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REVISION/CHANGE LOG			
Revision/Change Letter	Description of Changes	Pages Affected	Date of Revision/Change
0	Initial Issue	ALL	12/24/14
1	TSR Rev. #1 Flowdown for ICT operations	ALL	02/25/2016

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1.0 PURPOSE AND SCOPE

1.1 Purpose

This procedure provides instructions for storing and returning of gases in a surge drum(s).

1.2 Scope

This procedure applies to Facility Operations personnel involved in operating surge drums in the following areas:

- C-331
- C-333
- C-335 (excluding bottom surge system)
- C-337

2.0 REFERENCES

2.1 Use References

- CP4-OP-0236, *In Situ Chemical Treatments*
- CP4-OP-0438, *Periodic Regulatory Checks*
- CP4-OP-1121, *Cascade Valve and Leak Rating Operations*
- Job Hazard Analysis (JHA)-7347 General-01, *General Work Evolutions for Operations Controlled Facilities (excluding High Voltage Switchyards)*

2.2 Source References

- CP3-HS-2008, *Accident Prevention/Equipment Control Tags*
- Criticality Safety Audit/Incident Report 97-061
- SPC-CSE-19352-31, *PGDP Setpoint Analysis Calculation for the Cascade Building C-331 Surge Drum Pressure, Banks A, B, C, & D*
- SPC-CSE-19352-32, *PGDP Setpoint Analysis Calculation for the Cascade Building C-331 Surge Drum Pressure, Bank E*
- SPC-CSE-19352-33, *PGDP Setpoint Analysis Calculation for the Cascade Building C-333 Surge Drum Pressure, Banks A, B, C, D, E, F, G, H, & J*
- SPC-CSE-19352-34, *PGDP Setpoint Analysis Calculation for the Cascade Building C-335 Surge Drum Pressure, Banks A, B, C, D, & E*
- SPC-CSE-19352-35, *PGDP Setpoint Analysis Calculation for the Cascade Building C-337 Surge Drum Pressure, Banks A, B, C, & D*
- SPC-CSE-19352-36, *PGDP Setpoint Analysis Calculation for the Cascade Building C-337 Surge Drum Pressure, Banks E, F, G, H, & J*
- SPC-CSE-19352-58, *PGDP Setpoint Analysis Calculation for Cascade Building C-315 Bottom Drum Pressure*
- SPC-CSE-19352-70, *PGDP Setpoint Analysis Calculation for Surge Drum Room Temperatures*

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3.0 COMMITMENTS

- CP1-NS-3001, *Technical Safety Requirements for the Department of Energy Paducah Site Deactivation Project*
- Nuclear Criticality Safety Approval (NCSA) CAS-021, *Operation and Shutdown of the Diffusion Cascade*
- NCSA CAS-023, *Cell Servicing*

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

None

4.2 Limitations

4.2.1 00/000 Buildings

- A. Drums in C-331/C-333/C-335/C-337 shall be isolated from atmosphere except during maintenance. **If** any opening in process piping **or** drum wall can **NOT** be isolated from the drums, **then** it shall be covered with a fireproof cover when unattended, whether opening is for maintenance or is inadvertent.
- B. Spacing is **NOT** required between portable fissile material and surge drums.
- C. Drums that have been open to atmosphere for less than or equal to their hydration time limit (**22 days** for surge drums, as determined from last in specification pressure check performed according to CP4-OP-0438, *Periodic Regulatory Checks*) may be returned to service. **If** drums have been open to atmosphere for greater than their hydration time limit, **then** either of the following shall be performed prior to returning to service:
 1. **If** drum has **NOT** been purged or evacuated since being opened to atmosphere, **then** drum air shall be sampled for moisture to confirm below **1300 ppmv (800 ppmw)**.
 - or**
 2. Drum interior shall be visually inspected for uranium deposition that is significant enough to prevent seeing the drum wall metal.
- D. Surge drums and holding drums shall **NOT** be aligned for code relief to the C-310 condenser or accumulator rupture discs.

- E. Pressures shall be monitored at least daily in the surge drums and holding drums. Readings shall be maintained within the following limits:
1. **If** surge drums are **NOT** UF₆ negative, **then** pressure shall be maintained less than 13.7 psia.
 2. **If** surge drums have been sampled UF₆ negative **and** no UF₆ has been added since drums were sampled, **then** pressure is to be maintained as follows:
 - **Less than 7 psig** (including during maintenance activities)

and

 - **Unless** pressured for maintenance or being evacuated, **less than 13.7 psia** or **greater than 15.7 psia**.
- F. **If** an applicable building is in cold-shutdown **and** the drum room temperature is less than 100°F, **then** surge drums shall be isolated from all sources of UF₆ and HF by a **minimum** of **one** valve.
- G. C-331 F Drum shall remain double blocked and caution tagged and no UF₆ shall be admitted to F drum.

4.2.2 All Buildings

Surge drum temperature and pressure shall be maintained to keep UF₆ in gaseous phase according to Appendix B, *UF₆ Phase Diagram*, with a **maximum pressure of 13.7 psia** during operation.

5.0 PREREQUISITES

5.1 Review JHA-7347, *General Work Evolutions for Operations Controlled Facilities (excluding High Voltage Switchyards)*.

5.2 **If** evacuating surge drum(s), **then** ensure the following:

5.2.1 The following have been determined:

- Suction point(s)
- Discharge point(s)
- Required valve alignment

NOTES:

If combined ClF₃ **and** F₂ concentration is **greater than or equal to 8%**, **then** Appendix D, *Calculation to Reduce Surge Drum ClF₃ or F₂ Concentration*, can be used to calculate the amount of dilution with air needed to lower the concentration.

If dilution is required, **then** the laboratory must resample/reanalyze the drum contents.

5.2.2 If surge drums contain any of the following, **then** ensure contents have been analyzed by laboratory personnel prior to evacuations:

- Unknown type of gas
- Hydrogen Fluoride (HF)
- Fluorine (F₂)
- Chlorine Trifluoride (ClF₃)
- Refrigerant R-114

6.0 INSTRUCTIONS

NOTE:

Appendix C, *00 and 000 Building Surge Drum Capacities*, lists volumes for 00 and 000 building surge drums. Surge drums with larger volumes hold larger quantities of material at same pressure.

6.1 Transferring to Surge Drums

Facility Operations Personnel

6.1.1 Monitor surge drum pressures during content additions.

- Confirm surge drum temperature and pressure is maintained to keep UF₆ in gaseous phase according to Appendix B, *UF₆ Phase Diagram*.
- Maintain surge drum pressures **less than 13.7 psia unless** drum has been sampled UF₆ negative.

6.1.2 If drum pressure can **NOT** be monitored using instrumentation in Area Control Room (ACR), **then** perform the following:

- A. Isolate drum.
- B. Ensure sample buggy or other approved Maintenance and Test Equipment (M&TE) is connected to surge drum manifold or equivalent sample point.
- C. **When** sample buggy or other M&TE is installed, return the affected surge drum to service.
- D. Monitor pressure at buggy or other M&TE shiftly until repairs to ACR instrumentation are complete, **then** remove sample buggy or M&TE.

6.1.3 If applicable building is in cold shutdown **and** drum room temperature is **less than 100°F**, **then** isolate drum from all sources of UF₆ and HF with a **minimum** of one valve as follows:

- A. Ensure affected drum block valve is closed.
- B. Ensure affected drum 'C' valve inside surge drum room sample/calibration manifold is closed.

6.1.4 If adding contents containing ClF₃ or F₂ to surge drums, **then** confirm surge drum to be used is **NOT** isolated and caution tagged due to containing R-114 **greater than 1.0%**.

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- 6.1.5** If adding contents containing **greater than 1.0%** R-114 to surge drums, **then** confirm surge drum to be used is **NOT** isolated and caution tagged due to containing ClF₃ or F₂.
- 6.1.6** If surge drum(s) has/have been opened to atmosphere, **then** perform the following:
- A. If surge drum(s) has/have been open to atmosphere for **less than or equal to 22** days (as determined from last in specification pressure check performed according to CP4-OP-0438, *Periodic Regulatory Checks*), **then** evacuate according to Section **6.2**.
 - B. If surge drum(s) has/have been open to atmosphere for **greater than 22 days**, **then** perform the following:
 1. Perform either of the following:
 - a) If drum has **NOT** been purged or evacuated since being opened to atmosphere, **then** request laboratory sample drum for moisture to confirm below **1300 ppmv (800 ppmw)**.
 - or
 - b) Visually inspect drum interior to confirm no uranium deposition significant enough to prevent seeing the drum wall metal.
 2. Evacuate according to Section **6.2**.
- 6.1.7** If using Purge and Evacuation (P&E) station(s), **then** transfer contents to surge drum(s) according to the applicable P&E procedure.
- 6.1.8** If aligning directly to surge drum(s), **then** transfer contents to surge drum(s) according to CP4-OP-1121, *Cascade Valve and Leak Rating Operations*.
- 6.1.9** **When** transfer is complete, **then** ensure headers used are isolated according to CP4-OP-1121.
- 6.1.10** Record the following in narrative logs:
- System evacuated
 - Surge drum(s) used
 - Gas type and concentration/assay of material placed in drum (if available)
 - Surge drum(s) pressure as read on surge drum pressure indicator
- 6.1.11** If material from an In-Situ Chemical Treatment (ICT) was transferred to surge drum(s), **then** update the CP4-OP-0236-F03, *TG Amount Tracking Log*, according to CP4-OP-0236, *In Situ Chemical Treatments*.

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NOTE:

Surge drums isolated in following step can continue to be used for additional transfers of the same material.

6.1.12 If any of the following was transferred to surge drum(s), **then** open surge drum motor operated block valve breaker(s) **and** caution tag with information of drum contents.

- ClF_3
- F_2
- Greater than 1.0% R-114

6.2 Evacuating from Surge Drums

Facility Operations Personnel

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CAS-023

6.2.1 Monitor surge drum pressures during content evacuation.

- Confirm surge drum temperature and pressure is maintained to keep UF_6 in gaseous phase according to Appendix B, *UF₆ Phase Diagram*.
- Maintain surge drum pressures less than 13.7 psia unless drum has been sampled UF_6 negative.

6.2.2 If drum pressure can **NOT** be monitored using instrumentation in ACR, **then** perform the following:

- A. Isolate drum.
- B. Ensure sample buggy or other approved M&TE is connected to surge drum manifold or equivalent sample point.
- C. **When** sample buggy or other approved M&TE is installed, **then** return the affected surge drum to service.
- D. Monitor pressure at buggy or other approved M&TE shiftly **until** repairs to ACR instrumentation are complete, then remove sample buggy or M&TE.

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6.2.3 If surge drum(s) has/have been open to atmosphere for **greater than 22 days**, **then** perform **either** of the following:

- A. **If** drum has **NOT** been purged or evacuated since being opened to atmosphere, **then** request laboratory sample drum for moisture to confirm **below 1300 ppmv (800 ppmw)**.
- or**
- B. Visually inspect drum interior to confirm no uranium deposition significant enough to prevent seeing the drum wall metal.

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NOTES:

Special return manifolds (trickle manifolds) have been installed in some buildings to allow the return of surge drum contents at low rates while bypassing the normal evacuation/P&E systems. These have been installed primarily to return high concentration R-114 drum contents, but may be used for other purposes. Where these manifolds have been installed, valving orders will be used to specify which manifold valves to open to obtain desired return rates.

Evacuation rates may be adjusted as directed by the Shift Coordinator based on fluoride emissions from C-310 stack sample or equipment gas concentration.

- 6.2.4** Request Shift Coordinator permission to evacuate surge drum(s).
- 6.2.5** Evacuate surge drum(s) according to applicable P&E procedures or CP4-OP-1121, *Cascade Valve and Leak Rating Operations*.
- 6.2.6** **If** material from an ICT was evacuated from surge drum(s), **then** update the CP4-OP-0236-F03, *TG Amount Tracking Log*, according to CP4-OP-0236, *In Situ Chemical Treatments*.

7.0 ACCEPTANCE CRITERIA

None

8.0 POST-PERFORMANCE WORK ACTIVITIES

None

9.0 RECORDS

None

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Appendix A – Acronyms/Definitions

ACRONYMS

ACR – Area Control Room

ICT – In Situ Chemical Treatment

JHA – Job Hazard Analysis

M&TE – Maintenance and Test Equipment

NCSA – Nuclear Criticality Safety Approval

P&E – Purge and Evacuation

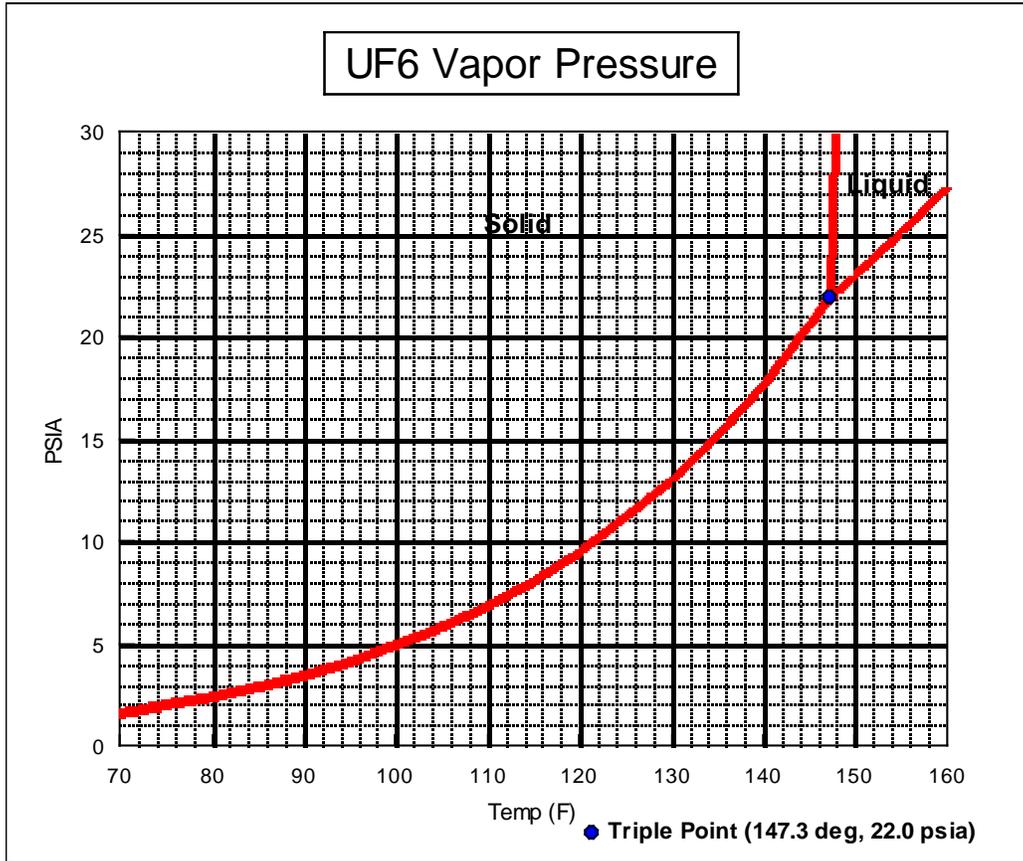
DEFINITIONS

Cold Shutdown – A facility with all stage motors stopped or running with RCW condensers disconnected.

Shiftly – To be performed at least every 12 hours

UF₆ Negative – UF₆ concentration less than 10 ppm at atmosphere.

Appendix B – UF₆ Phase Diagram



Appendix C – 00 and 000 Building Surge Drum Capacities

Building	Surge Drum Bank	Capacity (ft³)
C-331	A	10,000
	B	10,000
	C	10,000
	D	10,000
	E	8,000
	F	2,000
C-333	A	10,000
	B	10,000
	C	10,000
	D	10,000
	E	10,000
	F	10,000
	G	10,000
	H	8,000
	J	6,000
C-335	A	4,000
	B	6,000
	C	10,000
	D	10,000
	E	10,000

Appendix C – 00 and 000 Building Surge Drum Capacities (Continued)

Building	Surge Drum Bank	Capacity (ft³)
C-337	A	10,000
	B	10,000
	C	10,000
	D	10,000
	E	10,000
	F	10,000
	G	10,000
	H	8,000
	J	6,000

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Appendix D – Calculation to Reduce Surge Drum ClF₃ or F₂ Concentration

Add UF₆ or air to increase Surge Drum pressure to obtain the desired ClF₃ or F₂ concentration according to the following:

$$P2 = (P1 \times C1) / C2$$

Where:

P2= Final Surge Drum Pressure

P1= Initial Surge Drum Pressure

C1= Initial ClF₃ or F₂ concentration

C2= Final Desired ClF₃ or F₂ concentration

Example 1

Initial ClF₃ or F₂ concentration C1 = 8%

Initial Surge Drum Pressure P1 = 3 psia

Desired ClF₃ or F₂ concentration C2 = 5%

Final Surge Drum Pressure P2 = (3 psia x 8%) / 5% = 4.8 psia

Example 2

Initial ClF₃ or F₂ concentration C1 = 8%

Initial Surge Drum Pressure P1 = 3 psia

Final Surge Drum Pressure P2 = 6 psia

Rearranging Equation (1)

$$C2 = (P1 \times C1) / P2$$

Final ClF₃ or F₂ concentration C2 = (3 psia x 8%) / 6 psia = 4%