1. INTRODUCTION

1.1 Purpose

The presence of airborne tritium may be indicative of Fuel Storage Container (FSC) leakage. The purpose of this procedure is to determine airborne tritium concentration at the Fort St. Vrain (FSV) Independent Spent Fuel Storage Installation (ISFSI).

Additionally, this procedure defines the acceptance criteria for determining that a gross FSC and/or O-ring failure has been detected, and defines actions to be taken if such a failure is suspected.

1.2 Scope and Applicability

This procedure provides instructions to be used in determining the airborne tritium concentration in the charge face area and the exhaust chimneys at the FSV ISFSI.

Charge face tritium sampling is normally performed quarterly. Exhaust chimney tritium sampling is normally performed annually. Sampling is normally performed at the locations shown in Appendix A, "Layout of ISFSI Charge Face and Sample Figures," figures A-1 and A-3.

A trip blank and a background sample are also collected. The trip blank is a sample column that travels with the other samples but is never used or opened. The background sample may be performed at any time during the sampling sequence.

Applicable portions of this procedure may be used for tritium sampling at other locations and frequencies.

Sample results are compared to the 10CFR20 Appendix B, Table 2, Column 1 value for Hydrogen-3 (1E-7 uCi/ml). This is the acceptance criteria for determining that a gross FSC and/or O-ring failure has been detected. This value, the limit for licensed airborne radioactive material in the unrestricted area, was chosen because it is significantly above the FSV background airborne tritium value, and as such eliminates an overly conservative response to a positive value near the background value, which could represent a false positive value. Sample results which exceed the 10CFR20 value leave little doubt that an FSC and/or O-ring failure has occurred.

For perspective, note that an individual present in a tritium concentration of 1E-7 uCi/ml for an entire year would accumulate a dose of 100 mrem.

Sample results are also compared to the background and minimum detection limit (MDL) values. Sample results exceeding these values could be indicative of an FSC and/or O-ring failure and deserve further attention.

2. PRECAUTIONS AND LIMITATIONS

2.1 Upon completion, Appendix B, "FSV Tritium Sampling Data," and Appendix C, "Procedure Discrepancies," if used, must be removed from this procedure and maintained as the official record.

2.2 Personnel must follow the applicable hazard mitigations detailed in Appendix D, "Procedure Hazard Analysis."

2.3 If access to the crane rail ledge is needed, the individual(s) on the ledge and the crane operator must be in constant visual or verbal contact. Crane operation must only be directed by the designated individual on the ledge.

2.3.1 Prior to authorizing crane operation, the designated individual must ensure all individuals on the ledge are in a safe location and are aware of pending crane movement.

2.3.2 The individual(s) accessing the rail ledge or crane platform must be briefed regarding the exposed battery terminals.

2.4 If performing exhaust chimney sampling, fall protection must be implemented per the current Fall Hazard Prevention Analysis (FHPA).

2.5 Any deficiency, hazard, or abnormal condition noted during the performance of this procedure must be entered in Appendix C and reported verbally to the Facility Manager.

3. PREREQUISITES

3.1 Planning and Coordination

NOTE: *Approximately 2 weeks lead time may be necessary to obtain sample columns from the Analytical Laboratory*.

3.1.1 Obtain sample columns from the analytical laboratory as follows:

A. When performing routine sampling, six sample columns will be required when sampling the charge face area only

B. When performing routine sampling, twelve sample columns will be required when sampling both the charge face area and the exhaust chimneys

C. If performing other than normal charge face and/or exhaust chimney sampling, a background sample column and a trip blank are required in addition to the necessary sample column(s).

3.1.2 After receipt of the sample columns, verify that chain of custody form is included with the columns.

3.1.2.1 Verify that the sample column identification numbers on the columns match those on the form.

3.1.2.2 Verify the chain of custody seal(s) is/are intact.

3.1.2.3 Sign and date the chain of custody form.

3.1.3 Verify the drierite™ (or equivalent) media is blue.

3.1.4 Ensure the fall hazards prevention analysis (or equivalent) is in place prior to performing exhaust chimney sampling.

3.1.4.1 If required, ensure the necessary fall protection equipment is obtained.

3.1.5 Initiate heat/cold stress monitoring per MCP-2704, "Heat and Cold Stress," if applicable.

3.2 Training

3.2.1 Ensure the training requirements of Appendix D are met.

3.3 Special Tools, Equipment, Parts, and Supplies

3.3.1 Verify operability of the pump.

3.3.1.1 Record the serial number or other identifying information in Appendix B, table B-1.

3.3.2 Ensure the calibration of the mass flow meter is current.

3.3.2.1 IF the calibration is NOT current,
THEN return the flow meter to either the manufacturer or the INL Standards and Calibration Laboratory.

3.3.2.2 Record pertinent information in Appendix B, table B-1.

3.4 Approval and Notifications

3.4.1 See Appendix B for approval notifications.

4. INSTRUCTIONS

NOTE 1: *Unless designated in front of step, the Facility Safety Officer (FSO) is person performing steps.*

NOTE 2: *If sufficient sample tubing is available and adequate sample flow can be maintained, then the sample pump should be placed on the charge face floor when performing exhaust chimney sampling (see Appendix A-4).*

NOTE 3: *Section 4.1 sub-steps may be performed in any order at the direction of the Facility Safety Officer or Facility Manager.*

NOTE 4: *Appendix B, and Appendix C if used, serves as the official record. All sampling data is recorded in Appendix B, table B-2.*

4.1 Perform Tritium air sampling at the desired locations (see Appendices A-1 through A-4 for illustrations).

NOTE: *Step 4.1.1.1 may be performed at any convenient time prior to connecting sample tubing and initiating sampling.*

4.1.1 Assemble the sample train as shown in Figure A-2 or A-4 as applicable.

NOTE: *The chain of custody labels **SHOULD NOT** be removed from the top of the columns.*

4.1.1.1 Remove the chain of custody labels from the inlet and outlet of the sample column.

4.1.2 Connect sample pump using GFCI protection and extension cord as necessary.

4.1.3 Check that the needle valve is open.

4.1.4 Start the sample pump.

4.1.5 For optimum sample volume, adjust the sample flow rate to approximately 20 standard liters per minute (slpm) ± 2 slpm.

4.1.5.1 If unable to obtain optimum flow rate, then establish the maximum obtainable flow rate.

4.1.6 Record the sample start time and initial flow as displayed on the mass flow meter.

NOTE: *To ensure an adequate volume of water is collected by the molecular sieve, sampling should last at least 8 hours and no more than 16 hours. This will allow for one sample to be collected during the day and one collected over night.*

4.1.7 WHEN sampling is completed,
THEN do the following:

4.1.7.1 Record stop time and final flow rate.

4.1.7.2 Shut off the pump.

4.1.7.3 Remove the sample column.

4.1.7.4 Replace inlet and outlet caps.

4.1.8 Collect a background sample outside of and away from the ISFSI facility by repeating Steps 4.1.1 through 4.1.7.

4.2 Perform post performance activities.

NOTE: *Section 4.2 sub-steps may be performed in any order at the direction of the Facility Safety Officer or Facility Manager.*

4.2.1 For each sample collected, calculate total sample volume by multiplying sample time in minutes (min) by average sample flow rate in slpm.

4.2.1.1 Calculate the average flow rate by adding the beginning flow rate to the final flow rate and dividing by two.

4.2.1.2 Record the calculated value

4.2.2 Apply new chain of custody seal(s).

4.2.3 Initial and date the new chain of custody seal(s).

4.2.4 Sign and date the chain of custody form.

4.2.5 Place form and columns in shipping container and ship to the analytical laboratory.

4.2.6 Request analytical laboratory analyze samples in accordance with approved analytical procedures.

4.2.6.1 Request the analytical laboratory report results in micro-curies/ml of air within 7 days of analysis.

4.2.7 See Appendix B to review sample results.

4.2.8 Perform procedure closeout on Appendix B.

5. RECORDS

Analysis Results

Chain of Custody Form

Completed Copy of Appendix B, and Appendix C, if used.

Documentation of corrective actions performed per Appendix B, and Appendix C, if used.

NOTE: *Records management requirements are described in MCP-557, "Managing Records". See Records Schedule Matrix – NRC Record Center (NRC Schedule Matrix) for information on uniform file code, disposition authority, and retention period.*

6. DEFINITIONS

None

7. REFERENCES

RML Procedures:

MCP-2002, "Analytical Chain of Custody"

RAP-5, "Determination of Tritium in Water"

SP-SI, "Preparation of Silica Gel Sample for the Determination of Tritium"

Fall Hazard Prevention Analysis (FHPA) FSV#1

PRD-317, Radiation Protection, Safety and Health, and Environmental Protection Programs for NRC Regulated Facilities

8. APPENDIXES

Appendix A, Layout of ISFSI Charge Face and Sample Figures

Figure A-1, Layout of the ISFSI Charge Face

Figure A-2, Typical Configuration for Charge Face Sampling

Figure A-3, Exhaust Chimney Sample Port Layout

Figure A-4, Typical Configuration for Exhaust Chimney Sampling

Appendix B, FSV Tritium Sampling Data

Appendix C, Procedure Discrepancies

Appendix D, Procedure Hazard Analysis

Appendix E, Procedure Basis

Appendix A

Layout of ISFSI Charge Face and Sample Figures

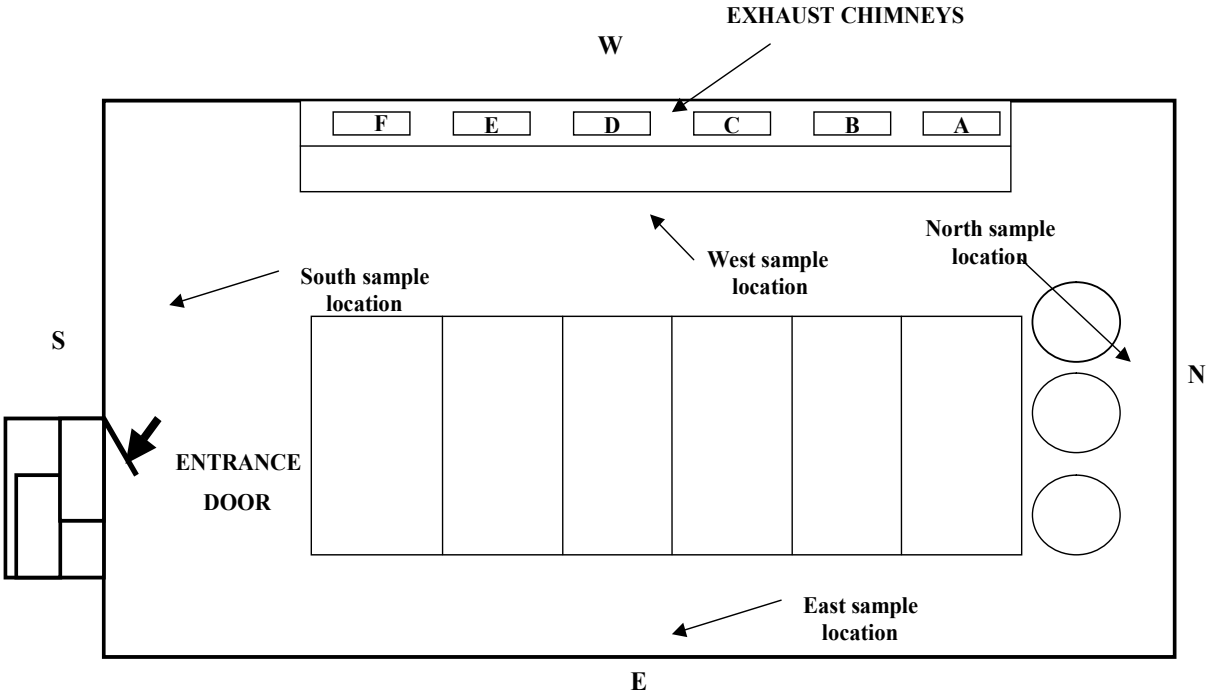

Figure A-1. Layout of the ISFSI Charge Face.

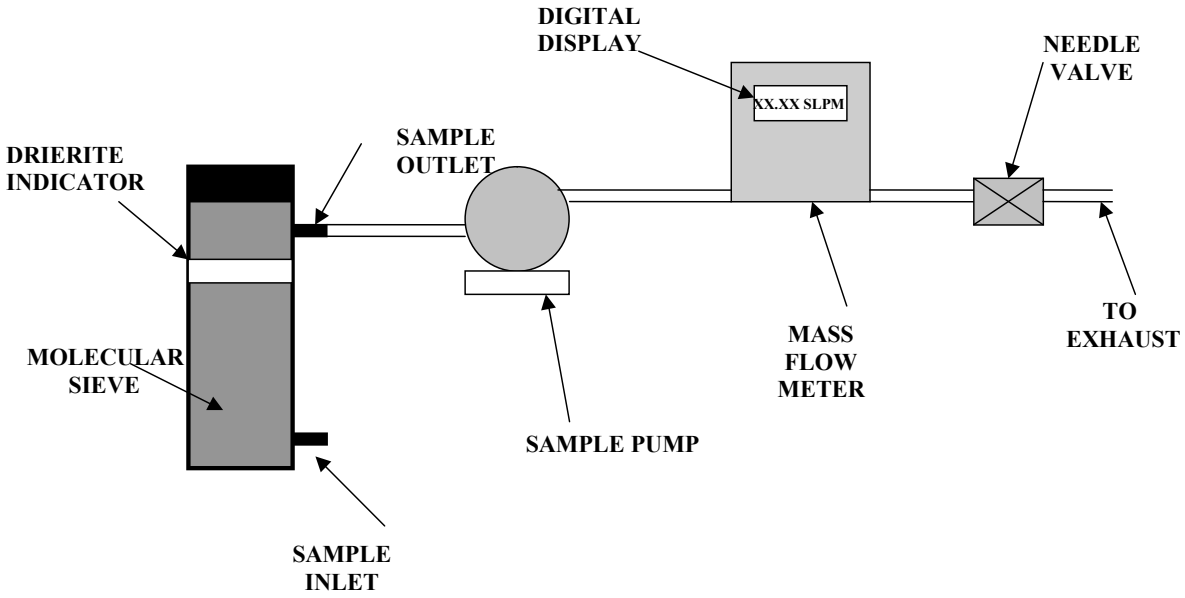

Figure A-2. Typical configuration for Charge Face sampling.

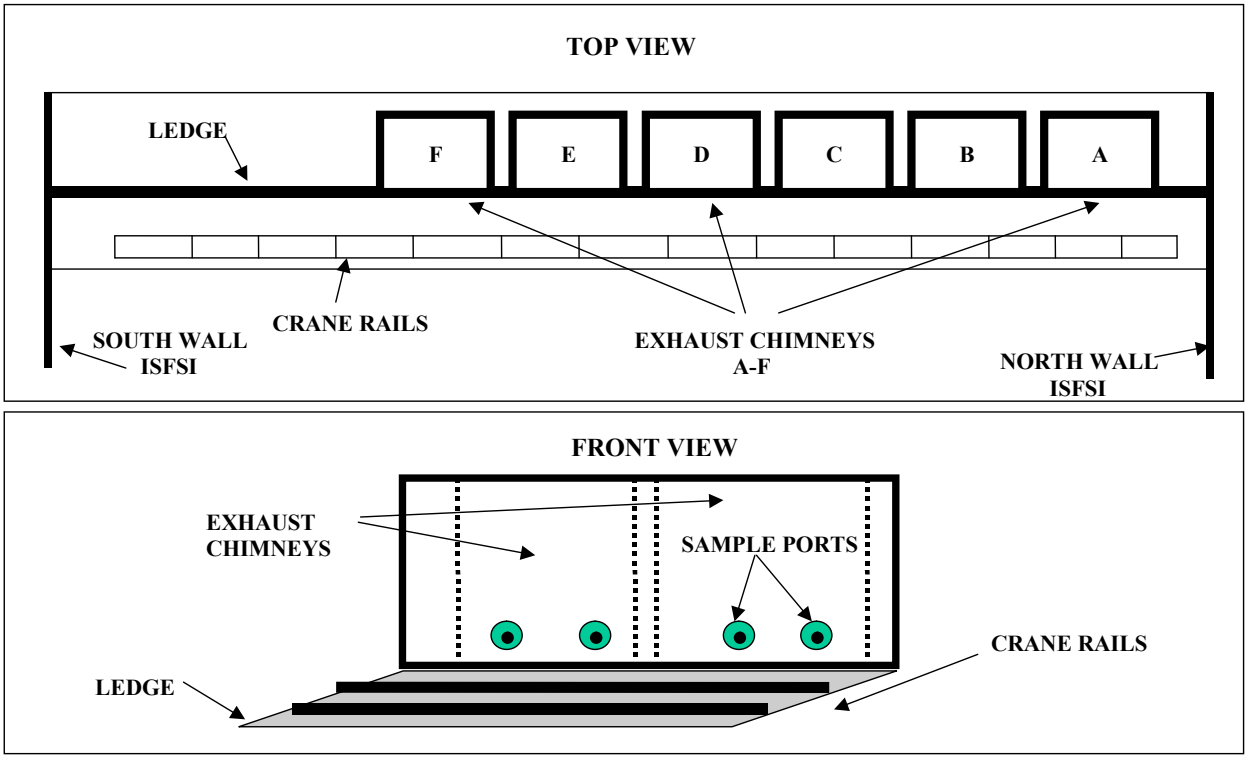

Figure A-3. Exhaust Chimney Sample Port Layout.

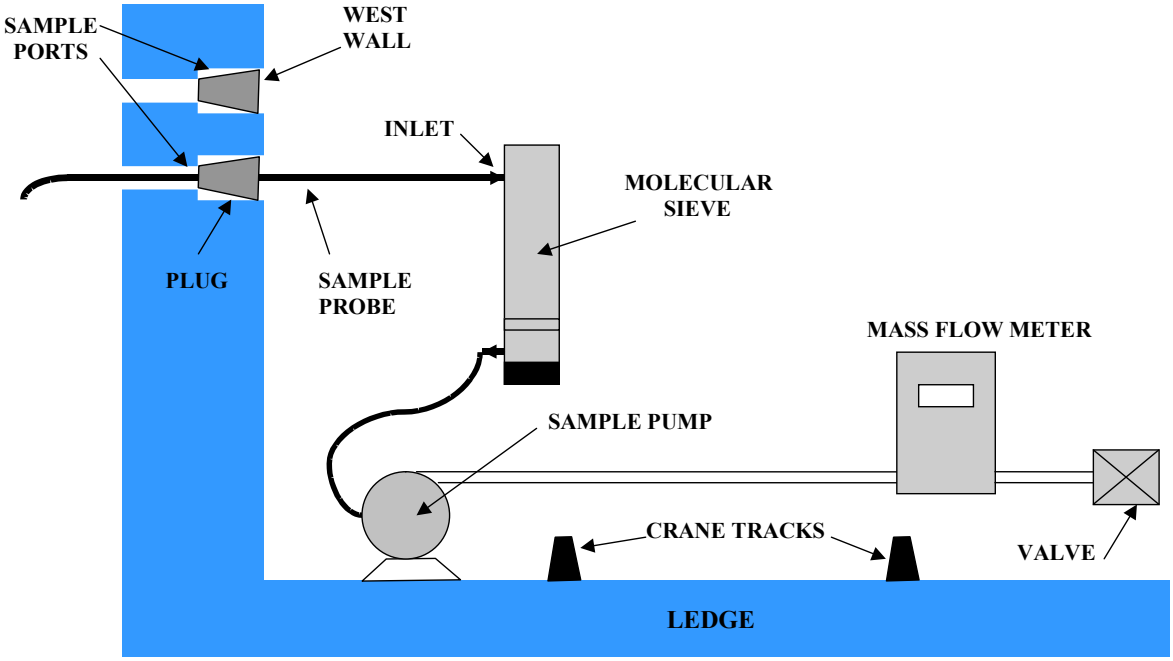

Figure A-4. Typical Configuration for Exhaust Chimney Sampling.

Appendix B

FSV Tritium Sampling Data

Table B-1, Equipment list

Item Description	Remarks	Quantity
Sample pump capable of 20 slpm		1
Mass Flow Meter calibrated to measure 20 +/- 2 slpm	S/N_____ Cal due date_____	1
Fittings, tubing, etc. necessary to assemble sampling apparatus.	N/A	A/R
GFCI protected extension cord	if extension cords are used	A/R
Ladder	if used	A/R
Hard hat	if overhead hazards exist	A/R
Fall protection fall arrest device	Inspection due date_____	A/R
Fall protection harnesses	Inspection due date_____	A/R
Fall protection connector straps	Inspection due date_____	A/R
Fall protection lanyards	Inspection due date_____	A/R

FSV ISFSI Manager: Ensure prerequisites have been completed.

Log this procedure in the FSV Daily Operations Log and release it to begin work.

Table B-2, Tritium Sampling Data

Column	Location*	Start date/time	Initial flow rate (slpm)	End date/time	Final flow rate (slpm)	Total sample time (min.)	Average flow rate (slpm)	Sample Volume (liters)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
13								

* Abbreviations such as “N, S, E, & W” may be used for “North, South, East, & West” charge face locations. Use “Vault A”, etc. to indicate the vault chimney sampled. “Background” may be abbreviated to “bkgd”.

FSO: Compare results to the 10CFR20 Appendix B, Table 2, Column 1 value for Hydrogen-3 (1E-7 uCi/ml) and the background and minimum detection limit (MDL) values.

Determine reportability (see PRD-317) and/or the need for additional actions (document below).

Table B-3, Additional Actions

Request all personnel signing or initialing steps in this procedure to complete the information in the table below:

Table B-4, Performers

Printed Name	S Number	Job Function	Initials	Signature

FSO Signature _____ Date _____

FSV ISFSI Manager: Verify all procedure steps have been completed.

Signature _____ Date _____

Appendix C

Procedure Discrepancies

Step No. from Above	Condition	Corrective Action Required/Taken

Appendix D

Procedure Hazard Analysis

Highly Hazardous Activity? ☐ Yes ☒ No	**HPSC No.:** TPR-6370

Disciplines (SMEs) involved in hazard analysis: (Checking the box indicates discipline is/was involved in the hazard analysis for the procedure.)

	Discipline		Discipline		Discipline
☒	Industrial Safety	☐	RCT/RAD Eng.	☐	Engineering
☐	Industrial Hygiene	☐	Env. Protection	☒	Operations
☐	Fire Protection	☒	Quality Assurance	☐	Other:

Required Job Training/Required Personal Protective Equipment

Training	PPE
Certified Fuel Handler	Fall protection equipment
Fall Protection	Leather gloves
Lockout/Tagout	GFCI(s)
	Substantial footwear

Sequence Of Basic Job Steps	Potential Hazards	Hazard Control/PPE
1. Position crane, Lockout/tagout crane, attach fall protection equipment, position ladder	1a. Unexpected equipment movement when used for fall protection	1a. Personnel must perform LO/TO as directed in procedure.
	1b. Ladder use	1b.1 Personnel must use appropriate, inspected ladder for task.
		1b.2 Personnel must use fall protection when working from ladder if required.
	1c. Fall hazard	1c.1 Personnel must attach fall protection fall restraint device to approved attachment point on crane bridge. Worker to wear approved fall protection harness as trained and attach harness to fall restraint. Inspect harness before donning per training. Assure fall restraint device inspection is current and restraint is in proper working order.
		1C.2 If access to the crane rail ledge is needed, the individual(s) on the ledge and the crane operator must be in constant visual or verbal contact. Crane operation must only be directed by the designated individual on the ledge. Prior to authorizing crane operation, the designated individual must ensure all individuals on the ledge are in a safe location and are aware of pending crane movement. The individual(s) accessing the rail ledge or crane platform must be briefed regarding the exposed battery terminals.
		1c.3 Personnel must use the current Fall Hazard Prevention Analysis (FHPA).

Sequence Of Basic Job Steps	Potential Hazards	Hazard Control/PPE
(1. continued)	1d. Pinch points	1d. Personnel must wear leather gloves when handling rigging or around possible pinch points.
	1e. Overhead hazards	1e. Personnel must wear head protection as necessary to prevent head injuries.
	1f. Unqualified operator/unsafe operation of the crane	1f. Personnel must verify crane operator qualification. Crane operation must be per PRD-650.
	1g. Uneven walking surfaces	1g. Personnel must wear substantial footwear.
	1h. Body hazards	1h. Personnel must use applicable steps in MCP 2692, "Ergonomics Program."
2. Assemble sample train	2a. Electric shock	2a. Personnel must use approved GFCIs on outlets and approved and inspected extension cords when length of cord on pump cannout reach outlets

Appendix E

Procedure Basis

Procedure Review Table							
Review Discipline	Rev.	DFC Intent[b] Change	DFC Nonintent[c] Change	Review Discipline	Rev.	DFC Intent[b] Change	DFC Nonintent[c] Change
Operations Management	X[a]	X	X	Industrial Safety	X	X	X
Qualified Operator	X	X	X	Engineering			
Radiological Engineering				Industrial Hygiene			
Environmental				Other:			
Quality	X[a]	X	*				

a. X = review required.
b. Reviews for intent DFCs require the same discipline reviews required for a revision.
c. Reviews for nonintent DFCs can be performed with only Operations management and a qualified operator's review and then implemented for immediate use. However, the remaining discipline reviews, as indicated by an asterisk (*), must be obtained within two (2) weeks. See MCP-2985, "Chapter XVI – Operations Procedures," for definitions of intent and nonintent changes.

Step	Basis	Source	Citation
Entire procedure	Provide for periodic inspection and maintenance of equipment.	Fort St. Vrain Safety Analysis Report	Section 7.6.4.1
1.1 1.2 4.2.7	Define acceptance criteria for determining that a gross FSC or O-ring failure has been detected.	Response to ICARE 104095/DOE-ID Surveillance 09-ISFSI-S-001	Deficiency 09-ISFSI-S-001-DR-001
2.1	Upon completion, Appendix B, "FSV Tritium Sampling Data," and Appendix C, "Procedure Discrepancies," if used, must be removed from this procedure and maintained as the official record.	Best management practice	

Step	Basis	Source	Citation
2.2	Personnel must follow the applicable hazard mitigations detailed in Appendix D, "Procedure Hazard Analysis."	Procedure Hazard Analysis	
2.3	If access to the crane rail ledge is needed, the individual(s) on the ledge and the crane operator must be in constant visual or verbal contact. Crane operation must only be directed by the designated individual on the ledge. Prior to authorizing crane operation, the designated individual must ensure all individuals on the ledge are in a safe location and are aware of pending crane movement. The individual(s) accessing the rail ledge or crane platform must be briefed regarding the exposed battery terminals.	Procedure Hazard Analysis	
2.4	If performing exhaust chimney sampling, fall protection must be implemented per the current Fall Hazard Prevention Analysis (FHPA).	Procedure Hazard Analysis	
2.5	Any deficiency, hazard, or abnormal condition noted during the performance of this procedure must be entered in Appendix C and reported verbally to the Facility Manager.	Best management practice	
3.2.1	Ensure the training requirements of Appendix D, "Procedure Hazard Analysis," are met.	Procedure Hazard Analysis	