ZIONSOLUTIONS LLC
An EnergySolutions Company

April 20, 2020 ZS-2020-0021

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

Zion Nuclear Power Station and ISFSI
Facility Operating License Nos. DPR-39 and DPR-48
NRC Docket Nos. 50-295, 50-304 and 72-1037

Subject: Radioactive Effluent Release Report, Radioactive Effluent Control Program Report, Offsite Dose Calculation Manual and Process Control Program for 2019

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 2019. The report is required to be submitted prior to May 1, 2020 and is provided as Attachment 1 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 the Zion Station Liquid and Gaseous Effluent Treatment Systems shall be included in the Annual Radioactive Effluent Release Report. There were no changes to these systems during the period of January through December 2019.

Per ODCM Section 12.7.3.1c, a summary of changes made during each revision and a current revision of the ODCM shall be submitted with the Annual Radioactive Effluent Release Report. There were no changes to the ODCM during the period of January through December 2019.

Changes were made to the Process Control Program during the period of January through December 2019. Per ODCM Section 12.7.2, a summary of changes and a current revision of the Process Control Program is submitted in Appendix E of Attachment 1.

There are no new regulatory commitments in this submittal.

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101 Shiloh Boulevard, Zion ▪ IL 60099
(224) 789-4016 ▪ Fax: (224) 789-4008 ▪ www.zionsolutionscompany.com

If you have any questions about this submittal please contact Mr. David Villicana at (224)789-4109.

Respectfully,

Gerard van Noordennen

Gerard van Noordennen
Senior Vice President Regulatory Affairs

Attachment:

1. Zion Station 2019 Annual Radioactive Effluent Release Report

cc: John Hickman, U.S. NRC Senior Project Manager
Regional Administrator, U.S. NRC, Region III
Service List (Cover letter only, no attachments)

Zion Nuclear Power Station, Unit 1 and 2 License Transfer Service List

cc:

Ken Robuck
President and CEO
Energy*Solutions*
299 South Main Street, Suite 1700
Salt Lake City, UT 84111

John Sauger
President and Chief Nuclear Officer
Reactor D&D
Energy*Solutions*
121 W. Trade Street, Suite 2700
Charlotte, NC 28202

Bruce Hinkley
Senior Vice President
D&D Operations
Energy*Solutions*
121 W. Trade Street, Suite 2700
Charlotte, NC 28202

Gerard van Noordennen
Senior Vice President
Regulatory Affairs
Energy*Solutions*
121 W. Trade Street, Suite 2700
Charlotte, NC 28202

Russ Workman
General Counsel
Energy*Solutions*
299 South Main Street, Suite 1700
Salt Lake City, UT 84111

Steven A. Reynolds
Manager, Nuclear Facility Inspection
Division of Nuclear Safety
Illinois Emergency Management Agency
245 W. Roosevelt Road, Units 55 & 56
West Chicago, Illinois 60185

Kelly F. Grahn
Senior Health Physicist
Illinois Emergency Management Agency
Division of Nuclear Safety
245 W Roosevelt Road, Building 8, Suite 55
West Chicago, IL 60185

William P. Mazzeno
Emergency Management Coordinator
Lake County Emergency Management Agency
1303 N. Milwaukee Avenue
Libertyville, IL 60048-1308

John E. Matthews
Morgan, Lewis & Bockius LLP
1111 Pennsylvania Avenue, NW
Washington, DC 20004

ATTACHMENT 1

Zion Station 2019 Annual Radioactive Effluent Release Report

LIST OF SECTIONS

I. EXECUTIVE SUMMARY

The 2019 Zion Nuclear Power Station (Zion Station) Annual Radioactive Effluent Release Report (ARERR) is attached. There were no liquid releases off site in 2019 with the termination of liquid effluents in 3rd quarter of 2018. Air monitoring of final demolition activities were performed during 2019. No detectable radioactivity was identified on any of the 607 air samples collected. The only off-site dose reported for 2019 is from the direct dose component resulting from radioactive material stored on site; principally spent nuclear fuel stored on the Independent Spent Fuel Installation (ISFSI) facility.

There were no airborne releases of licensed radioactive material in any monitored pathways in 2019.

Principal activities on site in 2019 included shipping concrete, steel and other demolition debris off site, backfilling with clean fill and performing final status surveys of open land areas under the site's License Termination Plan (LTP), Revision 2, approved by the NRC in October 2018.

Review of Report Format

- Radioactive waste and effluent tables used are from the latest revision to Regulatory Guide 1.21, Revision 2, "Measuring, Evaluating, and Reporting Radioactive Material in Liquid and Gaseous Effluents and Solid Waste."
- Meteorological Data is not reported here, per Revision 2 to Regulatory Guide 1.21. This information is readily available at the station for review and may be found in Zion Technical Support Document, TSD 18-002, "ZION Station ODCM Technical Bases for Meteorology and Occupancy Factors Utilized in Calculating Off Site Dose." Historical meteorological data, last updated in 1992, may be found in Chapter 2 of the Zion Station Defueled Safety Analysis Report (DSAR), July 2018. With the demolition of both unit vents, the meteorological tower, and the main stack between 2014 and 2016, a six-year average of this data (January 2009 to December 31, 2014) was assembled and has been used in the RETDAS code to calculate off-site dose from airborne releases since 2015.

Decommissioning Progress and the Impact on Effluents

- There were no liquid effluent discharges in 2019.
- 2.42 million cubic feet of construction debris and material (all Dry Active Waste DAW) was shipped off site to the Energy*Solutions* low level waste facility in Utah on 1106 Union Pacific rail cars. There were no mixed waste shipments made in 2019.
- During D&D, the primary potential source of airborne effluents is trace radionuclides present in the concrete dust generated during demolition. For Zion Station, gaseous air particulate (AP) samplers were utilized at various points in the former power block footprint and surrounded the construction demolition activities in 2019. Specifically, in 2019, these samplers were positioned at the following primary locations, but were relocated when work moved to different areas within the power block footprint to assure samplers were located at the source or relocated to adjacent areas in response to

construction activities. Placement of these monitors was in accordance with the site's ODCM and Radiation Protection Program.

- Surrounding the former power block including north near the former Waste Water Treatment Facility, northeast and southeast along the shore of Lake Michigan, south of the power block just south southeast of the ISFSI, and west just east of the north end of the switchyard.
- At three locations near the soil pile adjacent to the rail spur running directly east of the switchyard. These were moved as needed as the piles were moved.
- Between the soil and clean concrete debris piles along the rail spur to permit monitoring during rail car loading and material movement operations.

These monitoring locations constituted the effluent monitoring instrumentation for airborne effluents in 2019.

- The airborne results for all quarters are reported in the attached Table A-1A as Ground Level Batch Gaseous Releases.

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 2019.

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 off site, and therefore, no resulting off site impact.

3. Radioactive Waste Treatment System Changes

   There were no Radioactive Waste Treatment System Changes in 2019.

4. Annual Land-Use Census Changes

   A search for new gardens, farms and orchards within a 10-kilometer radius of the site was performed with no changes or additions identified for 2019. The annual resident survey was also completed with no changes to the previous year's results identified. No changes to the Zion Station Off Site Dose Calculation Manual (ODCM) were needed due to changes in the Land Use Census.

5. Effluent Monitor Instrument Inoperability

   There were periodic losses of power to effluent air samplers powered by portable generators, but none were out of service for more than 4 hours during work operations. These were all quickly returned to service using spare air samplers, when needed, or by using refueled or replacement portable power generators typically within 2 hours and within 4 hours in all cases, while work was being performed. If

inoperable for more than four hours, compensatory measures are required. More than 30 days of inoperability requires compensatory actions and an explanation as to why the inoperable monitor was not restored to service within 30 days in this report. Neither situation arose in 2019.

6. Offsite Dose Calculation Manual Changes

   There were no revisions made to the ODCM in 2019. Revision 11 was issued in June of 2018 and remained the version in effect during all of 2019.

7. Process Control Program Changes

   There were minor changes to the Process Control Program in 2019. A copy of the revised program is attached in Appendix E.

8. Errata/Corrections to Previous ARERRs

   There were no Errata/Corrections to previously issued ARERRs in 2019.

9. 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 off site, the ISFSI is the primary source of direct radiation exposure on site 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 essentially identical for both licenses.

      Direct dose was the only contributor of plant related radiation exposure to a member of the public as shown in Table A-5 with whole body dose less than 1.0 mrem per year (0.844 mrem/year) or 3.38% of the annual 40 CFR190 dose limit of 25 mrem/year.

III. APPENDICES

APPENDIX A - TABLES

Table A-1. Gaseous Effluents - Summation of All Releases

Summation of All Releases	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Uncertainty[3]
Fission and Activation Gases	Ci	NM[4]	NM	NM	NM	NM	N/A
Average Release Rate	µCi/s	N/A[2]	N/A	N/A	N/A	N/A	
% of Limit	%	N/A[2]	N/A	N/A	N/A	N/A	
Iodines and Halogens	Ci	NM	NM	NM	NM	NM	N/A
Average Release Rate	µCi/s	N/A	N/A	N/A	N/A	N/A	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
Particulates	Ci	<LLD[1]	<LLD	<LLD	<LLD	<LLD	± 23%
Average Release Rate	µCi/s	N/A	N/A	N/A	N/A	N/A	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
Tritium	Ci	NM	NM	NM	NM	NM	
Average Release Rate	µCi/s	N/A	N/A	N/A	N/A	N/A	
% of Limit	%	N/A	N/A	N/A	N/A	N/A	
Gross Alpha	Ci	<LLD	<LLD	<LLD	<LLD	<LLD	± 23%

[1] - <LLD - Not Detected: Sampled and analyzed for, but not detected at concentrations at or above the lower limit of detection (LLD).

[2] - N/A - Not Applicable: Release Rate and % of Limit requires detection of the radionuclides in this class to calculate release rates and compare to limits.

[3] - Error Estimation - Uncertainty is calculated in Appendix B.

[4] - NM: Not Measured. Tritium releases in gaseous form were not measured.

Table A-1A. Gaseous Effluents - Ground-Level Release - Batch Mode

Summation of All Releases	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Fission and Activation Gases	Ci	NM[2]	NM	NM	NM	NM

Iodines/Halogen	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Iodines and Halogens	Ci	NM	NM	NM	NM	NM

Particulates	Units	Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total
Co-60	Ci	<LLD[1]	<LLD	<LLD	<LLD	<LLD
Cs-137	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Eu-152	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Ni-63	Ci	<LLD	<LLD	<LLD	<LLD	<LLD
Total	Ci	<LLD	<LLD	<LLD	<LLD	<LLD

Tritium	Ci	NM	NM	NM	NM	NM

Gross Alpha	Ci	<LLD	<LLD	<LLD	<LLD	<LLD

[1] - *<LLD - Not Detected: Sampled and analyzed for, but not detected at concentrations at or above the lower limit of detection (LLD).*

[2] - *NM: Not Measured. Tritium releases in gaseous form were not measured.*

Table A-1B. Gaseous Effluents—Ground-Level Release—Continuous Mode
There were no Ground Level Continuous Gaseous Releases from Zion Station
Table A-1C. Gaseous Effluents—Elevated Release—Batch Mode
There are no Elevated Batch Gaseous Releases from Zion Station
Table A-1D. Gaseous Effluents—Elevated Release—Continuous Mode
There are no Elevated Continuous Gaseous Releases from Zion Station
Table A-1E. Gaseous Effluents—Mixed Mode Release—Batch Mode
There are no Mixed Mode Batch Gaseous Releases from Zion Station
Table A-1F. Gaseous Effluents—Mixed Mode Release—Continuous Mode
There are no Mixed Mode Continuous Gaseous Releases from Zion Station

Table A-2. Liquid Effluents - Summation of All Releases;
There were no liquid effluent releases in 2019.
Table A-2A. Liquid Effluents - Batch Mode –
There were no batch Liquid Effluent releases in 2019
Table A-2B. Liquid Effluents - Continuous Mode
There were no Continuous Liquid Releases from Zion Station in 2019

Table A-3. Low-Level Waste

Resins, Filters, and Evaporator Bottoms	Volume		Curies Shipped
Waste Class	ft^3	m^3	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
ALL	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^3	m^3	Curies
A	2.42E+06	6.85E+04	7.51E+01
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
ALL	2.42E+06	6.85E+04	7.51E+01

Major Nuclides for the Above Table: Fe-55 (7.91%), Co-60 (34.68%), Ni-63 (48.19%), Cs-137 (6.82%)

Irradiated Components	Volume		Curies Shipped
Waste Class	ft^3	m^3	
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

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

Other Waste	Volume		Curies Shipped
WASTE CLASS	ft^3	m^3	
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^3	m^3	
A	2.42E+06	6.85E+04	7.51E+01
B	0.00E+00	0.00E+00	0.00E+00
C	0.00E+00	0.00E+00	0.00E+00
ALL	2.42E+06	6.85E+04	7.51E+01

Major Nuclides for the Above Table: Fe-55 (7.91%), Co-60 (34.68%), Ni-63 (48.19%), Cs-137 (6.82%)

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
Gaseous Effluent Dose Limit, Beta Air[1]	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
Gaseous Effluent Dose Limit, Any Organ(Iodine, Tritium, Particulates with >8-day half-life)	7.5 mrem	7.5 mrem	7.5 mrem	7.5 mrem	15 mrem
Gaseous Effluent	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
(Iodine, Tritium, Particulates with > 8-Day half-life)					
% of Limit	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

[1] *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[1]	Thyroid[1]	Any other organ[1]
Dose Limit	**25 mrem/year**	**75 mrem/year**	**25 mrem/year**
Direct Dose	8.44E-01	8.44E-01	8.44E-01
Dose From Liquid	0.00E+00	0.00E+00	0.00E+00
Dose From Gaseous	0.00E+00	0.00E+00	0.00E+00
Postulated H-3 Dose	0.00E+00	0.00E+00	0.00E+00
TOTAL DOSE	8.44E-01	8.44E-01	8.44E-01
% of Limit	3.38E+00	1.13E+00	3.38E+00

[1] – *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 M – West Southwest) at the controlled area boundary with occupancy factors applied. The reported total dose is in units of mrem per year.*

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.

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

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

a. Gaseous Effluents

Sampling Error (*S*)	5%
Calibration Error (*C*)	10%
Counting Statistics Error (*CS*)	17%
Sample Volume Error (*V*)	10%
Total Error	23%

Appendix C – Errata

No Errata to Previously Issued ARERRs

Appendix D – ODCM Revisions

No Revision to the Zion Station ODCM Were Issued in 2019

Appendix E – PCP Revisions

Process Control Program (PCP) Changes Issued in 2019 are Attached

D&D Procedure

WASTE OPERATIONS PROCEDURE

Process Control Program Requirements

Procedure No. ZS-WM-123

Revision No. 6

Preparer: (Print name / sign): Richard Rickert/ Richard B Rickert Date: 10/16/19

Secondary Reviewer: (Print name / sign): Roger Boyce Roger W Boyce Date: 10-16-19

VP Regulatory Affairs or Designee has reviewed and determined required program & regulatory reviews (*new procedures only*) : SIGNATURE _____ DATE _____

Regulatory Required Reviews (per AD-11, "Regulatory Reviews")		
Part 72 ISFSI Impact License: 10 CFR 72.48	☐ YES	☒ NO
Part 50 License: 10 CFR 50.59 and 50.90	☒ YES	☐ NO
Fire Protection: 10 CFR 50.48(f)	☐ YES	☒ NO
Conditions of License: E-Plan: 10 CFR 50.54(q)	☐ YES	☒ NO

QA Review Required? ☐ YES ☒ NO

QA Reviewer: N/A DATE: —
Print Name / Signature

Technical Review Required? ☑ YES ☐ NO

Technical Reviewer: ROGER BOYCE / Roger W Boyce DATE: 10-16-19
Print Name / Signature

Technical Reviewer: N/A DATE: —
Print Name / Signature

Approval Section

DEPARTMENT MANAGER: David Villicana DATE: 10-17-19
Print Name / Signature

DECOMMISSIONING PLANT MANAGER*: Jeremy Hoff DATE: 10-22-19
Print Name / Signature

* Required for Technical Reviews only

Verification of Required Reviews Per MDI Completed :

DOCUMENT CONTROL: Kim Van Hoozen Kim Van Hooz DATE: 11/20/19
Print Name / Signature

Effective Date:

ATTACHMENT B-3

50.59 Applicability Review Form

Activity/Document Number: ZS-WM-123 **Revision Number:** 6

Address the questions below for all aspects of the Activity. If the answer is yes for any portion of the Activity, apply the identified process(es) to that portion of the Activity. Note that it is not unusual to have more than one process apply to a given Activity. See Section 4 of the Resource Manual (RM) for additional guidance.

I.	Does the proposed Activity involve a change:		
	1. Technical Specifications or Operating License (10 CFR 50.90)?	X NO __ YES	See Section 4.2.1.1 of the RM
	2. Conditions of License Quality Assurance program (10 CFR 50.54(a))? Security Plan (10 CFR 50.54(p))? Emergency Plan (10 CFR 50.54(q))?	X NO __ YES X NO __ YES X NO __ YES	See Section 4.2.1.2 of the RM
	3. Specific Exemptions (10 CFR 50.12)?	X NO __ YES	See Section 4.2.1.5 of the RM
	4. Radiation Protection Program (10 CFR 20)?	X NO __ YES	See Section 4.2.1.6 of the RM
	5. Fire Protection Program (applicable UFSAR or operating license condition)?	X NO __ YES	See Section 4.2.1.7 of the RM
	6. Programs controlled by the Operating License or the Technical Specifications (such as the ODCM).	X NO __ YES	See Section 4.2.1.7 of the RM
	7. Environmental Protection Program	X NO __ YES	See Section 4.2.1.7 of the RM
	8. Other programs controlled by other regulations.	X NO __ YES	See Section 4.2.1 of the RM
II.	Does the proposed Activity involve maintenance which restores SSCs to their original condition or involve a temporary alteration supporting maintenance that will be in effect during at-power operations for 90 days or less?	X NO __ YES	See Section 4.2.2 of the RM
III.	Does the proposed Activity involve a change to the:		
	1. UFSAR (including documents incorporated by reference) that is excluded from the requirement to perform a 50.59 Review by NEI 96-07 or NEI 98-03?	X NO __ YES	See Section 4.2.3 of the RM
	2. Managerial or administrative procedures governing the conduct of facility operations	__ NO X YES	See Section 4.2.4 of the RM
	3. Procedures for performing maintenance activities (subject to 10 CFR 50.65(a)(4))?	X NO __ YES	See Section 4.2.4 of the RM
	4. Regulatory commitment not covered by another regulation based change process (see NEI 99-04)?	X NO __ YES	See Section 4.2.3/4.2.4 of the RM
IV.	Does the proposed Activity involve a change to the Independent Spent Fuel Storage Installation (ISFSI) (subject to control by 10 CFR 72.48)	X NO __ YES	See Section 4.2.6 of the RM
V.	Does the proposed Activity involve a change to the Packaging & Transportation of Radioactive Material? (subject to control by 10 CFR 71)	X NO __ YES	
VI.	Is the proposed activity a Decommissioning Activity that requires a change to DSAR Chapter 3, 4 or 5 thereby requiring a 50.59 Screening.	X NO __ YES	

Check one of the following:

X **If** all aspects of the Activity are controlled by one or more of the above processes, **then** a 50.59 Screening is not required and the Activity may be implemented in accordance with its governing procedure.

☐ **If** any portion of the Activity is **not** controlled by one or more of the above processes, then process a 50.59 Screening for the portion not covered by any of the above processes. The remaining portion of the activity should be implemented in accordance with its governing procedure.

Signoff:

50.59 Screener/50.59 Evaluator: (Circle One) ROGER BOYCE (Print name) Sign: Roger W Boyce (Signature) Date: 10/15/19

Summary of Changes in this Revision:

Rev. 6:

- Update section 4.2.11 by removing a detailed explanation of the information needed for the Annual Radioactive Effluent Release Report (ARERR). Provided the correct location to the information that is required to be included in the Annual ARERR.

1. PURPOSE AND SCOPE

1.1. PURPOSE

This procedure provides the necessary requirements to ensure Zion*Solutions* PROCESS CONTROL PROGRAM parameters are established and met, as outlined in the burial site waste acceptance criteria (WAC). This process must also meet the regulations identified in 10 CFR Parts 20, 61 and 71.

1.2. SCOPE

This procedure is applicable to all low-level radioactive waste streams processed at Zion*Solutions*. This criterion includes all Department of Transportation (DOT), Nuclear Regulatory Commission (NRC), State and licensed burial facility regulations for the disposition , packaging, shipping, and burial of LLRW.
ZionSolutions Waste Operations Manager can designate vendor(s) to perform certain steps within this procedure when appropriate.

2. RESPONSIBILITIES

2.1. Waste Operations Manager – is responsible for:

- Maintaining the Process Control Program and its overall implementation.
- Ensure that waste is processed and packaged in accordance with procedures identified in this program.

2.2. Quality Assurance Manager - is responsible for:

- Implements Quality Control hold points and independent verifications in all related program procedures to ensure that regulatory requirements and disposal site criteria are satisfied.
- QA/QC Requirements.

2.3. Waste Processor/Operator – is responsible for:

- Providing documentation of satisfactory processing via completion of Energy*Solutions* procedure check lists.

2.4. Broker/Shipper's - are responsible for:

- Implementation of this procedure.

3. DEFINITIONS

3.1. **Batch** - A fixed volume of wet waste with essentially uniform physical, chemical, and radiological properties. A single batch of wet waste maybe dewatered in several containers. An isolated tank of agitated wet waste is an example of a batch.

3.2. **Disposal Facility** - An off-site facility for the disposal of radioactive waste which is licensed for that purpose by the host state and/or the NRC.

3.3. **Dry Active Waste (DAW)** - Radioactive Waste that is typically paper, wood, plastic, trash, air filters, metal, soil, concrete, asphalt, and used plant components, which without processing, contains essentially no free liquid.

3.4. **Item** - Any level of unit assembly, including structures, systems, subsystems, and subassemblies, components, part, or material.

3.5. **Process Control Program (PCP)** - Shall contain the approved formulas, sampling, analyses, tests and determinations, to ensure that the disposition and packaging of low-level radioactive (solid wet or dry) wastes are handled in compliance with:

- 10CFR Parts 20, 61 and 71
- 49CFR Parts171-178
- State regulations
- Burial ground requirements
- Other requirements governing the shipping and disposal of radioactive waste

The majority of PCP scope deals with, but is not limited to, wet wastes. Documents listed in the References Section of this procedure may be useful in providing more detailed clarification of the PCP program.

3.6. **Radioactive Waste Package** - The packaging together with its radioactive contents as presented for transport.

3.7. **Radioactive Waste Packaging** - The assembly of components necessary to ensure compliance with the packaging requirements of 49CFR and 10CFR71. It may consist of one or more containers, absorbent materials, spacing structures, thermal insulation, radiation shielding or mechanical shock absorbing devices. The vehicle, tie-down system and auxiliary equipment may be designated as part of the packaging.

3.8. **Radioactive Material** - Byproduct material, source material, special nuclear material, and technologically enhanced naturally occurring radioactive material (NORM) as defined in regulation. This includes, but is not limited to, station generated radioactive waste, radioactive material to be shipped to another licensee and spent fuel.

3.9. **Radioactive Material (for shipping purposes only)** - Material having a specific and total activity as defined in 49CFR §173.436. If the material is not radioactive for the purposes of hazardous material Class 7 transport, it is not subject to the requirements of 49CFR173. However, this is not considered free release criteria or considered non-radioactive under the provisions of 10CFR20.

3.10. **Radioactive Waste (Radwaste or Waste)** - Radioactive Material that has no further economic value and is to be shipped to a decontamination, volume reduction or disposal facility.

3.11. **Temporary System** - Systems intended for short-term duration and subsequent removal once they have completed their specific task or tasks. This does not include permanent systems, consumables, or vehicles and casks used to pick up/delivery service. Mobile radioactive waste processing systems to support decommissioning activities are examples of temporary systems.

3.12. **Waste Stream** - An individual, specific type or source of radioactive waste and its associated process that exhibit similar radionuclide distributions.

3.13. **Wet Waste** - Radioactive Waste containing free standing liquids or packaged underwater. Wet waste is usually solidified, encapsulated, or dewatered before shipping for disposal. Wet waste being sent to a processor may still contain water. Examples include radioactively spent resin, liquid filters, sludge oil, decontamination fluids, and irradiated hardware packaged underwater.

4. MAIN BODY

4.1. Limitations

4.1.1 Zion*Solutions* does not plan to solidify waste for direct transfer to a disposal facility. If on-site solidification is required, an outside vendor will perform that function under the vendor's PCP, which will be reviewed and approved by Waste Operations prior to commencing any solidification activities:

1.) Any proposed solidification process shall be evaluated for acceptability on a case-by-case basis.

2.) The vendor PCP will be submitted to Waste Operations Management prior to implementation for review and approval in accordance with applicable Zion*Solutions* procedures. The review will identify that there is sufficient supporting documentation of the vendor's PCP to give assurance that the final product will meet the requirements for transport and disposal in a safe and efficient manner.

3.) Solidification procedures shall be reviewed and approved in accordance with Zion*Solutions* procedures.

4.1.2 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. These radioactive waste requirements implement the regulations found in 10CFR §50.36a and General Design Criteria 60 of Appendix A to 10CFRPart 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.

4.1.3 The process control activities described in this program are QA approved. Process or equipment failures are subject to the requirements of 10CFR21, "Reporting of Deficiencies and Noncompliance."

4.1.4 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).

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

4.1.6 Waste classification will meet the requirements of 10CFR61 and disposal site criteria.

4.2. Procedure

4.2.1 Review and Qualification of Solidification Processes

1.) *Zion**Solutions*** does not plan to solidify or encapsulate waste for direct transfer to a disposal facility. If on-site solidification or encapsulation is required, an outside vendor will perform that function under the vendor's PCP, which will be reviewed and approved as follows:

A. Any proposed solidification process shall be evaluated for acceptability and applicability to the waste stream intended for solidification on a case by case basis.

B. The vendor PCP will be submitted to Waste Operations Management prior to implementation for review and approval in accordance with applicable *Zion**Solutions*** procedures. The review shall identify that there is sufficient supporting documentation of the vendor's PCP to give assurance that the final product will meet the requirements for transport and disposal in a safe and efficient manner.

C. Solidification procedures shall be reviewed and approved in accordance with applicable *Zion**Solutions*** procedures.

4.2.2 Reportable Events

1.) Mishaps involving the container or solidification process shall be evaluated for reportability under 10 CFR 21. In Generic Letter 91-02, the NRC expressed specific interest in reporting the following circumstances:

A. Changed container dimensions, cracking or damage from mishandling can be evidence of container failure.

B. The presence of free liquids in excess of 1% of the waste volume or excessive void space within the container. Such misuse is prohibited by 10 CFR §61.56 (b) (2).

C. Mishaps shall be documented using the station corrective action process.

D. Mishaps may be subject to a 30 day reporting criteria and require approval of the disposal facility prior to transport.

E. Other methods of processing resins shall be reviewed and approved by Waste Operations Management prior to implementation.

4.2.3 Dry Active Waste (DAW)

A. DAW is typically packaged into boxes, gondola railcars, intermodal containers, or C-vans and shipped to a licensed vendor that processes the DAW for final disposal or shipped directly to a licensed disposal facility.

B. DAW is examined prior to packaging through the Waste Package Certification process in order to eliminate items that may conflict with a vendor's ability to process the material or the disposal site criteria.

C. Removal of prohibitive items such as liquids or items found in DAW that would compromise the integrity of the package are removed and separated for special handling.

D. Inspection criteria are established for the receipt, pre-use, loading and transport of approved shipping containers being dispatched to a disposal facility.

4.2.4 Incinerable Fluids

A. Fluids that are capable of being incinerated (e.g. hydraulic fluids, lubricating oils, etc.) may be shipped to a processor that is licensed to perform that activity.

B. The vendor will be evaluated and approved by Waste Operations Management prior to implementation. Disposal is based on the vendor's process control program.

C. In the process, the fluid is typically consumed and the resultant activity captured for disposal or released under the vendor's license. The vendor may return any material that cannot be processed for disposal to Zion*Solutions*.

4.2.5 Sludges

A. Wet wastes that are not capable of being incinerated may be shipped to a vendor licensed to process, concentrate and/or solidify wet wastes. Processing resulting in on-site solidification is subject to the process controls for solidification discussed above.

B. The vendor may return any material that cannot be processed for disposal to Zion*Solutions*.

4.2.6 Prohibited Waste Constituents

1.) No radioactive waste capable of detonation, explosive decomposition or reaction will be shipped for disposal per 10 CFR §61.56 (a) (4). Components containing explosive materials, such as some automatic valves (e.g. fire protection valves on Halon and/or CO_2 systems), should be identified and the removal or disposal of these valves controlled by the work control process.

2.) No radioactive waste capable of generating toxic gases, vapors or fumes will be shipped for disposal per 10 CFR §61.56 (a) (5).

3.) No radioactive waste that is pyrophoric will be shipped for disposal per 10 CFR §61.56 (a) (6).

4.) Control of the generation of these types of waste is provided through the use of approved Zion*Solutions* procedures.

4.2.7 Mixed Waste

1.) No mixed waste will be submitted for disposal per 10 CFR §61.56 (a) (8) unless properly treated.

2.) Zion*Solutions* will ship its mixed waste inventory to licensed and permitted facilities for processing prior to disposal.

3.) The vendor will be evaluated by Waste Operations Management prior to implementation. Disposal is based on the vendor's process control program.

4.) The vendor's processes will also be reviewed to ensure compliance with 40 CFR requirements.

5.) Controls associated with the generation of mixed waste is provided through approved Zion*Solutions* procedures.

6.) Material safety data sheets (MSDS) on consumable materials are maintained for chemicals used on site.

4.2.8 Waste Characterization

Approved Zion*Solutions* procedures shall specify the method of waste classification to meet the requirements of 10 CFR §61.55. These procedures shall include the collection of data, computational methods, computer codes, etc. The following is a synopsis of the methodology employed and required elements of the procedures.

1.) Individuals performing the calculations described in this section and the reviewer of those calculations shall be specifically approved to perform that function by the Waste Operations Manager/Designee and/or otherwise qualified through an approved qualification program in accordance with station procedures. Approval, in lieu of specific qualification, should be based on experience at other nuclear facilities and/or demonstrated proficiency with the types of calculations or computer codes required.

2.) Radioactive waste streams are sampled and/or assessed biannually, prior to shipment, or after any evolution that may affect the distribution of radionuclides by a factor of ten (10) in waste streams for Class A, B, and C waste as defined in 10 CFR §61.55. An assay of beta, gamma and alpha emitting radionuclides will be performed.

3.) An approved outside laboratory is used by Zion*Solutions* to analyze waste streams to determine the distribution and activity of radionuclides listed in Tables 1 and 2 of 10 CFR 61.

4.) For DAW, dose rate to curie conversion calculations are performed to determine the total gamma emitter activity present in a container.

5.) Computational methods (including computer codes used to perform waste classification) shall be verified and validated by an individual as described in 4.2.8.1 as follows:

A. An individual shall review the computational methods basis document or manual.

B. The reviewer shall ensure technical accuracy, technical adequacy, reasonableness of assumptions, and traceability of data.

C. Calculation results shall be benchmarked against other verified methods to prove reasonable agreement.

D. Initial reviews and benchmark results shall be documented.

E. The verification / validation shall be reviewed and approved prior to implementation of the method.

6.) Calculations to determine curie content and waste classification of radioactive waste performed by means other than computer codes (i.e. manual calculations, etc.) shall be checked by a qualified individual as defined in 4.2.8.1, other than the originator, who shall be responsible to check and document the following:

A. Check the appropriateness of the application of the computational method;

B. Check assumptions and input data for reasonableness;

C. Perform a sufficient number of checks of the calculations to reasonably test accuracy and consistency of the results, OR,

D. Perform a check of the results by comparison with other similar calculations,

7.) Calculation methodology to assess the concentration of radionuclides for waste disposal shall incorporate the guidance provided in the NRC's "Final Branch Technical Position on Concentration Averaging and Encapsulation", January 1995.

4.2.9 PCP Document and Procedure Control

1.) Changes to the Process Control Program:

A. SHALL be documented and records of reviews performed shall be retained as required by the Quality Assurance Project plan. The documentation shall contain:

i. Sufficient information to support the change, together with the appropriate analyses, justifying the change(s).

ii. A determination that the change will maintain the solidified waste product to existing requirements of Federal, State, or other applicable regulations.

B. SHALL become effective after review and acceptance by:

i. Waste Operations Management will control revision of this PCP. Alterations to the program that may result from changes in vendor processes or plant activities, should be identified to and reviewed by Waste Operations Management. Waste Operations Management must approve changes to this procedure prior to submittal to the Zion*Solutions* Decommissioning Plant Manager.

ii. The Zion*Solutions* Decommissioning Plant Manager provides final document approval prior to issue and implementation.

2.) New process qualifications, or changes in an existing process, may be implemented prior to updating this procedure, provided the technical evaluation and approvals are documented.

3.) Radiation Protection Management and Waste Operations Management should ensure that required changes are incorporated to this procedure as appropriate.

4.) Waste shipment manifests and supporting documentation shall be retained until license termination plus 10 years. Support documents may include the analysis or a reference to the analysis, used in the determination of the total activity contained in disposal packages.

4.2.10 SHALL be submitted to the NRC in the Annual Radioactive Effluent Release Report for the period in which the change was made (including change in vendor).

4.2.11 The Annual Radioactive Effluent Release Report:

5.) SHALL be submitted prior to May 1st of each year in accordance with the Quality Assurance Project Plan.

6.) SHALL be in the format of Regulatory Guide 1.21, Revision 2- (Table 3). Also shown in reference 5.10 (Attachment 2.)

5. REFERENCES

5.1. Code of Federal Regulations, Title 10, "Energy", Appendix G to Part 20, "Requirements for Transfers of Low-Level Radioactive Waste Intended for Disposal at Licensed Land Disposal Facilities and Manifests."

5.2. Code of Federal Regulations, Title 10, "Energy", Part 61, "Licensing Requirements for Land Disposal of Radioactive Waste."

5.3. Code of Federal Regulations, Title 10, "Energy", Part 71, "Packaging and Transfer of Radioactive Material."

5.4. Code of Federal Regulations, Title 49, "Transportation", Sub Chapter C – Hazardous Materials Regulations, Part 173, "Shippers – General Requirements for Shipments."

5.5. NRC Regulatory Guide 1.143, "Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants.

5.6. NRC Generic Letter 91-02, "Reporting Mishaps Involving LLW Forms Prepared for Disposal."

5.7. Quality Assurance Project Plan (QAPP).

5.8. 10CFR20, 10CFR50.36a, General Design Criteria 60 of Appendix A to 10CFR50, 10CFR61, and 10CFR71.

5.9. Regulatory Guide 1.21, Measuring, Evaluating, and Reporting Radioactivity in Solid Wastes and Releases of Radioactive Materials in Liquid and Gaseous Effluents from Light-Water-Cooled Nuclear Power Plants, Revision 2.

5.10. ZS-RP-109-001-002, "Generation of the Annual Radioactive Effluent Release Report (ARERR)."

5.11. NRC Branch Technical Position On Concentration Averaging and Encapsulation, dated January 1995.

5.12. NRC Branch Technical Position On Waste Form, Rev.1, dated January 1991.

5.13. Zion Station Calculation No. 22N-0-119M-0001, Rev. 1, "Dose Effects on Radwaste Handling Accident Involving a HIC."

5.14. 295-201-97-CAQD-121605 (Zion Corrective Action).

5.15. NRC Branch Technical Position Rev.1 on Concentration Averaging and Encapsulation, dated February 2015.

6. RECORDS

None

7. ATTACHMENTS

None

8. FORMS

None