

April 26, 2023

ZS-2023-011

Office of Nuclear Regulatory Research  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001

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

Subject: Zion 2022 Annual Radioactive Effluent Release Report

In accordance with Facility Operation License Nos. DPR-39 and DPR-48, Quality Assurance Project Plan Appendix B, Section 5.7.3, "Radioactive Effluent Release Report," for Zion Nuclear Power Station, Units 1 and 2, attached is the Radioactive Effluent Release Report for 2022. The report is required to be submitted prior to May 1, 2023 and is provided as an Attachment to this letter. Certificate of Compliance No. 1031 for the MAGNASTOR SYSTEM, Appendix A, Technical Specification 5.1, requires submittal of an Annual Radioactive Effluent Control Program report which is included in this document.

Pursuant to 10 CFR 50.4 and Offsite Dose Calculation Manual (ODCM) Section 12.7.4, major changes made to Zion Station Liquid and Gaseous Effluent Treatment Systems shall be included in the Annual Radioactive Effluent Release Report (ARERR). There were no changes to these systems during the 2022 reporting period (i.e., between January and December of 2022).

Per ODCM, Section 12.7.3.1c, changes made to the ODCM shall be submitted, as a complete copy, with the ARERR for the reporting period in which any changes to the ODCM were made effective. There were no changes made to the ODCM during the 2022 reporting period.

There are no new regulatory commitments in this submittal.

Should you have any questions regarding this information, please contact Randall Heredia, Radiation Safety Officer, at (949) 943-7366.

Respectfully,

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Attachment 1: 2022 Annual Radioactive Effluent Release Report

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**Attachment 1**

***ZionSolutions* LCC**

**Zion Nuclear Power Station and ISFSI**

**2022 Annual Radioactive  
Effluent Release Report**

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## I. EXECUTIVE SUMMARY

The 2022 Zion Nuclear Power Station (Zion Station) Annual Radioactive Effluent Release Report (ARERR) is attached. No liquid or gaseous effluents were released from Zion Station in 2022. However, monoliths of concrete from abandoned structures were discovered within 3 feet of the site's graded surface contrary to lease requirements. These were removed from the site grounds, packaged, loaded on trucks and shipped to the EnergySolutions low level radioactive Waste Facility in Utah as detailed in Table A-3 of this report. Small pieces of concrete rubble incidental to these removals and to on-going site policing for trip hazards were also packaged, loaded on trucks, and shipped to the same EnergySolutions facility.

The low level waste described above was packaged, loaded and shipped offsite between March 1 and September 9, 2022 using Hittman Transportation Services Inc. The total volume of waste shipped consisted of 851.57 cubic feet, or 24.111 cubic meters of dry active waste (DAW) consisting of poured concrete blocks and concrete rubble containing  $8.27 \text{ E}+0$  millicuries, or  $8.27\text{E}-03$  Curies, in total of licensed material. The most significant radionuclide in the waste shipped was  $4.82\text{E}-03$  Curies of Ni-63.

The only offsite dose reported for 2022 is direct dose from radioactive material stored onsite; principally spent nuclear fuel and GTCC waste stored on the Independent Spent Fuel Installation (ISFSI) facility. Total direct dose at the controlled area boundary was 0.78 mrem in 2022 at location Z-131 for the year where sky shine has had its most significant measured impact. Adjusted for background levels and occupancy factors the highest offsite dose to a member of the public was 0.78 mrem for 2022.

Principal activities onsite in 2022 included shipping the concrete blocks and concrete rubble off-site, final site grading, performance of follow up final status surveys and additional sample collection with onsite and offsite analysis conducted under the site's License Termination Plan (LTP), Revision 2, approved by the NRC in October 2018.

### Decommissioning Progress and the Impact on Effluents

- There were no liquid effluent or gaseous effluent releases in 2022.

851.57 cubic feet, or 24.111 cubic meters, of Dry Active Waste (DAW), poured concrete blocks were shipped offsite to the EnergySolutions low level waste facility in Utah by Hittman services trucks to the BWF and Treatment Facilities off exit 49 on Interstate 80 in 2022.

## II. SUPPLEMENTAL INFORMATION

### 1. Abnormal Releases and Abnormal Discharges (e.g., leaks and spills)

There were no Abnormal Releases or Abnormal Discharges (e.g., spills or leaks of radioactive material) during decommissioning in 2022.

### 2. Non-routine, Planned Discharges (e.g., pumping of leaks and spills for remediation, results of ground water monitoring to quantify effluent releases to the offsite environment)

There were no non-routine, planned radioactive discharges for remediation resulting in releases offsite, and therefore, no resulting offsite impact.

### 3. Offsite Dose Calculation Manual Changes (ODCM)

There were no revisions to the Zion Station Offsite Dose Calculation Manual.

### 4. Errata/Corrections to Previous ARERRs

There were no Errata/Corrections to previously issued ARERRs in 2022.

### 5. Other (narrative description of other information provided to the U.S. Nuclear Regulatory Commission, e.g., the ARERR for ISFSIs)

- a. The ISFSI facility is located within the Zion Station Site and Controlled Area Boundaries. With all significant source term shipped offsite, the ISFSI is the primary source of direct radiation exposure onsite and to a member of the public in any unrestricted areas. The station boundary and owner-controlled boundary doses include the direct radiation component of the ISFSI. The Station decommissioning and Final Status Survey efforts proceed under the 10 CFR 50 licenses. The ISFSI Facility is operated per its general license issued under 10 CFR 72. The determination of offsite public dose impact is identical for both licenses.
- b. Direct dose was the only contributor of plant related radiation exposure to a member of the public as shown in Table A-5. with projected whole body dose of 0.78 mrem per year or 3.13% of the annual 40 CFR190 dose limit of 25 mrem/year measured 300 feet from the center of the ISFSI pad. This TLD is on the road leading to the ISFSI delivery gate, about 100 feet from the gate, and fully visible from the gate. The occupancy factor assumed is 160 hours per year, and specifically assumes a member of the public stands at that TLD location for 40 hours per week for four weeks every year. To date, the only activity in that location is delivery personnel who drive by that TLD periodically.

### III. APPENDICES

#### APPENDIX A – TABLES

**Note:** In accordance with Regulatory Guide 1.21, Revision 2, tables do not need to be included if all effluent monitoring results were not detectable and met the required lower limit of detection (LLD). As no effluents were released from Zion Station in 2022, effluent data tables are not included in the 2022 ARERR.

# Zion Station 2022 Annual Radioactive Effluent Release Report

**Table A-3. Low-Level Waste**

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	ft <sup>3</sup>	m <sup>3</sup>	Curies
A	0.00E+00	0.00E+00	0.00E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
<b>ALL</b>	0.00E+00	0.00E+00	0.00E+00

Major Nuclides for the Above Table: **N/A**

Dry Active Waste	Volume		Curies Shipped
Waste Class	ft <sup>3</sup>	m <sup>3</sup>	Curies
A	8.52E+02	2.41E+01	8.27E-03
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
<b>ALL</b>	8.52E+02	2.41E+01	8.27E-03

Major Nuclides for the Above Table: **Fe-55 (3.97%), Co-60 (27.06%), Ni-63 (58.39%), Cs-137 (7.81%)**, all other nuclides < 1.0%

Irradiated Components	Volume		Curies Shipped
Waste Class	ft <sup>3</sup>	m <sup>3</sup>	Curies
A	0.00E+00	0.00E+00	0.00E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
<b>ALL</b>	0.00E+00	0.00E+00	0.00E+00

Major Nuclides for the Above Table - **N/A**



Zion Station 2022 Annual Radioactive Effluent Release Report

**Table A-3. Low-Level Waste (continued)**

Other Waste	Volume		Curies Shipped
WASTE CLASS	ft <sup>3</sup>	m <sup>3</sup>	
A	0.00E+00	0.00E+00	0.00E+00
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
ALL	0.00E+00	0.00E+00	0.00E+00

Major Nuclides for the Above Table: N/A

Sum of All Low-Level Waste Shipped from Site	Volume		Curies Shipped
Waste Class	ft <sup>3</sup>	m <sup>3</sup>	
A	8.52E+02	2.41E+01	8.27E-03
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
ALL	8.52E+02	2.41E+01	8.27E-03

Major Nuclides for the Above Table: **Fe-55 (3.97%), Co-60 (27.06%), Ni-63 (58.39%), Cs-137 (7.81%), all other nuclides < 1.0%**

## Zion Station 2022 Annual Radioactive Effluent Release Report

**Table A-4. Dose Assessments, 10 CFR Part 50, Appendix I**

	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Yearly
Gamma Air Dose	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
% of Limit	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b>Gaseous Effluent Dose Limit, Beta Air<sup>1</sup></b>	10 mrad	10 mrad	10 mrad	10 mrad	20 mrad
Beta Air Dose	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
% of Limit	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
<b>Gaseous Effluent Dose Limit, Any Organ(Iodine, Tritium, Particulates with &gt;8-day half-life)</b>	7.5 mrem	7.5 mrem	7.5 mrem	7.5 mrem	15 mrem
Gaseous Effluent (Iodine, Tritium, Particulates with > 8-Day half-life)	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
% of Limit	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

<sup>1</sup> Dose to air (mrad) is applied to noble gas emissions only – noble gases are no longer created by fission at Zion or released from site following spent fuel transfer in 2014, and spent fuel pool treatment and drain down in 2015.

**Table A-5. EPA 40 CFR Part 190 Dose to Individual in the Unrestricted Area (mrem/year)**

	Whole Body <sup>1</sup>	Thyroid <sup>1</sup>	Any other organ <sup>1</sup>
<b>Dose Limit</b>	<b>25 mrem/year</b>	<b>75 mrem/year</b>	<b>25 mrem/year</b>
<b>Direct Dose</b>	7.80E-01	7.80E-01	7.80E-01
<b>Dose From Liquid</b>	0.00E+00	0.00E+00	0.00E+00
<b>Dose From Gaseous</b>	0.00E+00	0.00E+00	0.00E+00
<b>Postulated H-3 Dose</b>	0.00E+00	0.00E+00	0.00E+00
<b>TOTAL DOSE</b>	7.80E-01	7.80E-01	7.80E-01
<b>% of Limit</b>	3.13E+00	1.04E+00	3.13E+00

<sup>1</sup> – The 40CFR190 dose is the sum of internal exposure (consumption of food stuffs and water), inhalation and direct radiation in the highest X/Q sector at the site boundary for gaseous releases (sector A – North – zero mrem) and the sector with the highest direct dose (sector Q – Northwest for quarters 1 through quarters 4) at the controlled area boundary with occupancy factors applied. The reported total dose is in units of mrem per year.

# Zion Station 2022 Annual Radioactive Effluent Release Report

## Appendix B

### Error Estimation - Uncertainty

#### 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.

$$\text{Total Error} = \sqrt{S^2 + C^2 + CS^2 + V^2}$$

$$23\% = \sqrt{5^2 + 10^2 + 17^2 + 10^2}$$

#### a. Gaseous Effluents

Sampling Error ( <i>S</i> )	5%
Calibration Error ( <i>C</i> )	10%
Counting Statistics Error ( <i>CS</i> )	17%
Sample Volume Error ( <i>V</i> )	10%
<hr/> Total Error	23%

Appendix C – Errata

No Errata to Previously Issued ARERRs

Appendix D – ODCM Revisions

There were no revisions to the Zion Station ODCM in 2022.

## Appendix E – PCP Revisions

The Process Control Program (PCP) was terminated in 2020 as the only waste remaining onsite is spent nuclear fuel and GTCC waste sealed in shielded steel canisters, stored in thick walled steel rebar and concrete over packs, and soil samples retained onsite to accommodate re-analysis requests.

The spent fuel and GTCC waste will remain at the station until the National Spent Fuel Repository is completed and ready to accept it.

The spent nuclear fuel, GTCC waste and soil samples do not need to be processed nor will they be processed and therefore, the Process Control Program was terminated.

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