CP3-CH-1001 FRev. 3	**TITLE**: Process Equipment and Pipe Sampling	Page 1 of 13

DOCUMENT CATEGORY: Technical	**LEVEL OF USE:** ☒ Reference Level ☐ Continuous Use

Check all that apply:

TSR/NCS ☒ **WCO** ☐ **Shared Site** ☐

FUNCTIONAL AREA: Characterization (Sampling, Lab) **SUBJECT MATTER AREA**: Characterization	**SUBJECT MATTER EXPERT**: Chris Skinner, Field Sampling Manager
NUCLEAR SAFETY REVIEW DOCUMENTATION: FRNP-25-0344-S	**APPROVED BY/DATE (Signature on file):** Caleb Kline, Acting Laboratory and Characterization Manager
REQUIRED REVIEW DATE (or expiration date for temporary change): 06/10/2030	**EFFECTIVE DATE**: 06/16/2025

REVISION/CHANGE LOG

Revision/ Change Letter	Description of Changes	Pages Affected	Date of Revision/ Change	Approved By (signature on file)
FR0	Initial Release and AI-0003062.	All	10/14/2020	Documentation on File
FR1	Periodic Review, update SME, Approval, and required review date, update spacing requirements, update forms referenced.	All	09/28/2021	
FR1A	Intent change to implement CP1-NS-3001, Revision 13.	4, 5, 7, 9-12	09/01/2022	
FR2	Address CAPA CA-004035.	All	02/13/2023	
FR3	Added limitation for maximum 2 quart sample container when sampling uranium contaminated cascade equipment and added hazard controls from JHA.	All	06/10/2025	Caleb Kline

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1.0 PURPOSE AND SCOPE

1.1 Purpose

The purpose of this procedure is to provide instruction for the preparation, collection and handling of discrete samples from process equipment used during operation of the Paducah Gaseous Diffusion Plant (PGDP). This procedure provides instruction on maintaining traceability of sampling data. Process equipment may include, but **NOT** be limited to, compressors, converters, piping and valves. This procedure may also be used to collect samples from removed miscellaneous components and equipment.

1.2 Scope

This procedure shall be used by the Deactivation and Remediation Contractor personnel, and subcontractor personnel to sample process equipment and piping at the U.S. Department of Energy (DOE) Paducah site.

2.0 REFERENCES

2.1 Use References

- CP3-ES-1034, *Nuclear Criticality Safety Requirements for Sample Labeling, Handling, and Assay Smears*
- CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals*
- CP3-HS-2055, *Confined Space*
- CP3-HS-2010, *Instructions for Lockout/Tagout*
- CP3-NM-3002, *Intraplant Shipments and Receipts*
- CP3-OP-0211, *Inspection, Removal, Installation, and Handling of Uranium Contaminated Cascade Equipment*
- CP3-OP-0316, *Pre-Job Briefings and Post-Job Reviews*
- CP3-SM-1102, *Activity Level Work Execution and Closeout*
- CP3-WM-1036, *Nuclear Criticality Safety Implementation Requirements for Handling and Storage of Fissile and Potentially Fissile Waste*
- CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*
- CP3-WM-3015, *Waste Packaging*
- CP3-WM-9503, *Off-Site Shipments by Air Transport*
- CP4-ES-2410, *Sampling of Fissile/Potentially Fissile Material*
- CP3-ES-2700, *Sample and Miscellaneous Data Forms*
- CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*
- CP4-ES-2704, *Trip, Equipment, and Field Blank Preparation*

2.2 Source References

- CP2-HS-2000, *Worker Safety and Health Program for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*

- CP2-SM-1000, *Activity Level Work Planning and Control Program for the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*
- CP3-SM-1101, *Work Package Development*
- CP3-HS-2012, *Construction and Work Zone Barricades and Signs*
- CP3-WM-1017, *Safe Handling and Opening of Sealed Containers*
- JHA-20360, *Process Equipment and Pipe Sampling*
- NCSE 091, *Fissile/Potentially Fissile Waste Container Storage and Handling*
- NCSE 095, *Operation and Shutdown of the Diffusion Cascade*
- NCSE 120, *Nuclear Criticality Safety Evaluation for Equipment Removal, Handling, and Storage*
- NCSE CAS-101, *Nuclear Criticality Safety Evaluation for 00 and 000 Cascade Facilities*
- PGDP-SS-PL-001, *Paducah Gaseous Diffusion Plant Information Security Plan*
- United States Environmental Protection Agency 2001. *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual*. Region 4, Environmental Compliance Branch, Athens, GA, November.

3.0 COMMITMENTS

- CP1-NS-3001, *Technical Safety Requirements for the Department of Energy Paducah Site Deactivation and Remediation Project*
- NCSE 010, *Transport, Handling, and Storage of Fissile/Potentially Fissile Material Samples*
- NCSE 120, *Nuclear Criticality Safety Evaluation for Equipment Removal, Handling, and Storage*
- NCSE CAS-101, *Nuclear Criticality Safety Evaluation for 00 and 000 Cascade Facilities*
- NCSE GEN-01, *General Limits Used at the Paducah Gaseous Diffusion Plant*
- NCSE GEN-31, *The Collection and Handling of Fissile/Potentially Fissile Waste Samples*

4.0 PRECAUTIONS AND LIMITATIONS

4.1 Precautions

TSR 5.5.10.1

4.1.1 Fissile or potentially fissile samples in conveyance with greater than or equal to (≥) 250 g of ^{235}U with an enrichment of 1.0 wt. % ^{235}U or greater may only be transported in the approved travel locations shown in Appendix B, *Approved Travel Locations for Fissile Material ≥ 250g ^{235}U*, unless less than (<) 250 g ^{235}U or in full compliance with United States Department of Transportation (DOT) requirements for samples being shipped off-site.

4.1.2 **If** sampling material that may produce airborne contaminants, **then** an Industrial Hygiene Work Plan (IHWP) request should be submitted for this work on a case by case basis.

4.1.3 Asbestos Containing Material (ACM)/Potentially Asbestos Containing Material (PACM) shall **NOT** be touched **or** disturbed. Removal of ACM/PACM must be done by trained asbestos worker.

4.1.4 **If** assay is unknown, **then** process gas equipment samples shall be handled as potentially fissile (PF) according to CP4-ES-2410, *Sampling of Fissile/Potentially Fissile Material.*

4.1.5 Sampling personnel that handle and transport PF samples shall comply according to CP3-ES-1034, *Nuclear Criticality Safety Requirements for Sample Labeling, Handling, and Assay Smears*, and CP4-ES-2410, *Sampling of Fissile/Potentially Fissile Material*.

4.1.6 Personnel shall be aware of the hazards of chemicals they will be working with and shall evacuate the area and supervisor and Plant Shift Supervisor (PSS) notified, if spill, strange odor or smell, burning and itching from suspect chemical exposure.

4.1.7 Sampling personnel shall refer and follow the requirements of the job-specific IHWP for engineering controls, administrative controls, and personal protective equipment (PPE) if there is a potential exposure to arsenic, beryllium, chromium, lead, nickel, fluorine, or hydrogen fluoride.

4.1.8 **If** entry into a confined space is necessary, **then** persons shall have Confined Space Training and all applicable requirements of CP3-HS-2055, *Confined Space*, shall be followed for guidance and implementation where applicable to Permit Required Confined Spaces or Non-Permit Required Confined Spaces.

4.1.9 **If** Lockout/Tagout (LOTO) is required, **then** all applicable requirements of CP3-HS-2010, *Instructions for Lockout/Tagout*, shall be followed.

4.2 Limitations

NCSE GEN-31

4.2.1 Sampling operations are limited to a maximum of 5.5 wt. % ^{235}U.

4.2.2 The combined internal volume of sampling equipment being used to collect sample material shall be limited to a maximum of 1.2 liters at a time in a waste container storage array.

4.2.3 The combined internal volume of a batch of sample container(s) being filled with sample material is limited to a maximum of 1.2 liters. A maximum of one batch of samples shall be present in a waste container storage array. Once removed from the storage area, the sample containers shall be handled according to an NCSE (such as NCSE 010, and/or NCSE GEN-01.)

4.2.4 **NO** spacing is required between a batch of sample containers (with a maximum combined internal volume of 1.2 liters), and sampling equipment (with a maximum combined internal volume of 1.2 liters) within a waste container storage array.

4.2.5 **NO** spacing is required between a batch of sample containers (with a maximum combined internal volume of 1.2 liters), and waste containers (with a maximum internal volume of 32 gallons) within a waste storage array.

4.2.6 **NO** spacing is required between sampling equipment (with a maximum combined internal volume of 1.2 liters), and waste containers (with a maximum internal volume of 32 gallons) within a waste storage array.

NCSE GEN-31

4.2.7 Sampling equipment must be visually inspected after each sampling operation to ensure that gross quantities of sample material have been removed. **NO** Nuclear Criticality Safety (NCS) spacing requirements are necessary for the storage of the sampling equipment after inspection has shown that the sample material has been removed.

4.2.8 Rags and absorbent pads may be used to assist sampling operations. Waste generated from sampling operation shall be handled according to CP3-WM-1036, *Nuclear Criticality Requirements for Handling and Storage of Fissile and Potentially Fissile Waste*.

NCSE 010

4.2.9 Spacing requirements for sample batches shall be handled and stored with 2 foot edge-to-edge spacing (1 foot edge-to edge spacing on shelves of NCS-approved shelf unit) or greater from each other and all other fissile/PF material (except for items being added or removed from a batch).

4.2.10 Applicable batch requirements are as follows:

One batch is classified as any number of sample containers containing solids, liquids, **or** slugged oil, whose total volume does **NOT** exceed 1.4 liters.

OR

One batch is classified as any number of sample containers containing solids, liquids, **or** slugged oil, whose total volume does **NOT** exceed 2.5 liters, provided that all of the sample vials/containers are larger than 8 milliliter in volume.

OR

One batch is classified as **NO** more than 40 containers, whose total combined volume does **NOT** exceed 6.0 liters, containing solids, liquids, or slugged oil.

4.2.11 NCS exempt samples are **NOT** subject to batch limits or spacing requirements unless they are intermingled (i.e.: mixed in with) with a fissile/potentially fissile sample batch; then they become part of the sample batch and must follow requirements listed in the applicable NCSE. Stacking of NCS exempt samples above and below fissile/potentially fissile sample batches is allowed, except in NCS-approved shelf storage units.

4.2.12 Any size or type of secondary container, such as a cooler, jar, jug, plastic bag, or tray, may be used to handle and store sample containers provided that **NO** more than one batch is placed in any given secondary container. Multiple secondary containers may be used, however, **if** any secondary container can be enclosed such that the samples are **NOT** immediately visible (e.g.: inside a cooler with a lid, bag, jar), **then** the outer container shall be labeled as though it were a potentially fissile sample while it is being used to handle/store the fissile/potentially fissile sample(s).

4.2.13 Only one batch of samples may be transported on a given transport device provided that the batch of samples is spaced 2 feet edge-to-edge **or** greater from all other fissile/PF material.

TSR 5.5.10.1

4.2.14 Fissile or PF samples in conveyance with greater than or equal to (≥) 250 g of ^{235}U with an enrichment of 1.0 wt. % ^{235}U or greater may only be transported in the approved travel locations shown in Appendix B unless less than (<) 250 g ^{235}U or in full compliance with DOT requirements for samples being shipped off-site.

NCSE GEN-01

4.2.15 Samples that are **NOT** labeled with the A or B designator shall **NOT** be used for NCS purposes.

NCSE 120 CAS-101

4.2.16 Sampling containers, sample coupons, sampling devices, cleaning tools or scoops that are used to perform sampling of process gas equipment shall have a total volume of **2 quarts or less**.

4.2.17 Sampling personnel that handle and transport PF samples shall comply with CP3-ES-1034, *Nuclear Criticality Safety Requirements for Sample Labeling, Handling, and Assay Smears*.

4.2.18 Sampling personnel will handle the sample taken by craft personnel.

4.2.19 Intrusive sampling of process gas equipment shall be handled according to applicable work control documents.

4.2.20 **NO** welding, plasma, or torch techniques shall be used for cutting without approval of Work Control.

4.2.21 Extreme weather conditions may limit or preclude the conduct of fieldwork.

4.2.22 **When** sampling outdoors to prevent changing the characteristics of the material being sampled or contamination of the surrounding area, **then** sampling during dusty or wet conditions shall be avoided.

4.2.23 All posted requirements pertaining to any given sampling location shall require compliance.

5.0 PREREQUISITES

5.1 Plan **and** coordinate work activities where process equipment and pipe sampling are required according to CP3-SM-1001, *Work Package Development* and CP3-SM-1102, *Activity Level Work Execution and Closeout*.

5.2 **If** sampling uranium contaminated cascade equipment, **then** follow the requirements of CP3-OP-0211, *Inspection, Removal, Installation, and Handling of Uranium Contaminated Cascade Equipment*.

5.3 Review **and** refer to the following:

- Sampling Analysis Plan (SAP).
- Sampling and Analysis Event Plan (SAEP) for specific sampling methods and equipment to be used.
- Reference applicable photographs, maps, or figures that designate sample locations.

5.4 Comply with additional requirements as they apply such as:

- Characterization Plan
- SAP or SAEP
- Industrial Hygiene Work Plan (IHWP)
- Radiological Work Permit (RWP), which define the work area(s), discuss expected radiological and non-radiological hazards
- Required training

- PPE requirements
- Hazard controls

5.5 Develop classification plans, as necessary, for sampling process gas equipment.

5.6 Prior to beginning work, read **and** sign off on the RWP **and/or** IHWP.

5.7 Obtain chain-of-custody forms (COC), data forms, sample labels, **and** custody seals as necessary from Sample Management Office (SMO).

5.8 Ensure that all reusable sampling equipment has been decontaminated, **or if** new, **then** certified pre-cleaned, prior to use.

5.9 **If** prior decontamination of sampling equipment cannot be confirmed, **then** decontaminate the equipment according to CP4-ES-2702, *Decontamination of Sampling Equipment and Devices*, prior to use.

5.10 Perform a pre-job briefing to SAEP, Work Package (WP) **or** the applicable implementing and safety documents associated with the sampling event according to CP3-OP-0316-F02, *Pre-Job Briefing Checklist*.

5.11 **If** applicable, **then** prepare quality control (QC) samples according to CP4-ES-2704, *Trip, Equipment, and Field Blank Preparation*.

5.12 Prior to the start of field sampling activities, notify the following parties:

- Facility Manager
- Industrial Safety Specialist/Industrial Hygienist
- Radiological Control (RADCON)
- Sample Management Office
- Infrastructure/Physical Security involving classified material

5.13 Don appropriate PPE according to the IHWP **and/or** RWP.

5.14 Wear a hard hat if there are known hazards that may cause head injury or potential of falling objects.

5.15 Wear safety glasses with side shields when working in areas with an increased potential for flying particles, debris, or dust.

5.16 Keep a two-way radio **and/or** cell phone at the sampling site during any sampling event for communication purposes.

5.17 Contact IH for guidance for PCB contaminated equipment and pipe sampling.

5.18 Identify nuclear material and handle according to CP3-NM-3002, *Intraplant Shipments and Receipts*.

5.19 Locate **and** mark each area to be sampled.

5.20 Perform any housekeeping as necessary.

6.0 INSTRUCTIONS

NOTES:

The sampler is responsible for maintaining the integrity of the sample. Special care shall be used to ensure that all sampling procedures are well communicated and followed by craft personnel.

Sampler

6.1 Ensure assigned project personnel record all observations and operations according to CP3-ES-2700, *Sample and Miscellaneous Data Forms.*

6.2 Prepare **and** collect the type(s) of QC samples as specified in the Characterization Plan, SAP/SAEP, or WP according to CP4-ES-2704.

CAUTION:

Photo documentation may require Derivative Classifier review, especially if associated with classified subject matter.

6.3 Perform photo documentation of sample location, as applicable, being sure to capture the component and sample identification numbers in the photo(s).

6.4 **If** sample to be taken is identified as classified **or** suspected of being classified, **then** handle according to PGDP-SS-PL-001, *Paducah Gaseous Diffusion Plant Information Security Plan*.

6.5 Avoid excess vibration to the extent practicable, to minimize loss of any loose sampling material or deposit.

6.6 Ensure that sample material or deposit is **NOT** compromised either by collection method or sample packaging.

6.7 Avoid cross-contamination of samples **and** change PPE as necessary and between sample locations.

6.8 Maintain custody of the samples and related sample documentation during sampling event according to CP3-ES-2709, *Chain-of-Custody Forms, Sample Labels, and Custody Seals*.

6.9 Coordinate with craft personnel in order for samplers to be present and have sight of the sample collection to ensure the sample is taken at the correct location, sufficient sample volume is collected to meet requirements and **NO** contaminants compromise the sample material.

NOTES:

Cross section widths will vary depending upon the diameter of the pipe. Applicable SAP, SAEP or characterization plan should be followed for instructions on coupon dimensions and locations.

In general, pipes with diameters 1-inch **or** less will be cut to approximately 5-inches to 8-inches in length. Pipes with diameters in the range greater than 1-inch but less than 3-inches will be cut to 2-inch to 3-inch lengths. For pipes **or** equipment greater than 3-inches, the sample will be cut out to provide approximately 100 cm^2 of internal surface area.

6.10 **If** specified by COC or other applicable sample documents provided, **then** ensure the sample volume or mass requirements are met **and** document in the field sample log book or data form as well as on the COC.

6.11 Document field and sampling information in the appropriate logbook or data form according to CP3-ES-2700, *Sample and Miscellaneous Data Forms.*

6.12 Communicate any deviations to the Characterization Engineer and sample requester prior to collecting the planned sample **and** ensure changes are logged in the field logbook or applicable data forms.

6.13 Document any and all deviations from relevant sample points (e.g., lack of media or inability to sample at proposed sample point) **and** include rationale for any changes.

6.14 **If** size reduction is required, **then** perform reduction according to the applicable approved task specific work control documents and plans, as well as documented in the field log book **or** applicable field sampling forms.

6.15 **If** collecting a composite sample, **then** obtain the complete sample mass or volume before changing sampling tools.

6.16 **If** collecting samples for NCS purposes, **then** obtain two independent and representative samples **and** complete Section E of CP3-ES-1034-F01, *Sample Request Form*, according to CP3-ES-1034.

NCSE GEN-01

6.17 Ensure that the first sample has an "A" designator and the second sample has a "B" designator, according to CP3-ES-1034 and as specified in applicable SAP, SAEP or characterization plan.

6.18 Document applicable field and sampling observations in the appropriate logbook(s) along with any field data forms according to CP3-ES-2700.

6.19 Complete the COC forms and sample documents according to CP3-ES-2709.

7.0 ACCEPTANCE CRITERIA

None

8.0 POST PERFORMANCE WORK ACTIVITIES

Sampler

8.1 Dispose of excess sample media according to CP3-WM-3015, Waste Packing and CP3-WM-1036, as appropriate.

8.2 Decontaminate sampling equipment **and** document according to CP4-ES-2702 with the following requirements:

NCSE GEN-31

8.2.1 **If** sampling equipment was used in a fissile or PF operation, **then** dispose of waste according to CP3-WM-1036.

8.2.2 **If** sampling equipment was used in a non-fissile operation, **then** dispose of waste according to CP3-WM-1037, *Generation and Temporary Storage of Waste Materials*.

TSR 5.5.10.1

8.3 Ensure fissile or PF samples in conveyance with greater than or equal to (≥) 250 g of ^{235}U with an enrichment of 1.0 wt. % ^{235}U or greater are only transported in approved travel locations shown in Appendix B unless less than (<) 250 g ^{235}U or in full compliance with DOT requirements for samples being shipped off-site.

8.4 Coordinate with RADCON for release of the sample containers from the area/boundary (if applicable) for transportation to sample storage location**.**

8.5 Remove PPE, including respirator (if applicable), **and** place in plastic bags for removal from the sampling site.

8.6 Manage used PPE, plastic, non-reusable sample tools, decontamination fluids, and other waste according to CP3-WM-3015.

8.7 Maintain custody of samples according to CP3-ES-2709 until samples are transferred to the designated sample management facility or laboratory for analysis**.**

8.8 Obtain surface contaminated objects survey data of the interior surface of samples, measured during field activity, from RADCON **and** submit to Characterization Engineer for final transportation and accountability determination, as applicable.

8.9 Complete CP-4728, *Intraplant Nuclear Material Transfer*, if applicable, **and** submit to Material Control & Accountability and Transportation Specialist.

8.10 Coordinate with RADCON, **and** release the sample(s) and related COC documentation for further handling according to with CP3-WM-9503, *Off-Site Shipments by Air Transport.*

8.11 **If** off-site shipment is needed by air transport, **then** prepare samples for shipment off-site according to CP3-WM-9503.

8.12 Submit a copy of the COC forms and logbook pages **or** data forms to the SMO for entry into Project Environmental Measurements System.

9.0 RECORDS

9.1 Records Generated

The following records may be generated by this procedure:

- CP-4728, *Intraplant Nuclear Material Transfer*
- Data Forms
- Logbook

Forms are to be completed according to CP3-OP-0024, *Forms Control*.

9.2 Records Disposition

The records are to be maintained according to CP3-RD-0010, *Records Management Process*.

Appendix A – Acronyms/Definitions

ACRONYMS

ACM – Asbestos Containing Material

COC – Chain-of-Custody

DOE – U.S. Department of Energy

DOT – United States Department of Transportation

IHWP – Industrial Hygiene Work Plan

JHA – Job Hazard Analysis

LOTO – Lockout/Tagout

NCS – Nuclear Criticality Safety

NCSE – Nuclear Criticality Safety Evaluation

NCSA – Nuclear Criticality Safety Approval

PACM – Potentially Asbestos Containing Material

PGDP – Paducah Gaseous Diffusion Plant

PSS – Plant Shift Supervisor

PPE – Personal Protective Equipment

PF – Potentially Fissile

QC – Quality Control

RADCON – Radiological Control

RWP – Radiological Work Permit

SAP – Sampling Analysis Plan

SAEP – Sampling and Analysis Event Plan

SMO – Sample Management Office

WP – Work Package

DEFINITIONS

Composite Sample – A sample collected at a given point in time consisting of a series of discrete samples (aliquots) that have been mixed together.

Appendix B – Approved Travel Locations for Fissile Material ≥ 250g ^{235}U