**Contract No:**

This document was prepared in conjunction with work accomplished under Contract No. DE-AC09-08SR22470 with the U.S. Department of Energy (DOE) Office of Environmental Management (EM).

**Disclaimer:**

# Calculation Cover Sheet

| | | |
|---|---|---|
| Project<br>KIS | Calculation No.<br>U-CLC-K-00006 | Project No.<br>N/A |
| Title<br>Volume Determination for SRS and Hanford 3013 Inner Containers | Functional Classification<br>NA | Sheet 2 of 4 |
| | Discipline<br>NMM Engineering | |
| Calc Level<br>☒ Type 1 ☐ Type 2 | Type 1 Calc Status<br>☐ Preliminary ☒ Confirmed | |
| Computer Program No. ☒ N/A | Version/Release No.<br>N/A | |
| Purpose and Objective<br>This calculation documents the volume of the inner 3013 container found in the SRS 3013 package configuration based on the design drawings. The SRS inner container is similar to the one used for Hanford 3013 packages. | DC/RO<br>See AIM Coversheet | Date |

Summary of Conclusion

The following volumes were determined for the SRS Inner 3013 and the Hanford Inner container:

**Inner 3013 Volumes**

| | |
|---|---|
| Min. Outside Volume | 2.311 L |
| Max. Outside Volume | 2.320 L |
| Min. Inside Volume | 2.089 L |
| Max. Inside Volume | 2.110 L |

**Revisions**

| Rev. No. | Revision Description |
|---|---|
| 0 | Initial Issue |
| | |

**Sign Off**

| Rev. No. | Originator (Print) Sign/Date | Verification/ Checking Method | Verifier/Checker (Print) Sign/Date | Manager (Print) Sign/Date |
|---|---|---|---|---|
| 0 | E.R. Hackney<br>Approvals in AIM | Document Review | L. E. Traver<br>Approvals in AIM | D. M. Barnes<br>Approvals in AIM |

| | | |
|---|---|---|
| Additional Reviewer -- (Print)<br>NA | Signature<br>NA | Date<br>NA |
| Design Authority -- (Print)<br>E.R. Hackney | Signature<br>Approvals in AIM | Date<br>See AIM |
| Release to Outside Agency -- (Print)<br>N/A | Signature<br>N/A | Date<br>N/A |

Security Classification of the Calculation

Classification in AIM

## 1.0 OPEN ITEMS

There are no open items affecting this calculation.

## 2.0 REFERENCES

1. United States Department of Energy, *Stabilization, Packaging, and Storage of Plutonium-Bearing Materials*, DOE-STD-3013-2004, April 2004.
2. R-R4-F-0107, Rev. 0, FB-Line Bagless Transfer System 4.600" OD x 9" High Can Detail
3. R-R4-F-0119, Rev. 0 FB-Line Bagless Transfer System Cut Can Details
4. R-R3-F-0030, Rev. 1, FB-Line Bagless Transfer System 4.600" OD Can Hollow Plug Weldment

## 3.0 INPUT AND ASSUMPTIONS

The container dimensions were taken from the reference drawings. The inner 3013 container is assumed to be manufactured in accordance with the applicable design drawing. No inspections or field measurements were made as part of this calculation.

The Hanford Inner Can is based on a very similar 4.600" OD x 9" high can found on EES-22726-R1-002 Rev. C or a Dynamics Machine Works 2043 Rev. B. Any dimensional differences found between the SRS can and Hanford can were less than 0.005".

### 3.1 SRS Inner 3013 Can Dimensions (Ref. 2, 3, 4)

Outside Diameter = 4.600" ± 0.005"
Inside Diameter = 4.48" ± 0.005"
Wall Thickness = 0.060" ± 0.01"
Height of Can w/ Lid = 8.590" + 0.11" = 8.70" ± 0.01"
Overall Cut Height = 9.000" + 0.1"/- 0.2"
Lid Thickness = 0.12"
Bottom Thickness = 0.25" ± 0.03"
Max Bottom Thickness = 0.28"
Min. Inside Length = 8.59" – 0.280" = 8.31"
Max. Inside Length = 8.59" – 0.220" = 8.37"

## 4.0 ANALYTICAL METHODS AND COMPUTATIONS

### 4.1 SRS Inner 3013 Can Volumes

Estimate the volume of the inner 3013 container as a sum of three separate parts. The first part is the majority of the can as a cylinder using:

$$V_{CYIINDER} = \pi r^2 h$$

The second part is the sloped section from which the volume can be estimated using the formula for the frustrum of a right circular cone:

$$V_{SLOPE} = \frac{1}{3}\pi h\left( R_1^2 + R_2^2 + R_1 R_2 \right)$$

and the third part is the volume of the narrowed bottom:

$$V_{BOTTOM} = \pi r^2 h$$

Data from above results in the following values:

| | |
|---|---|
| Min. Outside Volume | 2.311 L |
| Max. Outside Volume | 2.320 L |
| Min. Inside Volume | 2.089 L |
| Max. Inside Volume | 2.110 L |

## 5.0 RESULTS

Maximum and minimum volumes for the inner container were determined from published allowances from the most current revisions of the container drawings. See table above.

## 6.0 CONCLUSION

The results of the calculations correlate to the Hanford Inner container because the Bagless welder used by Hanford was built by WSRC/EES and modeled after the original FB-Line Bagless welder.