attachments 1-6 to this letter. A listing of commitments contained in this submittal is provided in the 1st Attachment.

Pursuant to 10 CFR 50.4 and Technical Specification 5.6.1.c. there were changes made to the Zion Station Offsite Dose Calculation Manual (ODCM) during the period of January through December 2012. The 7th Attachment provides the changes made to the ODCM during the calendar year of 2012. Also pursuant to 10 CFR 50.4, Technical Specification 5.6.1.c., and Section 12.7.2 of Zion Station ODCM there were changes made to the Zion Station Process Control Program (PCP) during the period of January through December 2012. The changes made to the PCP are included in the 8th Attachment.

Technical Specification 5.6.1 for the Zion Nuclear Power Station requires a copy of the entire ODCM be submitted to the NRC as part of, or concurrent with, the Radioactive Effluent Release Report. A copy of the entire Zion Station ODCM, current as of December 31, 2012 is enclosed.

If you have any questions about this submittal please contact Mr. Christopher Keene at (224)789-4073.

Respectfully,


Gary Bouchard
Decommissioning Plant Manager
ZionSolutions, LLC

IE 48
NRK

Attachments:

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 - 2.1 Unit 1 Gaseous Effluent
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8. ZS-WM-123 Process Control Program Requirements

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Attachment 1 – Supplemental Information

1. Regulatory Limits: The dose to a member of the public from liquid and gaseous effluents released from each unit to areas at or beyond site boundary shall be limited to the following:
 - a. Fission and Activation products:
 - i. Tech Spec Whole Body: 500 mrem/year
 - ii. Tech Spec Skin: 3000 mrem/year
 - b. Particulates with half-lives > 8 days, tritium and Iodine:
 - i. Tech Spec Organ: 1500 mrem/year
 - ii. 10CFR50 Organ: 7.5 mrem/quarter, 15 mrem/year
 - c. Liquid Effluents:
 - i. 10CFR50 Whole body: 1.5 mrem/quarter, 3mrem/year
 - ii. 10CFR 50 Organ: 5 mrem/quarter, 10 mrem/year
2. Effluent Concentration Limits (ECL): Limits used in determining allowable release rates or concentrations.
 - a. Gaseous Effluents: 10CFR20 Appendix B Table 2 Column 1.
 - b. Liquid Effluents: 10 X 10CFR20 Appendix B Table 2 Column 2.
3. Measurements and Approximations of Total Radioactivity.
 - a. Fission and Activation Products: 100% Kr-85 is assumed in calculations since other isotopes have decayed. Vent stack activity is continuously monitored for fission and activation gases.
 - b. Particulate and tritium releases are continuously monitored and samples collected and analyzed weekly. Particulate filters are sent to an independent lab for quarterly composite analysis. Tritium activity in gaseous releases from evaporation of water in the spent fuel pool and water filled reactor cavities.
 - c. Liquid effluents are continuously monitored and isotopic analysis performed weekly.
4. Batch Releases:
 - a. Liquid: There were no liquid batch releases in 2012
 - b. Gaseous: There were no gaseous batch releases in 2012.
5. Abnormal Releases:
 - a. Liquid: There were no liquid abnormal releases in 2012.
 - b. Gaseous: there were no gaseous abnormal releases in 2012.

Attachment 1 – Supplemental Information (continued)

6. Gaseous and Liquid Waste Treatment Systems and Process Control Program

Zion Station ODCM Section 12.6.4 requires major changes to the Gaseous and Liquid Waste Treatment Systems to be reported in the Annual Radioactive Effluent Release Report.

Zion Station ODCM Section 12.7.2 requires major changes to the Process Control Program(PCP) to be submitted in the Annual Radioactive Effluent Release Report.

The Waste Gas Hold-up System was permanently vented. In Zion's defueled configuration this system is no longer applicable.

In Zion's defueled configuration, the charcoal iodine removal system is no longer applicable.

Due to radioactive decay and no means of production, radioactive iodine is not a concern at Zion.

7. Limiting Conditions of Operation (LCOs)

Zion Station ODCM Section 12.7.2 requires explanation as to why the inoperability of liquid or gaseous monitoring instrumentation was not corrected within the time specified in the ODCM to be submitted with the Annual Radioactive Effluent Release Report.

There are no such occurrences

8. Liquid Holdup Tanks and Gas Storage Tanks

Zion Station ODCM Section 12.7.2 requires a description of events leading to liquid holdup tanks or gas storage tanks exceeding technical specification limits to be included in the Annual Radioactive Effluent Release Report.

The contents of the six gas decay tanks have been sampled and determined to have negligible activity. The Gas Decay Tanks have been abandoned in place.

No liquid holdup tanks exceeded the limits of Permanently Defueled Technical Specifications 5.6.3 during 2012.

Attachment 1 – Supplemental Information (continued)

9. Offsite Dose Calculation Manual (ODCM)

Changes to the ODCM are required by Zion Station Permanently Defueled Technical Specification 5.6.1. and ODCM Section 12.6.3 to be submitted as part of, or concurrent with, the Annual Radioactive Effluent Release Report.

A summary of changes made to the ODCM during 2012 and an entire copy of the ODCM, current as of December 31, 2012 are required to be submitted.

Revisions to ODCM and Process Control Program are listed below:

a. ODCM Revisions:

Page/Section	Change Summary
10-10/Table 10-2	1A,1B purge exhaust fan maximum allowed flow rate changed to 45,000 cfm
12-28/Table 12.4-1a	Modified daily sampling requirements to reflect requirement to sample during decommissioning activities.
12-28/Table 12.4-1h	Change to allow short duration interruptions to facilitate filter changeout without deviating from continuous sampling requirements.
12-28/Table 12.4-1i	Changed Unit 1 purge exhaust fan maximum allowed flowrate to 45,000 cfm.

b. Process Control Program (PCP)

Summary of Changes – 2012: ZS-WM-123 Rev 0:

Complete re-write of procedure.

Summary of Changes – 2012: ZS-WM-123 Rev 1:

1. Provided additional guidance on Radioactive Waste Requirements – The following are the steps included:

Step 4.1.3 - Radioactive Waste Requirements: The basis for the functionality of the radioactive waste system is to ensure the system will be available for use whenever radioactive waste requires processing and packaging prior to being shipped offsite. These radioactive waste requirements implement the requirements of 10CFR §50.36a and General Design Criteria 60 of Appendix A to 10CFR Part 50. The process parameters included in establishing the PROCESS CONTROL PROGRAM may include, but are not limited to waste type, waste pH, waste/liquid/solidification agent/catalyst ratios, waste oil content, waste principal chemical constituents, mixing and curing times.

Attachment 1-Supplemental Information (continued)

Step 4.14 - Liquid LLRW Requirements for Vendors: ZionSolutions requires that all vendors who process liquid LLRW meet all EnergySolutions quality standards and shall use an NRC approved PROCESS CONTROL PROGRAM Topical report. Furthermore,

the vendor solidification/stabilization media must be approved by the licensed burial sites.

Step 4.1.5 - The process control activities described in this program and the high integrity containers (HICs) and liners referenced in the NRCs radioactive waste packaging Certificate of Compliance (C of C) are QA approved. Process or equipment failures are subject to the requirements of 10CFR21, "Reporting of Deficiencies and Noncompliance."

Step 4.1.6 - During the processing or dewatering of Class B or C waste, deviations from the process control parameters or acceptable waste form properties shall be evaluated for reportability as "mishaps". Failures during qualification testing are not considered "mishaps" and are not reportable events. Mishaps shall be reported to the NRC within 30

days of knowledge of the event and approval from the disposal site shall be obtained prior to shipment.

Step 4.1.7 - Liquid wastes will be solidified in accordance with the NRC Technical Position on Waste Form, Rev. 1, January 1999; Waste Form Technical Position, Rev. 1, and the applicable disposal site criteria prior to disposal. (See Attachment 2 for details).

Step 4.1.8 - Containers, shipping casks, and methods of packaging will meet applicable federal regulations, e.g., 10CFR71 and 49CFR173, Subpart I.

Step 4.1.9 - Waste classification will meet the requirements of 10CFR61 and disposal site criteria.

Step 4.1.10 - Procedures or other administrative controls/documents shall assure that the radioactivity content transferred to any one liner or HIC will not result in exceeding the design basis site boundary dose calculated in Reference 5.16 (Zion Corrective Action 295-201-97-CAQD-121605).

2. Discussion of ZionSolutions not planning on performing any solidification processes for waste from ZionSolutions. If any solidification is required, it will be an off-site vendor performing the activity.
3. Provide when a High Integrity Container (HIC) is to be used.
4. Provide a list of reportable events based on 10CFR21 and Generic NRC letter 91-02.
5. Detail Cartridge Filter Elements and their use.
6. Detail Demineralizer Resins and their use/disposal.
7. Detail Dry Active Waste (DAW) generation, prohibited items, and packaging.
8. Detail Irradiated Metal/Hardware description and packaging guidance.
9. Detail Incinerable Fluids – Description of how generated and disposal.

Attachment 1-Supplemental Information (continued)

10. Detail Sludges/Bottoms: When generated and process requirements.
11. List Prohibited Waste Constituents: Specific details regarding no materials capable of detonation or explosive decomposition. Also no radioactive waste capable of generating toxic gases, vapors, fumes, or pyrophoric shall be shipped for disposal.
12. Detail Mixed Waste Generation – Control and Treatment for disposal.
13. Detail Waste Characterization: Requirement to characterize waste in accordance with 10CFR61.55.
14. Detail PCP Document and Procedure Control – Establishes the requirements for the PCP records review, changes to the PCP, and retention of records for 10 years past license termination.
15. Elimination of the quarterly PCP review of the solid waste system and only perform the review/verification annually.
16. Submittal of the annual radioactive effluent report on May 1st of each year.
17. Establish Attachment 2 – Minimum Review Criteria for Solidification Process
18. Establish Attachment 3 – Waste Types suitable for dewatering: requirements when dewatering resins and activated hardware/metal.
19. Establish Attachment 4 – Prohibited Materials – specifically for loading a HIC.

Summary of Changes: 2013: ZS-WM-123 Rev 2:

This revision has been included though the effective date was in 2013 because the Process Control Program solid waste data included in this report is based on Rev 2.

Updated list of references to revision of regulatory guide revisions as described in the ODCM. Updated references to reflect new procedural guidance. Edited wording of reporting requirements to reflect requirements of Rev 1 of Regulatory Guide 1.21. Two minor editorial changes.

Attachment 2.1 – Unit 1 Gaseous Releases

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 1 Vent Stack

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine-131						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Particulates Half Life >= 8 days						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Tritium						
1. Total Release	Ci	1.32E-02	1.42E-02	9.00E-03	1.28E-02	4.92E-02
2. Avg. Release Rate	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GASEOUS EFFLUENTS - GROUND RELEASES - CONTINUOUS MODE

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases		<LLD	<LLD	<LLD	<LLD	<LLD
Iodines		<LLD	<LLD	<LLD	<LLD	<LLD
Particulates Half Life >= 8 days		<LLD	<LLD	<LLD	<LLD	<LLD
Tritium						
H-3	Ci	1.32E-02	1.42E-02	9.00E-03	1.28E-02	4.92E-02
Totals for Period	Ci	1.32E-02	1.42E-02	9.00E-03	1.28E-02	4.92E-02

GASEOUS EFFLUENTS - GROUND RELEASES - BATCH MODE

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
No Batch Releases.						

LLD values are listed on attachment 2.5

Attachment 2.2 – Unit 2 Gaseous Releases

GASEOUS EFFLUENTS - SUMMATION OF ALL RELEASES
Unit 2 Vent Stack

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine-131						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Particulates Half Life >= 8 days						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Tritium						
1. Total Release	Ci	1.32E-02	1.42E-02	9.00E-03	1.28E-02	4.92E-02
2. Avg. Release Rate	uCi/sec	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

GASEOUS EFFLUENTS - GROUND RELEASES - CONTINUOUS MODE

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
Fission and Activation Gases		<LLD	<LLD	<LLD	<LLD	<LLD
Iodines		<LLD	<LLD	<LLD	<LLD	<LLD
Particulates Half Life >= 8 days		<LLD	<LLD	<LLD	<LLD	<LLD
Tritium						
H-3	Ci	1.32E-02	1.42E-02	9.00E-03	1.28E-02	4.92E-02
Totals for Period	Ci	1.32E-02	1.42E-02	9.00E-03	1.28E-02	4.92E-02

GASEOUS EFFLUENTS - GROUND RELEASES - BATCH MODE

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR
-----	-----	-----	-----	-----	-----	-----
No Batch Releases.						

LLD values are listed on attachment 2.5

Attachment 2.3 – Liquid Effluent Releases

LIQUID EFFLUENTS - SUMMATION OF ALL RELEASES

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

Fission and Activation Gases						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Iodine-131						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Particulates Half Life >= 8 days						
1. Total Release	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
2. Avg. Release Rate	uCi/sec	<LLD	<LLD	<LLD	<LLD	<LLD
Volume of liquid waste	liters	2.63E+06	3.56E+06	3.12E+06	2.97E+06	1.23E+07
Volume of dil. water	liters	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

LIQUID EFFLUENTS - BATCH MODE

REPORT FOR 2012	Units	QTR 1	QTR 2	QTR 3	QTR 4	YEAR

No batch releases.						

LLD values are listed in attachment 2.5

Attachment 2.4 - Direct Radiation

2012 40cfr190 evaluation of Dose From container ESUU # 500031									
Survey's indicate 40' Sealand was moved between 9-12 to 9-24 of 2012									
The first working day after 9-12-12 was 9-13-12 and dose will be calculated as of this date since									
Survey on 9-24-12 does not indicate the survey was performed when the sealand was moved									
only what the current survey results are.									
Days from 9-12-12 to 12-31-12									
	12/31/12								
-	9/13/12								
	109 days								
Exposure rate based on microshield 8.00E-03 mR/hr.									
At real person location on beach area East of RRA 258' From sealand.									
Occupancy factor: 1200 hrs/y (1200hrs/8760hrs)									
8.00E-03 mR x	0.96 mRem x	24 hr x	109 days x	1200 hrs =	2.75E+00 mrem				
hr.	mR	day		8760 hrs					

Dose assigned to each unit:

Unit 1: 1.38E+00 mrem

Unit 2: 1.38E+00 mrem

Attachment 2.5-LLD's

Liquid	
Isotope	LLD (uCi/ml)
Tritium	<1.00E-05
Ar-41	3.75E-08
Mn-54	3.49E-08
Co-58	3.43E-08
Co-60	4.27E-08
Zn-65	7.58E-08
Kr-85	6.78E-06
Kr-85m	3.18E-08
Kr-87	5.47E-08
Kr-88	9.70E-08
Nb-95	2.82E-08
Zr-95	5.37E-08
Xe-131m	1.33E-06
Xe-133	9.64E-08
Xe-133m	2.36E-07
Cs-134	3.55E-08
Xe-135	3.16E-08
Xe-135m	4.14E-08
Cs-137	3.40E-08
Xe-138	1.14E-07
Ce-141	5.07E-08
Ce-144	2.21E-07
Gross Alpha	<1.0E-07

Gaseous	
Isotope	LLD (uCi/ml)
Tritium	<1.00E-06
Ar-41	1.00E-08
Kr-85	2.51E-06
Kr-85m	9.14E-09
Kr-87	1.67E-08
Kr-88	2.58E-08
Xe-131m	3.53E-07
Xe-133	2.48E-08
Xe-133m	6.48E-08
Xe-135	8.03E-09
Xe-135m	1.61E-08
Xe-138	3.25E-08
Gross Beta	<1.0E-06
Gross Alpha	<1.0E-11

Notes:

Gross Beta/Gross Alpha/Tritium: LLD's are calculated each week during composite sample analysis and verified to be less than LLD required by ODCM Tech Spec limit.

The same detector was not used for each sample analysis. Therefore the most limiting LLD of each different instrument for each isotope are the values listed above.

Attachment 2.6-Error Estimation

Estimates of Total Error

The following is a calculated estimate of the maximum potential total error associated with reported values in the Annual Radioactive Effluent Release Report. The Total error is determined by calculating the square root of the sum of the squares of the individual errors.

a. Gaseous Effluents

Sampling Error	5%
Calibration Error	10%
Counting Statistics Error	17%
Sample Volume Error	10%
<hr/>	
Total Error	23%

b. Liquid Effluents

Sampling Error	5%
Calibration Error	10%
Counting Statistics Error	16%
Sample Volume Error	2%
<hr/>	
Total Error	20%

ZionSolutions, LLC

ZS-2013-0176: Attachment 3 – Solid Waste and Irradiated Fuel Shipments

A. Solid Waste Shipped Offsite for Burial or Disposal (Not irradiated fuel)

1. Types of Waste

Types of Waste	Total Quantity (m ³)	Total Activity (Ci)	Period	Est. Total Error %
a. Spent resins, filter sludges, evaporator bottoms, etc.	5.83E+00	9.48E+00	2012	2.50E+01
b. Dry compressible waste, contaminated equip, etc.	2.16E+03	2.23E+01	2012	2.50E+01
c. Irradiated components, control rods, etc.	4.96E+01	1.22E+03	2012	2.50E+01
d. Other (describe)	0.00E+00	0.00E+00	2012	0.00E+00

Attachment 3 – Solid Waste and Irradiated Fuel Shipments (continued)

2. Estimate of major nuclide composition (by waste type)

Major Nuclide Composition	Waste Type a. Resins, sludges bottoms %	Waste Type b. DAW contam. equipment %	Waste Type c. Irradiated components %	Waste Type d. Other %
Ag-110m	0.00E+00	3.71E-06	0.00E+00	0.00E+00
Am-241	6.52E-04	6.38E-02	8.16E-06	0.00E+00
C-14	2.80E-03	1.83E-01	4.94E-02	0.00E+00
Ce-144	6.92E-03	4.72E-01	0.00E+00	0.00E+00
Cm-242	1.54E-05	1.24E-01	1.40E-08	0.00E+00
Cm-243	3.27E-04	2.29E-02	4.67E-06	0.00E+00
Cm-244	0.00E+00	0.00E+00	4.60E-06	0.00E+00
Co-60	1.62E+01	2.34E+01	5.45E+01	0.00E+00
Cs-134	0.00E+00	0.00E+00	7.17E-06	0.00E+00
Cs-137	1.70E+00	3.03E+01	2.11E-03	0.00E+00
Fe-55	5.95E-02	1.24E+01	9.49E+00	0.00E+00
H-3	1.08E-02	2.29E-01	1.20E-01	0.00E+00
I-129	2.86E-04	2.59E-02	9.24E-07	0.00E+00
Mn-54	0.00E+00	0.00E+00	3.49E-03	0.00E+00
Nb-94	3.61E-02	7.50E-02	8.59E-04	0.00E+00
Ni-59	9.62E-01	4.94E-01	3.05E-01	0.00E+00
Ni-63	8.09E+01	2.59E+01	0.00E+00	0.00E+00
Ni-63am	0.00E+00	0.00E+00	3.56E+01	0.00E+00
Pu-238	1.57E-04	4.94E+00	5.01E-06	0.00E+00
Pu-239	6.67E-05	2.72E-02	1.23E-06	0.00E+00
Pu-240	0.00E+00	0.00E+00	1.23E-06	0.00E+00
Pu-241	7.89E-02	1.93E-01	3.52E-05	0.00E+00
Pu-242	1.11E-05	5.43E-03	1.55E-08	0.00E+00
Ra-226	0.00E+00	0.00E+00	8.08E-05	0.00E+00
Sb-125	6.88E-03	3.05E-01	5.47E-05	0.00E+00
Sr-89	8.84E-04	1.15E-01	0.00E+00	0.00E+00
Sr-90	8.29E-02	2.48E-01	3.03E-05	0.00E+00
Tc-99	1.72E-03	2.43E-01	1.48E-04	0.00E+00
Zn-65	5.25E-03	2.49E-01	0.00E+00	0.00E+00

Attachment 3 – Solid Waste and Irradiated Fuel Shipments (continued)

(continued)

3. Solid Waste Disposition

Number of shipments	Mode of Transportation	Destination
45	Truck	Clive CWF
33	Rail	Clive CWF
1	Truck	WCS Texas

B. Irradiated Fuel Shipments (disposition)

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

C. Changes to the Process Control Program:

Changes to the PCP are included in Attachment 7.

Attachment 4.1 – 40 CFR 190 Compliance Summary

UNIT 1 & 2 (DOCKET Numbers 50-295 & 50-304)

EXECUTIVE SUMMARY

A review of 2012 effluent data indicates that the activity released from the station was far below any regulatory limit. There was no noble gas released in 2012. This trend can be attributed to the shutdown of units since 1996 and 1997.

Airborne

	Dose to Maximally Exposed Receptor from Unit 1	Dose to Maximally Exposed Receptor from Unit 2
Gamma Air	0.00E+00 mrad	0.00E+00 mrad
Beta Air	0.00E+00 mrad	0.00E+00 mrad
Total Body	0.00E+00 mrem	0.00E+00 mrem
Skin	0.00E+00 mrem	0.00E+00 mrem
Organ	6.25E-05 mrem (Child Liver)	6.25E-05 mrem (Child Liver)

Aquatic

There was NO Aquatic release of radioactivity from Zion Station during 2012.

	Dose to Maximally Exposed Receptor (Any) from Unit 1	Dose to Maximally Exposed Receptor (Any) from Unit 2
Total Body	0 mrem	0 mrem
Organ	0 mrem	0 mrem

Direct Radiation

	Dose to Maximally Exposed Member of the public from Unit 1	Dose to Maximally Exposed Member of the public from Unit 2
Total Body	1.38E+00mrem	1.38E+00mrem

Attachment 4.2 – Unit 1

I. Unit 1 (Docket Number 50-295)

A. 10 CFR20 & 40CFR190 Compliance Assessment: The demonstration of compliance with 40CFR190 will be used to demonstrate compliance with 10CFR20.

1. Total Effective Dose Equivalent 1.38E+00 mrem/year
2. 40 CFR 190 Whole body limit 25 mrem/year
3. 40 CFR 190 Max exposed organ 25 mrem (75 mrem thyroid)
4. % Whole body limit 5.52E-02 %
5. % Max exposed organ 5.52E-02 % child liver (1.84E-02 % thyroid)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
TEDE	1.68E-05	1.81E-05	1.15E-05	1.38E+00	1.38E+00
	mrem	mrem	mrem	mrem	mrem

B. Maximally Exposed Receptor:

1. Airborne

	Qtr Obj	1 st Qtr	2 nd Qtr	3 rd Qtr	4 th Qtr	Yearly limit 10CFR 50 App. I	Total Dose 2012	% of Yearly limit
Gamma air (mrad)	5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10.0	0.00E+00	0.00E+00
Beta Air (mrad)	10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20.0	0.00E+00	0.00E+00
Total Body (mrem)	7.5	1.68E-05	1.81E-05	1.15E-05	1.63E-05	15.0	6.25E-05	4.17E-06
Skin (mrem)	7.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	15.0	0.00E+00	0.00E+00
Organ (mrem)	7.5	1.68E-05	1.81E-05	1.15E-05	1.63E-05	15.0	6.25E-05	4.17E-06
Critical Organ		Child liver	Child liver	Child liver	Child liver		Child liver	Child liver

2. Aquatic

	Qtr Obj	1 st Qtr	2 nd Qtr	3 rd Qtr	4 th Qtr	Yearly limit 10CFR 50 App. I	Total Dose 2012	% of Yearly limit
Total Body (mrem)	1.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.0	0.00E+00	0.00E+00
Organ (mrem)	5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10.0	0.00E+00	0.00E+00
Critical Organ		NA	NA	NA	NA		NA	NA

3. Direct

	Qtr Obj	1 st Qtr	2 nd Qtr	3 rd Qtr	4 th Qtr	Yearly limit 40CFR190	Total Dose 2012	% of Yearly limit
Total body (mrem)	6.25	0.00E+00	0.00E+00	0.00E+00	1.38E+00	25.0	1.38E+00	5.52E-02

Attachment 4.3 – Unit 2

II. Unit 2 (Docket Number –304)

- C. 10 CFR20 & 40CFR190 Compliance Assessment: The demonstration of compliance with 40CFR190 will be used to demonstrate compliance with 10CFR20.

6. Total Effective Dose Equivalent	1.38E+00 mrem/year
7. 40 CFR 190 Whole body limit	25 mrem/year
8. 40 CFR 190 Max exposed organ	25 mrem (75 mrem thyroid)
9. % Whole body limit	5.52E-02 %
10. % Max exposed organ	5.52E-02 % child liver (1.84E-02 % thyroid)

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
TEDE	1.68E-05	1.81E-05	1.15E-05	1.38E+00	1.38E+00
	mrem	mrem	mrem	mrem	mrem

- D. Maximally Exposed Receptor:

4. Airborne

	Qtr Obj	1 st Qtr	2 nd Qtr	3 rd Qtr	4 th Qtr	Yearly limit 10CFR 50 App. I	Total Dose 2012	% of Yearly limit
Gamma air (mrad)	5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10.0	0.00E+00	0.00E+00
Beta Air (mrad)	10.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	20.0	0.00E+00	0.00E+00
Total Body (mrem)	7.5	1.68E-05	1.81E-05	1.15E-05	1.63E-05	15.0	6.25E-05	4.17E-06
Skin (mrem)	7.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	15.0	0.00E+00	0.00E+00
Organ (mrem)	7.5	1.68E-05	1.81E-05	1.15E-05	1.63E-05	15.0	6.25E-05	4.17E-06
Critical Organ		Child liver	Child liver	Child liver	Child liver		Child liver	Child liver

5. Aquatic

	Qtr Obj	1 st Qtr	2 nd Qtr	3 rd Qtr	4 th Qtr	Yearly limit 10CFR 50 App. I	Total Dose 2012	% of Yearly limit
Total Body (mrem)	1.5	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.0	0.00E+00	0.00E+00
Organ (mrem)	5.0	0.00E+00	0.00E+00	0.00E+00	0.00E+00	10.0	0.00E+00	0.00E+00
Critical Organ		NA	NA	NA	NA		NA	NA

6. Direct

	Qtr Obj	1 st Qtr	2 nd Qtr	3 rd Qtr	4 th Qtr	Yearly limit 40CFR190	Total Dose 2012	% of Yearly limit
Total body (mrem)	6.25	0.00E+00	0.00E+00	0.00E+00	1.38E+00	25.0	1.38E+00	5.52E-02

Attachment 4.4 – Combined 40 CFR 190 Report

III. Combined 40CFR190 Report:

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

GAS ANNUAL DOSE SUMMARY

Year.....: 2012
 From Unit.....: 1
 To Unit.....: 2
 Coefficient Type.....: Historical
 Gas Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.00
 Compass Point.....: NA

=== MAXIMUM PERIOD DOSE TO LIMIT (Any Organ) ===

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Quarter 1	CHILD	LIVER	3.35E-05	Quarter	5.63E+00	5.96E-04	7.50E+00	4.47E-04
Quarter 2	CHILD	LIVER	3.62E-05	Quarter	5.63E+00	6.43E-04	7.50E+00	4.82E-04
Quarter 3	CHILD	LIVER	2.29E-05	Quarter	5.63E+00	4.07E-04	7.50E+00	3.05E-04
Quarter 4	CHILD	LIVER	3.26E-05	Quarter	5.63E+00	5.79E-04	7.50E+00	4.34E-04
Annual	CHILD	LIVER	1.25E-04	Annual	1.13E+01	1.11E-03	1.50E+01	8.35E-04

=== MAXIMUM PERIOD DOSE TO LIMIT (Tot Body) ===

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Admin Limit	Admin % of Limit	T.Spec Limit	T.Spec % of Limit
Quarter 1	CHILD	TBODY	3.35E-05	Quarter	5.25E+00	6.39E-04	7.50E+00	4.47E-04
Quarter 2	CHILD	TBODY	3.62E-05	Quarter	5.25E+00	6.89E-04	7.50E+00	4.82E-04
Quarter 3	CHILD	TBODY	2.29E-05	Quarter	5.25E+00	4.36E-04	7.50E+00	3.05E-04
Quarter 4	CHILD	TBODY	3.26E-05	Quarter	5.25E+00	6.20E-04	7.50E+00	4.34E-04
Annual	CHILD	TBODY	1.25E-04	Annual	1.05E+01	1.19E-03	1.50E+01	8.35E-04

Attachment 4.4 – Radiological Impact on Man (continued)

40CFR190 URANIUM FUEL CYCLE DOSE REPORT

COMBINED MAXIMUM ANNUAL DOSE SUMMARY

Year.....: 2012
 From Unit.....: 1
 To Unit.....: 2
 Liquid Receptor.....:
 Coefficient Type.....: Historical
 Gas Receptor.....: 5 Composite Crit. Receptor - IP
 Distance (meters).....: 0.00
 Compass Point.....: NA

=== MAXIMUM PERIOD DOSE TO LIMIT (Any Organ) ===

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Limit	Percent of Limit
Quarter 1	CHILD	LIVER	3.35E-05	Quarter	6.25E+00	5.37E-04
Quarter 2	CHILD	LIVER	3.62E-05	Quarter	6.25E+00	5.79E-04
Quarter 3	CHILD	LIVER	2.29E-05	Quarter	6.25E+00	3.66E-04
Quarter 4	CHILD	LIVER	3.26E-05	Quarter	6.25E+00	5.21E-04
Annual	CHILD	LIVER	1.25E-04	Annual	2.50E+01	5.01E-04

=== MAXIMUM PERIOD DOSE TO LIMIT (Tot Body) ===

Dose Period	Age Group	Organ	Dose (mrem)	Limit Period	Limit	Percent of Limit
Quarter 1	CHILD	TBODY	3.35E-05	Quarter	6.25E+00	5.37E-04
Quarter 2	CHILD	TBODY	3.62E-05	Quarter	6.25E+00	5.79E-04
Quarter 3	CHILD	TBODY	2.29E-05	Quarter	6.25E+00	3.66E-04
Quarter 4	CHILD	TBODY	3.26E-05	Quarter	6.25E+00	5.21E-04
Annual	CHILD	TBODY	1.25E-04	Annual	2.50E+01	5.01E-04