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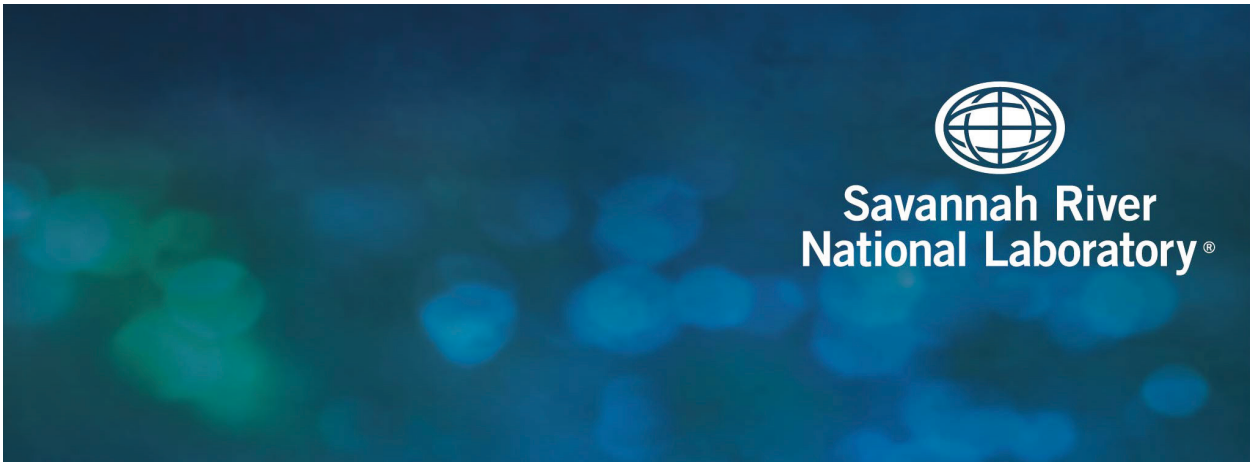


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# Characterization of Infrequent Samples from the Concentration, Storage, and Transfer Facility: H-Area Diversion Box 7 (HDB-7) Sump Sample: December 2021 Sample

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December 2021

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# REVIEWS AND APPROVALS

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# EXECUTIVE SUMMARY

In December 2021, SRR-E sent an ~250 mL sample identified as HDB-7 from an H-Area diversion box sump to SRNL for analysis. The sample was clear and colorless and free from any solids. SRNL analysis indicated that the sample contained 2.97E+05 dpm/mL Cs-137, 3.74E+05 dpm/mL total beta activity, 1.04E+03 dpm/mL beta activity following cesium removal, and below detectable levels of alpha activity and alpha activity following cesium removal. In addition, the pH of the sample was 7.32, free hydroxide concentration was 2.09E-07 M, and the density was 0.991 g/mL.

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| | |
|---|---|
| CSTF | Concentration, Storage and Transfer Facility |
| LSC | Liquid Scintillation Counting |
| MDA | Minimum Detectable Activity |
| PMP | Polymethylpentene |
| SRNL | Savannah River National Laboratory |
| SRR-E | Savannah River Remediation-Engineering |
| TTQAP | Task Technical and Quality Assurance Plan |
| TTR | Technical Task Request |

## 1.0 Introduction

On occasion, Savannah River Remediation Engineering (SRR-E) will request Savannah River National Laboratory (SRNL) to perform analysis on Concentration, Storage, and Transfer Facility (CSTF) samples originating from the sump encasement, catch tank, drain cell, or waste tank annulus per the Technical Task Request (TTR) or email. In December 2021, SRR-E sent SRNL a sample identified as HDB-7 from a diversion box sump. Following the specified TTR[i], Task Technical and Quality Assurance Plan (TTQAP)[ii], and updated request by SRR-E through email, SRNL tested the sample for Total Alpha and Total Beta by liquid scintillation counting (LSC), Cs-137 by Gamma scan, density, and pH (original plans were to determine Free $OH^-$ by titration, but the sample was neutral).

## 2.0 Experimental Procedure

The H-Area diversion box sump HDB-7 sample was received on 21 December 2021 at SRNL. As the "as-received" sample radiation dose rate was 5 mrem/hr extremity and 1 mrem/hr skin and whole body, the container was moved to a radiological hood for inspection. Approximately 250 mL of sample was collected from the receipt vessel and was transferred into clear polymethylpentene (PMP) beakers for visual inspection.

The sample appearance was clear and colorless with no visual solids. Aliquots of the sample were directly transferred into shielded bottles and submitted in triplicate preparations each for total gamma/beta/alpha and free hydroxide analyses.

The density of the sample was measured in triplicate by recording the weight of 2 mL of sample on a balance at 17.8 °C. The sub-samples used for density determination were combined with the original sample and stored in a plastic bottle.

### 2.1 Quality Assurance

Requirements for performing reviews of technical reports and the extent of review are established in manual E7 2.60[iii]. SRNL documents the extent and type of review using the SRNL Technical Report Design Checklist contained in WSRC-IM-2002-00011, Rev. 2[iv]. This review meets the acceptance criteria to comply with the TTR[i] requesting this work with a functional classification of Safety Class and per guidance in the TTQAP.[ii] Data are recorded in the electronic laboratory notebook system as Experiment ID A2341-00117-18.[v]

## 3.0 Results and Discussion

A photograph of the HDB-7 sample is provided in Figure 3-1. The sample was split into three portions for inspection. Separate samples were submitted in triplicate for analysis by each of the following methods: 1) radiochemical analysis (total gamma, beta, and Cs-removed beta and alpha) and 2) free hydroxide. Due to the neutral pH of the sample, free hydroxide could not be determined by titration and the sample pH was measured instead. Free hydroxide was then calculated from the pH. Results are provided in Table 3-1.

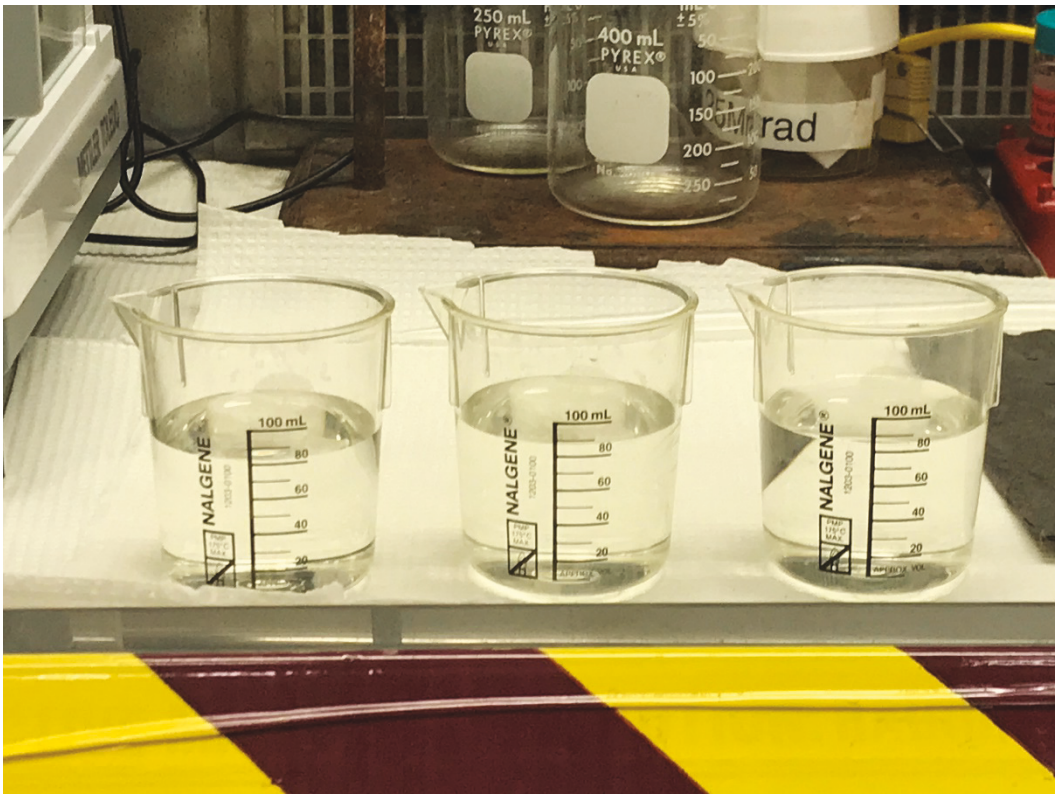


**Figure 3-1. Photograph of the HDB-7 Sample Split Between Three PMP Beakers**

**Table 3-1. Results for December 2021 HDB-7 sample: Total Alpha, Total Beta, Total Gamma scan, Density, pH, and Free Hydroxide.**

| Test | Replicate 1 | Replicate 2 | Replicate 3 | Average | %RSD |
|---|---|---|---|---|---|
| Total Alpha (dpm/mL) (one sigma %uncertainty) | *<5.08E+02 (Upper Limit) | *<8.93E+02 (Upper Limit) | *<9.73E+02 (Upper Limit) | *<5.08E+02 | N/A |
| Cs-Removed Alpha (dpm/mL) (one sigma % uncertainty) | *<1.83E+01 (MDA) | *<1.93E+01 (MDA) | *<1.83E+01 (MDA) | *<1.83E+01 | N/A |
| Total Beta (dpm/mL) (one sigma % uncertainty) | 3.69E+05 (10%) | 3.77E+05 (10%) | 3.75E+05 (10%) | 3.74E+05 | 1.11 |
| Cs-Removed Beta (dpm/mL) (one sigma % uncertainty) | 1.06E+03 (20.3%) | 1.11E+03 (20.0%) | 9.40E+02 (21.1%) | 1.04E+03 | 8.43 |
| Total Gamma (dpm/mL) (one sigma % uncertainty) | 3.00E+05 (5.00%) | 3.01E+05 (5.00%) | 2.90E+05 (5.00%) | 2.97E+05 | 2.05 |
| pH | 7.27 | 7.42 | 7.28 | 7.32 | 1.15 |
| Free Hydroxide (M) | 1.86E-07 | 2.63E-07 | 1.91E-07 | 2.09E-07 | 20.65 |
| Density (g/mL) | 0.993 | 0.993 | 0.987 | 0.991 | 0.35 |

*Note: Results were below detectable limit for quantification by method, therefore result is upper limit based on sensitivity of the analysis method.

## 4.0 Conclusions

The HDB-7 sample characterization indicated low to moderate gamma and beta activity in the sample and no measurable alpha activity. The density was 0.991 g/mL, the pH was 7.32, and the free hydroxide was 2.09E-07 M.

## 5.0 References

[i] Technical Task Request, “Infrequent CSTF Samples”, X-TTR-H-0101, Rev. 1, June 2021.
[ii] L. N. Oji, S. C. Lucatero, “Task Technical and Quality Assurance Plan for the Analysis of Infrequent Samples from the Concentration, Storage, and Transfer Facility”, SRNL-RP-2020-00565, Rev.1, July 2021.
[iii] “Technical Reviews,” E7 Manual, Procedure 2.60, Rev. 18, 2019
[iv] “Savannah River National Laboratory Technical Report Design Check Guidelines”, WSRC-IM-2002-00011, Rev.2, 2004.
[v] W. D. King: ELN: A2341-00117-18 (Electronic Notebook (Production)); SRNL, Aiken, SC 29808 (2021).

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