

**Revision Log**

Pages Affected	Description of Revision
All	This procedure has been updated to conform with the current procedure template.
2	<p>Section 1.1 – Removed S/RID flagging and the following: This procedure implements Title 10, Code of Federal Regulations (CFR), Part 835.401, General Requirements (a and b).</p> <p>Section 1.2 – Added the following to the Scope: Sample results using this procedure are only used to determine whether the water needs to be radiologically controlled to ensure worker protection. The results cannot be used to determine free release of water or compliance with any other acceptance criteria (i.e., offsite laboratory receipt limit, Department of Transportation criteria, etc.).</p>
3	Section 3.1 – Changed “Perform a job site review” to “A job site review shall be performed” in the second paragraph.
4	Section 5.1 – Added “Sample received date and time” as a bullet in Step 4. Added “sample” in Step 7B.
5	Section 5.1 – Deleted the following sub-step of Step 11: “REMOVE planchet from hot plate or heat lamp” (this action occurs in Step 12). Changed “Do NOT allow the planchet to become dry” into a Caution for Step 11B3.
6	<p>Section 5.1 – Deleted “(in cpm or dpm, as appropriate)” from the second bullet in Step 13A and from Step 13B2.</p> <p>Section 5.2 – Moved a Step 3 note to Step 1 and changed “Results for samples analyzed for tritium only shall be recorded on OSR 4-682; OSR 4-681 is not needed for these samples.” to “OSR 4-681 is not used to record results for samples analyzed for tritium.”</p>
7	<p>Section 5.3 – Deleted bullets “Correction factor(s), when applicable” and “Daily background in cpm, where applicable” from Step 3. Deleted the following two sub-steps of Step 5 (counting systems providing results in cpm are no longer used):</p> <ul style="list-style-type: none"> <li>• WHEN using counting systems that provide results in cpm, THEN DETERMINE dpm value for both alpha and beta using the following formula located in the calculation space provided on OSR 4-681: ( ___ Gross Counts ÷ ___ Sample Count Time) - ___ Bkgd (cpm) x ___ CF = ___ dpm.</li> <li>• WHEN using counting systems that provide results in dpm, THEN CHECK the N/A box in the unused calculation space on OSR 4-681.</li> </ul>
8	Section 6.0 – Deleted the following references: 10 CFR 835.401, General Requirements, and [S/RID], Standards/Requirements Identification Document, 10 CFR 835, Occupational Radiation Protection.

## 1.0 INTRODUCTION

### 1.1 Purpose

This procedure provides instructions for water sample preparation, tracking, and analysis for alpha, beta-gamma, and tritium contamination.

### 1.2 Scope

This procedure applies to Radiological Protection (RP) personnel preparing and analyzing water samples to determine the concentration of alpha, beta-gamma, and tritium contamination on a timely basis.

This procedure applies primarily to water samples expected to be of low activity (e.g., environmental, release, small spills). It can be used for higher activity samples (e.g., confirmatory process samples, basin samples) with some exceptions.

Sample results using this procedure are only used to determine whether the water needs to be radiologically controlled to ensure worker protection. The results cannot be used to determine free release of water or compliance with any other acceptance criteria (i.e., offsite laboratory receipt limit, Department of Transportation criteria, etc.).

This is a Reference procedure. The user is not required to have this procedure present while performing the activity.

## 2.0 GENERAL INFORMATION

### 2.1 Definitions and Abbreviations

**Counting System** – Any of the various counting systems available for use by RP which are specified in WSRC-IM-2005-00001, RME Technical Specifications Manual.

**PHA** – Pulse Height Analysis

**Sample Number** – Unique and sequential to each RP facility (e.g., 01/01/92: 92-HC-001 for 200-H Canyon, 92-HTF-001 for 200-H Tank Farm, 92-K-001 for 100-K Area).

### 2.2 Responsibilities

#### 2.2.1 Radiological Protection (RP) Personnel

RP personnel are responsible for:

- Following this procedure safely and correctly
  - Ensuring all procedure attachments applicable to their facility are present and completed.
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### 3.0 PRECAUTIONS AND LIMITATIONS

#### 3.1 Safety

Comply with applicable Radiological Work Permit (RWP).

A job site review shall be performed prior to beginning work to ensure the scope of work is covered under individual hazard analysis.

Additional hazard analysis may be required to ensure facility/job specific hazards are identified and the appropriate actions are taken to eliminate/mitigate the identified hazard(s).

### 4.0 PREREQUISITES

#### 4.1 Tools and Equipment

- Tweezers
- Graduated pipette
- 5-milliliter (mL) pipette tips
- 2-inch stainless steel planchets for 10-mL samples
- 1.5-inch stainless steel planchets for 5-mL samples
- Hot plate or heat lamp
- Indelible marker
- OSR 4-681, Water Sample Calculation Worksheet
- OSR 4-682, Water Sample Analysis Data Sheet
- OSR 4-690, Label: Caution Radioactive Material (large)
- OSR 4-691, Label: Caution Radioactive Material (small)
- Alpha and beta counting system
- Applicable portable survey instruments

### 5.0 PERFORMANCE

#### 5.1 Sample Preparation and Analysis (Alpha and Beta)

1. **SURVEY** sample container with portable instruments.
  2. **COMPLETE** OSR 4-690 or OSR 4-691 label, **AND**  
**PLACE** on sample container.
  3. **ASSIGN** next sequential number using OSR 4-682 (e.g., 01/01/92: 92-HC-001 for 200-H Canyon, 92-HTF-001 for 200-H Tank Farm, 92-K-001 for 100-K Area), **AND**  
**WRITE** sample number on top of OSR 4-690 or 4-691 label.
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**5.1 Sample Preparation and Analysis (Alpha and Beta), (cont.)**

4. **RECORD** the following on OSR 4-681:
    - Sample number
    - Sample location
    - Sample date and time
    - Sample received date and time.
  
  5. **IF** a sample probes greater than background, **THEN**  
  
**ENSURE** safe preparation of sample (e.g., evaporate sample in a hood for contamination control).
  
  6. **IF** sample container probes less than  $3E+4$  disintegrations per minute (dpm) beta-gamma, **THEN**  
  
**PREPARE AND ANALYZE** a 10-mL sample.
    - A. **IF** a 5-mL sample is requested, **THEN**  
  
**PREPARE AND ANALYZE** a 5-mL sample also.
  
  7. **IF** sample container probes greater than or equal to  $3E+4$  dpm beta-gamma, **THEN**
    - A. **NOTIFY** RP First Line Manager (FLM).
    - B. **SEND** sample to appropriate laboratory for gamma PHA, gross alpha, and beta-gamma analysis,  
  
**OR**  
  
**DISPOSE** of sample as contaminated waste based on RP Management instructions.
      - 1) **IF** sample was disposed as contaminated waste, **THEN**  
  
**RECORD** "disposed of" in Comments section on OSR 4-681.
    - C. **WHEN** sample results are received, **THEN**  
  
**RECORD** sample results on OSR 4-681.
  
  8. **APPLY** a wet wipe, followed by a dry wipe, to a 1.5-inch or 2-inch stainless steel planchet.
  
  9. **MARK** sample number on bottom of planchet with an indelible marker.
  
  10. **ENSURE** pipette tip is changed between samples to prevent cross-contamination of samples.
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**5.1 Sample Preparation and Analysis (Alpha and Beta), (cont.)**

11. **PERFORM** the following techniques, as applicable, to reduce potential for splattering sample on a hot planchet:

A. **IF** using a 5-mL planchet, **THEN**

- 1) **PLACE** planchet on hot plate or under heat lamp that is OFF.
- 2) **PIPETTE** 5-mL of the sample into a cool planchet.
- 3) **TURN ON** hot plate or heat lamp.
- 4) **ALLOW** sample to dry.

**NOTE**

If using the 2-inch planchet, the entire 10-mL can be dispensed.

B. **IF** using a 10-mL planchet, **THEN**

- 1) **PLACE** planchet on hot plate or under heat lamp that is OFF.
- 2) **PIPETTE** 5-mL of the sample into a cool planchet.

**CAUTION**

Do not allow the planchet to become dry. If the planchet becomes dry, introducing water droplets to a hot planchet could cause splattering, resulting in potential contamination of equipment and inaccurate sample analysis.

3) **TURN ON** hot plate or heat lamp.

a) **IF** planchet becomes dry, **THEN**

**ENSURE** planchet cools sufficiently prior to introducing the other 5-mL of the sample.

4) **PIPETTE** remainder of sample into planchet as it evaporates until the entire 10-mL sample has been dispensed.

12. **WHEN** evaporation of the sample is complete, **THEN**

A. **REMOVE** planchet from hot plate or heat lamp.

B. **ALLOW** planchet to cool.

**5.1 Sample Preparation and Analysis (Alpha and Beta), (cont.)**

13. **PROBE** planchet with portable survey equipment for alpha and beta-gamma radiation.
- A. **IF** sample probes less than 1E+5 dpm beta-gamma and less than 4E+3 dpm alpha, **THEN**
- PERFORM** one or both of the following, as applicable:
- **COUNT** the 5-mL sample in the appropriate counting system(s) for five minutes, **AND**
- NOTIFY** Control Room.
- **COUNT** the 10-mL sample in the appropriate counting system(s) for ten minutes, **AND**
- RECORD** results on OSR 4-681.
- B. **IF** sample probes greater than or equal to 1E+5 dpm beta-gamma or greater than or equal to 4E+3 dpm alpha, which is above the contamination limit for the counting system, **THEN**
- 1) **UTILIZE** portable beta-gamma and alpha instruments to count the sample.
  - 2) **CALCULATE AND RECORD** results on OSR 4-681.

**5.2 Sample Preparation and Analysis (Tritium)**

<p><b><u>NOTE</u></b></p> <p>OSR 4-681 is not used to record results for samples analyzed for tritium.</p>
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1. **RECORD** the following on OSR 4-682 for tritium samples:
  - Sample number
  - Sample location
  - Sample date and time.
2. **SEND** samples to an approved Tritium Laboratory for analysis.

<p><b><u>NOTE</u></b></p> <p>The following two steps only apply to C, K, and L Areas.</p>
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3. **NOTIFY** 105-K Central Control Room to have the sample recorded in SOP-SAMP-002-CKL, Sample Analysis Schedule and Control.
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**5.2 Sample Preparation and Analysis (Tritium), (cont.)**

4. **OBTAIN** tritium results from previous shift, **AND**  
**RECORD** on OSR 4-682.
5. **RECORD** results, supervisory review, and custodian notification in a timely manner, **AND**  
**NOTE** all delays or discrepancies on a Radiological Survey and in the Facility Shift Turnover Log.

**5.3 Sample Calculations**

1. **ENSURE** counting system(s) is within the calibration period.
  2. **ENSURE** daily source response and background checks have been completed.
  3. **RECORD** the following counting system information on OSR 4-681 based on type of system used:
    - Radiation Monitoring Equipment (RME) Instrument ID
    - Calibration due date.
  4. Using forceps/tweezers, **PLACE** planchet containing the sample in sample tray of counting system being used.
  5. **PERFORM** a five- or ten-minute count of the sample, as required, for alpha and for beta.
  6. **ENTER** dpm value in the space provided on OSR 4-681, **AND**  
**COMPLETE** calculations.
  7. **RECORD** results for both alpha and beta analysis on OSR 4-681.
  8. **RECORD** required data, as appropriate, on OSR 4-681.
  9. **CONTACT** sample custodian with results, **AND**  
**RECORD** name of person contacted, date, and time on OSR 4-681.
  10. **IF** water sample is greater than 3 dpm/mL (1.35 E-6 microcuries [ $\mu\text{Ci}$ ]/mL) alpha and/or 16 dpm/mL (7.2 E-6  $\mu\text{Ci}$ /mL) beta-gamma, **THEN**
    - A. **NOTIFY** RP and Facility Management
    - B. **RESAMPLE** water as instructed.
    - C. **BARRICADE** as Contamination Area (CA), if appropriate (e.g., puddle).
    - D. **RECOMMEND** clean-up/decontamination action to Facility Management.
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**5.3 Sample Calculations, (cont.)  
Step 10, (cont.)**

- E. **RECOMMEND** Facility Management notify Environmental As Low As Reasonably Achievable (ALARA) Coordinator or Liquid Effluent Program Manager that reviewing the RAD Release Reports may be prudent.
11. **RETAIN** all samples that calculate greater than 3 dpm/mL alpha and/or 16 dpm/mL beta-gamma and all samples that initially probed greater than background, **AND** **DISPOSE** of samples as directed by RP Management.
12. **RECORD** results, supervisory review, and custodian notification in a timely manner, **AND** **NOTE** all delays or discrepancies on a Radiological Survey and in the Facility Shift Turnover Log.
13. **REFER TO** Manual 5Q1.2, Procedure 302A, Calculating Liquid Radioactive Releases, to calculate radioactive releases.

**5.4 Post Performance**

1. **FORWARD** each completed OSR 4-681 to RP FLM for review.
2. **IF** in a facility performing the tritium analysis only, **THEN** **FORWARD** OSR 4-682 to RP FLM for review.

**6.0 REFERENCES**

1B, 3.31, Records Management  
5Q1.2, 302A, Calculating Liquid Radioactive Releases  
AHA ID: HCA-24735  
SOP-SAMP-002-CKL, Sample Analysis Schedule and Control  
WSRC-IM-2005-00001, RME Technical Specifications Manual

**7.0 RECORDS**

Records generated as a result of implementing this procedure are maintained in accordance with Manual 1B, Procedure 3.31, Records Management.

Facility Shift Turnover Log

Radiological Surveys

OSR 4-681 Water Sample Calculation Worksheet

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**7.0 RECORDS, (cont.)**

OSR 4-682 Water Sample Analysis Data Sheet

**7.1 Forms**

OSR 4-681 Water Sample Calculation Worksheet

OSR 4-682 Water Sample Analysis Data Sheet

OSR 4-690 Label: Caution Radioactive Material (Large)

OSR 4-691 Label: Caution Radioactive Material (Small)

**8.0 ATTACHMENTS**

None

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