National Nuclear Security Administration
Los Alamos Field Office
3747 West Jemez Road, A316
Los Alamos, New Mexico 87544
(505) 667-5105/Fax (505) 667-5948

Environmental Management
Los Alamos Field Office
1200 Trinity Drive, Suite 400P
Los Alamos, New Mexico 87544
(240) 562-1122

Date: May 12, 2023

Mr. Ricardo Maestas, Acting Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Response to the Request for Additional Information Fiscal Year 2022 Nonconformance Report, Los Alamos National Laboratory, EPA ID #NM0890010515

Dear Mr. Shean:

The United States Department of Energy (DOE) and its field offices, the National Nuclear Security Administration-Los Alamos Field Office (NA-LA) and the Environmental Management-Los Alamos Field Office (EM-LA), along with Triad National Security, LLC (Triad) and Newport News Nuclear BWXT-Los Alamos, LLC (N3B), collectively the Permittees, submit this response to the New Mexico Environment Department-Hazardous Waste Bureau's (NMED-HWB) March 30, 2023, *Request for Additional Information Fiscal Year 2022 Nonconformance Report Los Alamos National Laboratory EPA ID #NM0890010515.* The attached enclosures address the information requested in the above-referenced letter.

Enclosure 1 includes copies of Nonconformance Report (NCR) packages for NCR-LANL-0003-22, NCR-LANL-0285-21, and NCR-LANL-0289-21 providing the additional information provided to the Central Characterization Project (CCP) used to closeout characterization and documentation of CCP's approval or acceptance of the additional information for containers LA00000069506, LA00000073668, LA00000074392, LA00000074720, LA00000074722, LA00000073611, LA00000073442, LA00000073650, and LA00000074382. Also included in Enclosure 1 is a summary table providing the location of the requested information within each of the NCR packages and the requested information.

Enclosure 2 includes copies of NCR packages for NCR-LANL0050-22 and NCR-LANL-0343-21 providing the additional information provided to the CCP used to closeout characterization and documentation of CCP's approval or acceptance of the additional information for containers 68273, 68278, 92536, and 92773. Also included in Enclosure 2 is a summary table providing the location of the requested information within each of the NCR packages and the requested information.

If you have questions or comments for NA-LA/Triad concerning this submittal, please contact Karen E. Armijo (NA-LA) at (505) 665-7314 or Jessica Moseley (Triad) at (505) 412-9362.

If you have questions or comments for EM-LA/N3B concerning this submittal, please contact Arturo Duran (EM-LA) at (575) 373-5966 or Christian Maupin (N3B) at (505) 695-4281.

Sincerely,

KAREN ARMIJO

Digitally signed by KAREN ARMIJO
Date: 2023.05.10 13:42:17 -06'00'

Karen E. Armijo
Permitting and Compliance Program Manager
National Nuclear Security Administration
Los Alamos Field Office
U.S. Department of Energy

Sincerely,

M Lee Bishop

Digitally signed by M Lee Bishop
Date: 2023.05.11 14:21:41 -06'00'

M. Lee Bishop, Director
Office of Quality and Regulatory Compliance
Environmental Management
Los Alamos Field Office
U.S. Department of Energy

Enclosures: (1) Response to the Request for Additional Information on Identified Containers in Fiscal Year 2022 Nonconformance Report, U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Field Office and Triad National Security, LLC

(2) Response to the Request for Additional Information on Identified Containers in Fiscal Year 2022 Nonconformance Report, U.S. Department of Energy, Environmental Management, Los Alamos Field Office and Newport News Nuclear BWXT-Los Alamos, LLC

Copy w/enclosures:
Ricardo Maestas, NMED-HWB, Santa Fe, NM, ricardo.maestas@env.nm.gov
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n3brecords@em-la.doe.gov
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U.S. DEPARTMENT OF
ENERGY

National Nuclear Security Administration
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Subject: Response to the Request for Additional Information Fiscal Year 2022 Nonconformance Report, Los Alamos National Laboratory, EPA ID #NM0890010515

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ENCLOSURE 1

Response to the Request for Additional Information on Identified Containers in Fiscal Year 2022 Nonconformance Report

U.S. Department of Energy, National Nuclear Security Administration, Los Alamos Field Office and Triad National Security, LLC

Date: May 12, 2023

U.S. Department of Energy,
National Nuclear Security Administration Los Alamos Field Office, and
Triad National Security, LLC

NA-LA/Triad

Reference Container ID	(1) Information provided to Central Characterization Project (CCP) for Close Out (Close Out Information)	(2) CCP Acceptance or Approval of Close Out Information	Reference Attachment
*LA000000695066 53700 (Parent) 11-08-1994	**NCR-LANL-0003-22** Page 9 of 16 (Attachment 4 Page 4 of 11) – Calculation for 69506 showing it meets BoK Criteria 3 ounces (89 ml) of liquid was observed during repackaging, and RTR identified 3 kg of homogeneous solids (AKA08). Sorbent is the only potential source of homogeneous solids in the container. The composition of the liquid is unknown but can be bounded by 70% (16M) HNO3, which is technical grade nitric acid often used in lab work; at higher concentrations of HNO3, the nitric acid is unstable and volatilizes. Assuming the acid is fully converted to KNO3 (the most conservative metal nitrate that could form from the available cations), the concentration of KNO3 in organic kitty litter would be 4.7 wt. %	**NCR-LANL-0003-22** Page 4 of 16 (Attachment 3 Page 1 of 6) – Containers 69044 and 69506 Meet the BoK Criteria In BoK20, containers 69044 and 69506 were determined to be non-compliant with the BoK criteria due to the Inclusion of organic kitty litter used which could have Included oxidizing chemicals (AKAOB, BOK20). The use of organic kitty litter to sorb liquids that Include oxidizing chemicals Is prohibited by the BoK. Resolution: As stated above, during the initial evaluation In BOK20, containers 69044 and 69506 were determined to be non-compliant with BoK criteria. However, In the testing used to support the BoK, a concentration for oxidizing chemicals sorbed in organic kitty litter was found that produced a non-oxidizer result. Using this concentration (11 wt. %) with the documented volume of liquid added to the containers (AKA08), the amount of homogeneous solids Identified through RTR, and a conservative assumption for the composition of the sorbed liquid (70% HN03), a mass balance calculation can be performed that shows that the sorbed masses In these containers do not contribute to an oxidizing hazard. Therefore, containers 69044 and 69506 were re-evaluated and determined to be compliant with the BoK criteria (BOK20Addendum 5). Therefore, the above containers can be resolved from NCR-LANL-0003-22.	**NCR-LANL-0003-22** Page 4; (Attachment 3 Page 1 of 6) – Containers 69044 and 69506 Meet the BoK Criteria Page 9; (Attachment 4 Page 4 of 11) – Calculation for 69506 showing it meets BoK Criteria Page 15; Attachment 1 – Approved Containers Page 16; (Attachment 4 Page 11 of 11) – TA-55 Information Release Form

Response to Request for Additional Information Fiscal Year 2022 Nonconformance Report

Reference Container ID	(1) Information provided to Central Characterization Project (CCP) for Close Out (Close Out Information)	(2) CCP Acceptance or Approval of Close Out Information	Reference Attachment
LA00000073668	**NCR-LANL-0285-21** Page 3 of 46 (Attachment 1 Page 38 of 48) – Final Disposition: An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days.	**NCR-LANL-0285-21** Calculation Cover Sheet Attachment 3 Page 2 of 43 and ongoing Calculation Sheets: An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation and the containers in Block 3 having been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0285-21** Page 3; (Attachment 1 Page 38 of 48) – Final Disposition Page 5; Calculation Cover Sheet Attachment 3 Page 2 of 43 and ongoing Container was shipped and emplaced at the WIPP on 10-25-2022
LA00000074392	**NCR-LANL-0285-21** Page 3 of 46 (Attachment 1 Page 38 of 48) – Final Disposition: An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days.	**NCR-LANL-0285-21** Calculation Cover Sheet Attachment 3 Page 2 of 43 and ongoing Calculation Sheets: An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation and the containers in Block 3 having been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0285-21** Page 3; (Attachment 1 Page 38 of 48) – Final Disposition Page 5; Calculation Cover Sheet Attachment 3 Page 2 of 43 and ongoing

Reference Container ID	(1) Information provided to Central Characterization Project (CCP) for Close Out (Close Out Information)	(2) CCP Acceptance or Approval of Close Out Information	Reference Attachment
LA00000074720	**NCR-LANL-0285-21** Page 3 of 46 (Attachment 1 Page 38 of 48) – Final Disposition: An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days.	**NCR-LANL-0285-21** Calculation Cover Sheet Attachment 3 Page 2 of 43 and ongoing Calculation Sheets: An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation and the containers in Block 3 having been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0285-21** Page 3; (Attachment 1 Page 38 of 48) – Final Disposition Page 5; Calculation Cover Sheet Attachment 3 Page 2 of 43 and ongoing
LA00000074722	**NCR-LANL-0285-21** Page 3 of 46 (Attachment 1 Page 38 of 48) – Final Disposition: An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days.	**NCR-LANL-0285-21** Calculation Cover Sheet Attachment 3 Page 2 of 43 and ongoing Calculation Sheets: An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation and the containers in Block 3 having been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0285-21** Page 3; (Attachment 1 Page 38 of 48) – Final Disposition Page 5; Calculation Cover Sheet Attachment 3 Page 2 of 43 and ongoing Container was shipped and emplaced at the WIPP on 10-25-2022

Reference Container ID	(1) Information provided to Central Characterization Project (CCP) for Close Out (Close Out Information)	(2) CCP Acceptance or Approval of Close Out Information	Reference Attachment
LA00000073611	**NCR-LANL-0289-21** Page 3 of 53 (Attachment 1 Page 38 of 48) An evaluation performed by NWP Packaging Engineers and documented in source document 0399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0289-21** Page 3 of 53 (Attachment 1 Page 38 of 48) An evaluation performed by NWP Packaging Engineers and documented in source document 0399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0289-21** Page 3; (Attachment 1 Page 38 of 48) Page 6; (Attachment 5 Page 3 of 44) and ongoing Container was shipped and emplaced at the WIPP on 10-25-2022
LA00000073442	**NCR-LANL-0289-21** Page 3 of 53 (Attachment 1 Page 38 of 48) An evaluation performed by NWP Packaging Engineers and documented in source document 0399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0289-21** Page 3 of 53 (Attachment 1 Page 38 of 48) An evaluation performed by NWP Packaging Engineers and documented in source document 0399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0289-21** Page 3; (Attachment 1 Page 38 of 48) Page 6; (Attachment 5 Page 3 of 44) and ongoing Container was shipped and emplaced at the WIPP on 6-23-2022

Reference Container ID	(1) Information provided to Central Characterization Project (CCP) for Close Out (Close Out Information)	(2) CCP Acceptance or Approval of Close Out Information	Reference Attachment
LA00000073650	**NCR-LANL-0289-21** Page 3 of 53 (Attachment 1 Page 38 of 48) An evaluation performed by NWP Packaging Engineers and documented in source document 0399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0289-21** Page 3 of 53 (Attachment 1 Page 38 of 48) An evaluation performed by NWP Packaging Engineers and documented in source document 0399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0289-21** Page 3; (Attachment 1 Page 38 of 48) Page 6; (Attachment 5 Page 3 of 44) and ongoing Container was shipped and emplaced at the WIPP on 10-11-2022
LA00000074382	**NCR-LANL-0289-21** Page 3 of 53 (Attachment 1 Page 38 of 48) An evaluation performed by NWP Packaging Engineers and documented in source document 0399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0289-21** Page 3 of 53 (Attachment 1 Page 38 of 48) An evaluation performed by NWP Packaging Engineers and documented in source document 0399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.	**NCR-LANL-0289-21** Page 3; (Attachment 1 Page 38 of 48) Page 6; (Attachment 5 Page 3 of 44) and ongoing

CCP Documentation
for
NCR-LANL-0003-22

Attachment 1 – CCP Nonconformance Report (NCR)

CCP NONCONFORMANCE REPORT (NCR)

(Use NCR Continuation, Attachment 3, if necessary)

NCR No. NCR-LANL-0003-22 Revision 0

1. Lot No., Heat No., or Serial No. (if applicable): N/A	2. Process (e.g., NDA, NDE, VE, Other): AK	3. Batch Data Report #(s): N/A
4. Order/Work Order/Job Control Number (if applicable): N/A	5. PO # (if applicable): N/A	Container #(s): 69044 69506
	6. Supplier (if applicable): N/A	

DESCRIPTION OF NONCONFORMANCE

7a. NCR Description: ☐ < 100 nCi/g ☐ Prohibited Item ☐ E-Flag ☐ Receipt Inspection ☐ Transportation ☐ WWIS/WDS ☒ Other

7b. Requirement(s) (Enter Implementing Procedure No., Revision, Section No., & Quoted Text):
DOE/WIPP-17-3589, Revision 1, U.S. Department of Energy Carlsbad Field Office Basis of Knowledge for Evaluation oxidizing chemicals in TRU Waste.
Section 4.5, Organic Sorbents states in part, "Oxidizing chemicals sorbed into polysaccharide sorbents are not acceptable at the WIPP without treatment, testing, or a technical justification supporting compliant shipment and receipt at WIPP."

7c. Actual Condition:
BoK 20 for LA-MHD03.001 rejects the containers identified in Block 3 for the potential to contain polyol organic sorbents (i.e. polysaccharide sorbents) with oxidizing chemicals.

7d. Have the CCP HOLD TAGS associated with this NCR been applied? ☒ YES ☐ NO If no is checked, explain.
kdg 1-18-22

8. NCR Originator:
David Fry (printed name) DAVID FRY (Affiliate) Digitally signed by DAVID FRY (Affiliate) Date: 2022.01.17 09:25:43 -07'00' (signature) 1/17/2022 (date)

9. Does the identified condition have the potential to impact AK? If YES or INDETERMINATE, enter Trend Code L in Block 10. ☒ YES ☐ NO ☐ INDETERMINATE

10. Trend Code: L

11. Responsible Manager/Individual: Laura Turner

12. Recurring Condition? ☐ YES ☒ NO (If Yes, list NCRs and Issue Notices):

13. Significant Condition? ☐ YES ☒ NO
Programmatic Condition? ☐ YES ☒ NO
(If Yes, enter Issue Notice No.):

14. QA Engineer or QA Designee validation:
Katie Gentry (printed name) Katie Gentry (signature) 1-17-2022 (date)

CCP RECORDS ORIGINAL
DATE REC'D 03/10/2022

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0003-22 **Revision 0**

INTERIM DISPOSITION

15a. Interim Disposition (Check Only One):

☐ N/A (See Final Disposition) ☒ Hold ☐ Conditionally Accept ☐ Conditionally Use

☐ Sort ☐ Reinspect or Retest ☐ Remediate

15b. Instructions for Completion of the Interim Disposition:

The AKE will evaluate host site provided information and, along with the SPM, determine a path forward.

INTERIM DISPOSITION APPROVALS

16a. Responsible Manager/Individual/SPM/VPM:

David Fry	DAVID FRY (Affiliate) Digitally signed by DAVID FRY (Affiliate) Date: 2022.01.17 09:26:20 -07'00'	1/17/2022
printed name	signature	date

16b. QA Engineer or QA Designee:

Katie Gentry	Katie Gentry	1-17-2022
printed name	signature	date

COMPLETION OF INTERIM DISPOSITION

17. Interim Disposition Complete – Responsible Manager/Individual/SPM/VPM:

David Fry	David Fry	03/07/2022
printed name	signature	date

18. Interim Disposition Verified – QA Engineer:

Katie Gentry	Katie Gentry	3-7-2022
printed name	signature	date

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0003-22 **Revision 0**

FINAL DISPOSITION

19. Final Disposition (Check Only One: Use-As-Is, Repair, Reject, Rework, or Scrap):
☒ Use-As-Is ☐ Repair

19a. Technical Justification – Required for Use-As-Is or Repair dispositions. [☐ N/A for Reject, Rework, or Scrap]

The containers identified in Block 3 have been evaluated by the AKE, as evidenced in DR193. Additional information from the Host Site demonstrates compliance of the container with BoK criteria, documented in BoK 20 Addendum 5.

☐ Reject ☐ Rework ☐ Scrap

19b. Instructions for Completion – Required for Reject, Repair, Rework, or Scrap [☒ N/A for Use-As-Is]

19c. Corrective Actions (Actions to Prevent Recurrence – For Repair or Rework, if applicable.
[☒ N/A if not applicable, and for Use-As-Is, Reject, and Scrap]

FINAL DISPOSITION APPROVALS

20. Responsible Manager/Individual/SPM/VPM:

David Fry	David Fry	03/07/2022
printed name	signature	date

21. QA Engineer or QA Designee:

Katie Gentry	Katie Gentry	3-7-2022
printed name	signature	date

CLOSURE

22. Final Disposition Complete - Responsible Manager/Individual/SPM/VPM:

David Fry	David Fry	03/07/2022
printed name	signature	date

23. Attachments: 1. Hold Tag Applied 2. Reportability Email 3. Interim Closure 4. Final Closure Document 5. Hold Tag Removal

24a. HOLD TAG removal has been verified and reconciled for all nonconforming items on the NCR: ☒

24b. If HOLD TAG is not applicable, check: ☐ and explain:

25. Final Disposition Verified – NCR Closed QA Engineer:

Katie Gentry	Katie Gentry	3-9-2022
printed name	signature	date

Attachment 3 - Acceptable Knowledge Source Document Summary

Site(s): Los Alamos National Laboratory	Source Document Tracking Number: DR193
Waste Stream Number(s): LANL Non-Specific Library Files (Applicable only when site library is not in use)	
Acceptable Knowledge Documentation Type: ☑ TRU Waste Management Program Information ☑ Waste Stream-Specific Information ☐ Additional Information	Category: ☐ C - Correspondence ☐ D - Documents ☐ M - Miscellaneous ☐ P - Procedures ☑ DR - Discrepancy Resolution ☐ U - Unpublished Documents ☐ AKA - Acceptable Knowledge Assessment ☐ CCE - Chemical Compatibility Evaluation ☐ BOK - Basis of Knowledge ☐ TEC - Technical Paper
Title or Description of Source Document [a]: Containers 69044 and 69506 Meet the BoK Criteria	
Source Document Reference Information (author(s), document and revision number, date, publisher): B. Ams, NA, Rev. NA, 01/19/2022, AK-TA55-22-035	

AK # [b]	Source Doc. Page #[c]	AK Information Summary
PR6, WS3, WS8, WS9, WS11	All	In BOK20, containers 69044 and 69506 were determined to be non-compliant with the BoK criteria due to the inclusion of organic kitty litter used which could have included oxidizing chemicals (AKA08, BOK20). The use of organic kitty litter to sorb liquids that include oxidizing chemicals is prohibited by the BoK. Resolution: As stated above, during the initial evaluation in BOK20, containers 69044 and 69506 were determined to be non-compliant with BoK criteria. However, in the testing used to support the BoK, a concentration for oxidizing chemicals sorbed in organic kitty litter was found that produced a non-oxidizer result. Using this concentration (11 wt. %) with the documented volume of liquid added to the containers (AKA08), the amount of homogeneous solids identified through RTR, and a conservative assumption for the composition of the sorbed liquid (70% HNO3), a mass balance calculation can be performed that shows that the sorbed masses in these containers do not contribute to an oxidizing hazard. Therefore, containers 69044 and 69506 were re-evaluated and determined to be compliant with the BoK criteria (BOK20 Addendum 5). Therefore, the above containers can be resolved from NCR-LANL-0003-22.

Attachment 3 - Acceptable Knowledge Source Document Summary (continued)

Site(s): Los Alamos National Laboratory	Source Document Tracking Number: DR193

Source Document Data Limitations (if any):

1. None.

Acceptable Knowlege Expert:

Amy Johns , Amy Johns Date: 1/20/2022
Print /Sign

[a] Provide description for non-titled information (i.e., container paperwork, MSDS sheets, etc)
[b] Obtain from Acceptable Knowledge Documentation Checklist
[c] For microfilm or microfiche, identify box, tape, reel number and location.

Basis of Knowledge Evaluation

To: Tania Guardado, CCP SPM
From: Bridget Ams, Acceptable Knowledge Expert
Date: December 15, 2021
Subject: Basis of Knowledge Criteria Evaluation for Containers in Waste Stream LA-MHD03.001, Addendum 5

1.0 Introduction

This memorandum presents an evaluation of characterization data for waste stream LA-MHD03.001 containers based on the evaluation criteria in the *"Basis of Knowledge for Evaluating Oxidizing Chemicals in TRU Waste"*, DOE/WIPP-17-3589, Rev. 1, hereafter referred to as the BoK. The purpose of this evaluation is to determine whether the targeted containers meet the criteria of the BoK for the treatment and management of oxidizing materials. This is being conducted as part of the effort to support the Department of Energy Carlsbad Field Office in making decisions regarding the appropriate disposition path for the LA-MHD03.001 waste stream.

The BoK criteria focus on the physical and oxidizing chemical contents of the waste stream as described in the approved Chemical Compatibility Evaluation Memorandum (CCE11), the approved Acceptable Knowledge Assessment (AKA08), and the data sheets generated during real-time radiography (RTR) and visual examination (VE). The CCEM provides a detailed analysis of the chemicals that can be present in any given container. The AKA provides a detailed description of the management and packaging of the waste containers, with a description of the contents of each container derived from various sources, which are cited in the AKA. The RTR/VE data sheets provide the most recent certified evaluation of the individual container contents.

There are 4 containers from the LA-MHD03.001 waste stream that are part of this evaluation. Of those containers, all four have been determined to be compliant with the BoK criteria and are identified in Attachment 1.

2.0 Waste stream description

As described in CCP-AK-LANL-009, *Central Characterization Program Acceptable Knowledge Summary Report for Los Alamos National Laboratory Chemistry And Metallurgy Research (CMR) Facility*, LA-MHD03.001 is a TRU-mixed debris waste stream originating from the Chemistry And Metallurgy Research (CMR) Facility located in Technical Area (TA)-03 and is composed predominantly of mixed heterogeneous debris and lesser quantities of homogeneous solids (less than 50 percent by volume). The heterogenous debris includes combustible (e.g., wipes, plastic, rubber) and non-combustible materials (e.g., small tools, cans, metal debris).

3.0 Evaluation of waste to Basis of Knowledge criteria

The following sections address the criteria defined in Section 4 of the BoK that must be met prior to acceptability at the WIPP.

4.0 Criteria for evaluating TRU waste with oxidizing chemicals

4.1 Evaluation and review

Waste containing one or more oxidizing chemicals has been evaluated to the criteria in section 4.0 of the BoK.

4.2 Oxidizing chemical verification

> "Waste streams with oxidizing chemicals, whether listed on Table 4-1 or not, must be reevaluated by the AKE to determine if oxidizing chemicals are actually present in the waste."

The identification and evaluation of the oxidizing chemicals were performed using information from the CCEM and the AKA. The following chemicals are listed in Attachment 1 of CCE11 as either RGN 2 (oxidizing acids) or RGN 104 (strong oxidizing agents):

- Metal Nitrates
- Nitric Acid
- Rad-Release II Step 1 Surface Prep
- Rad-Release Rinse Solution

The predominant metal nitrates present are dependent on the products used for neutralization, cementation, and sorption. In this waste stream, sodium, potassium, and magnesium could be available to form metal nitrates. All of these are included in Table 4-1 of the BoK and are therefore bounded by the formal testing performed to support the BoK.

Nitric acid in its liquid form would be expected to evaporate after sorption. However, for the purpose of this evaluation, the more conservative assumption, that any nitric acid in the waste is fully converted to a metal nitrate, is used. As discussed above, any metal nitrate salts that could form from the available cations are bounded by the criteria in the BoK. Both Rad-Release II Step1 Surface Prep and Rad-Release Rinse Solution are listed in Attachment 1 of the CCE because they include nitric acid.

4.3 Distribution of oxidizing chemicals within waste components

> "Personnel performing the AK characterization must determine how well the oxidizing chemicals are distributed as well as the concentration of oxidizing chemicals within each waste component that contains oxidizing chemicals."

Liquid is added to the sorbent, and the mixture is mixed until homogeneous (P159, P356). Any oxidizing chemicals would be evenly distributed in these components.

4.4 pH adjustment of oxidizing acids, bases, and solutions

> "Oxidizing acids and aqueous solutions with oxidizing chemicals in containers and as free liquids separated from the solid portion of the waste generated or treated and repackaged should be pH adjusted prior to sorbing or solidifying."

At the CMR, liquids were neutralized as necessary (P356). At the Waste Characterization Reduction and Repackaging Facility, pH testing was required to identify liquids outside of the pH range of 2 to 12, and the liquids were neutralized as necessary (P159). These neutralization processes would have resulted in the presence of metal nitrates, as identified in Section 4.2.

4.5 Organic sorbents

> "Oxidizing chemicals sorbed into polysaccharide sorbents are not acceptable at the WIPP without treatment, testing, or a technical justification supporting compliant shipment and receipt at WIPP."

Two containers in this population (69044 and 69506) include organic kitty litter that was potentially used to sorb a liquid containing oxidizing chemicals (AKA08).

For 69044, 6 ounces (178 mL) of liquid was observed during repackaging, and RTR identified 10 kg of homogeneous solids (AKA08). Sorbent is the only potential source of homogeneous solids in the container. The composition of the liquid is unknown but can be bounded by 70% (16M) HNO_3, which is technical grade nitric acid often used in lab work; at higher concentrations of HNO_3, the nitric acid is unstable and volatilizes. Assuming the acid is fully converted to KNO_3 (the most conservative metal nitrate that could form from the available cations), the concentration of KNO_3 in organic kitty litter would be 2.9 wt. %, as shown below:

178 mL liquid * 16 mol HNO_3 per 1000 mL liquid = 2.8 mol HNO_3

2.8 mol HNO_3 → 2.8 mol KNO_3

2.8 mol KNO_3 * 101 g per mol KNO_3 = 290 g KNO_3

290 g KNO_3 / 10000 g total * 100 = 2.9 wt. % KNO_3

For 69506, 3 ounces (89 mL) of liquid was observed during repackaging, and RTR identified 3 kg of homogeneous solids (AKA08). Sorbent is the only potential source of homogeneous solids in the container. The composition of the liquid is unknown but can be bounded by 70% (16M) HNO_3, which is technical grade nitric acid often used in lab work; at higher concentrations of HNO_3, the nitric acid is unstable and volatilizes. Assuming the acid is fully converted to KNO_3 (the most conservative metal nitrate that could form from the available cations), the concentration of KNO_3 in organic kitty litter would be 4.7 wt. %, as shown below:

89 mL liquid * 16 mol HNO_3 per 1000 mL liquid = 1.4 mol HNO_3

1.4 mol HNO_3 → 1.4 mol KNO_3

1.4 mol KNO_3 * 101 g per mol KNO_3 = 140 g KNO_3

140 g KNO_3 / 3000 g total * 100 = 4.7 wt. % KNO_3

The testing that supported the BoK, as reported in LA-UR-16-27276, *Results from Preparation and Testing of Sorbents Mixed with Potassium Nitrite*, found that 11 wt.% was the maximum concentration of potassium nitrite that produced a non-oxidizer result in dry sWheat Scoop kitty litter (D334). Therefore, these containers are compliant with this criterion.

4.5.1 Engineered organic polymer sorbents with oxidizing chemicals

> "Table 4-3 lists the wt. % of oxidizing chemical allowed when well mixed in a tested EOPS."

There is no evidence that these containers include EOPSs (AKA08, M244). Therefore, this criterion does not apply to these containers.

4.5.2 Organic rags, wipes, sorbent pads, and pillows

> "When the TRU waste site or WIPP Certified Program determines that waste rags, wipes, sorbent pads, and pillows contaminated with oxidizing chemicals would yield oxygen readily to cause or enhance the combustion of organic materials, the following criteria shall apply:
> - Rags, wipes, sorbent pads, and pillows shall be treated to the criteria contained in Section 5.1; or
> - The TRU waste site may treat the waste by a method that can be approved by the CBFO Manager."

The presence of rags, cloth wipes, and pads potentially contaminated with nitric acid or neutralized solutions of nitric acid could not be ruled out in all four containers in this population (AKA08, M244).

- 69044
- 69506
- 72861
- 72887

In M367 and M391, LANL has documented that these containers are not EPA ignitable, described in part in 40 CFR 261.21 as "a substance...that yields oxygen readily to stimulate the combustion of organic matter." CCE11 has documented that in these containers, nitric acid and nitrate salt mixtures with polyols will not cause an adverse reaction, such as generating fire (i.e., causing combustion). Therefore, these containers are also compliant with this criterion, and no treatment is required for rags, wipes, and pads.

4.5.3 Ion exchange resins

> "Ion exchange resins with oxidizing chemicals that are stabilized with Portland cement are not oxidizers when the resins are well mixed in the cement and do not exceed 10 wt. % in the set cement monolith. When the cement monolith is intact based on visual observation, it is acceptable to conclude that the 10 wt. % limit for the ion exchange resins has been met.
>
> Ion exchange resins that do not meet the criteria above, organic solvents, and other miscellaneous organic materials containing oxidizing chemicals are not acceptable at the WIPP without a verifiable basis that can be used to determine the waste will be safe and compliant for receipt and emplacement in the WIPP."

Two containers in this population include resins (AKA08, M244):

- 72861
- 72887

The resins in these containers were either unspent or were rinsed with hydrochloric acid or hydrobromic acid and do not have nitrate loadings (C450, M244). Therefore, these resins do not contain oxidizing chemicals. There is no evidence that the containers in this evaluation contain organic solvents or miscellaneous organic materials containing oxidizing chemicals (AKA08, M244). Therefore, this criterion does not apply to these containers.

4.6 Inorganic materials with oxidizing chemicals

4.6.1 Oxidizing chemicals sorbed in inorganic sorbents

> "Table 4-4 provides the maximum concentration of oxidizing chemical acceptable at the WIPP when it is sorbed in a listed inorganic sorbent.
>
> NOTE: The CBFO will not grant equivalency for Hydromatrix, Micro-Cel E, perlite, or vermiculite."

One container (72887) in this population includes an acidic solution sorbed with zeolite in a ratio of 4 parts (by weight) zeolite to 1 part liquid (M244). The liquid contains trace amounts of nitric acid (M244), which can be bounded by 70% (16M) HNO_3, which is technical grade nitric acid often used in lab work; at higher concentrations of HNO_3, the nitric acid is unstable and volatilizes. Assuming the acid is fully converted to KNO_3 (the most conservative metal nitrate that could form from the available cations), the concentration of KNO_3 in zeolite would be 22 wt. %, as shown below:

1 g liquid per 4 g zeolite * 70 g HNO_3 per 100 g liquid = 0.175 g HNO_3 per g zeolite

0.175 g HNO_3 / 63 g per mol HNO_3 = 0.0028 mol HNO_3

0.0028 mol HNO_3 → 0.0028 mol KNO_3

0.0028 mol KNO_3 * 101 g per mol KNO_3 = 0.28 g KNO_3 per g zeolite

0.28 g KNO_3 / (1 g zeolite + 0.28 g KNO_3) * 100 = 22 wt. % KNO_3

This is below the 35 wt. % oxidizing chemicals allowed by the BoK to be sorbed in zeolite. Therefore, this container is compliant with this criterion.

4.6.2 Inorganic sludges with oxidizing chemicals not mixed with sorbents

> "Inorganic sludges with up to 30 wt. % oxidizing chemical that have not been mixed with sorbent are acceptable at the WIPP."

There is no evidence that these containers include sludges (AKA08, M244). Therefore, this criterion does not apply to these containers.

4.6.3 Oxidizing chemicals solidified in a cement or grout matrix

> "Wastes with oxidizing chemicals, whether listed in Table 4-1 or not, that are cemented or grouted are not considered oxidizers when the following criteria are met.
> • No more than 20 volume percent of the set material has external dimensions less than 2 centimeters; and
> • No free liquid is present."

There is no evidence that these containers include oxidizing chemicals solidified in a cement or grout matrix (AKA08, M244). Therefore, this criterion does not apply to these containers.

4.7 Mixtures of organic and inorganic materials with oxidizing chemicals

> "When the waste is a mixture of inorganic sorbent listed in Table 4-4 and organic sorbent listed on Table 4-3, the maximum wt. % of oxidizing chemicals allowed is determined by the lowest concentration allowed of any of the sorbents in the mixture."

These containers do not contain mixtures of inorganic and organic sorbents (AKA08, M244). Therefore, this criterion does not apply to these containers.

> "Sorbents that are not found in Table 4-3 or Table 4-4 are not acceptable for disposal at WIPP until the TRU waste site or AKE has requested an equivalency determination and the CBFO has determined that the sorbent is equivalent to one of the sorbents listed in Table 4-3 or Table 4-4."

There is no evidence of sorbents in these containers that are not included in Tables 4-3 or 4-4 of the BoK (AKA08, M244). Therefore, this criterion does not apply to these containers.

4.8 Oxidizing chemicals that are the sole component of waste

> "Oxidizing chemicals that are the sole waste component(s) (e.g., metal nitrate salts with or without free liquid) are not acceptable for disposal at WIPP without treatment."

There is no evidence that containers in this population include oxidizing chemicals that are the sole component of the waste (AKA08, M244). Therefore, this criterion does not apply to these containers.

4.9 Surfaces contaminated with oxidizing chemicals

> "Waste components with low porosity and impermeable surfaces that have been exposed to liquid or solid oxidizing chemicals are surface-contaminated only. These types of waste components will not exhibit oxidizing behavior regardless of the distribution of the oxidizing chemicals when there is no observable adhesion of the oxidizing chemical to the surface."

The packaging paperwork for two containers in this population (72861 and 72887) identifies waste components that had trace contact with nitric acid and could retain surface contamination of oxidizing chemicals (M244). These materials are items that have low porosity and impermeable surfaces, such as glass vials and plastic bottles (M244). The packaging paperwork does not identify observable adhesion of oxidizing chemicals on the surface. These containers are compliant with this criterion.

4.10 Oxidizing chemicals spilled or released into soils

> "Soils containing up to 30 wt. % oxidizing chemicals are allowable without treatment provided they are not also contaminated with organics released in bulk liquid form (excludes natural organic matter content of the soil)."

This waste stream does not contain soils (CCP-AK-LANL-009). Therefore, this criterion does not apply to these containers.

4.11 Oxidizing chemicals in waste retrieved from earthen disposal pits

> "The total concentration of oxidizing chemicals in waste retrieved from earthen pits will be <30 wt. % provided the waste is not also contaminated with liquid organics.
>
> TRU waste sites with burial pits where oxidizing chemical salts were disposed must remove salt crystals other than small visible crystals that are impractical to pick out from the excavated soil/waste mixture. The dissolved salt in the soils plus the remaining visible crystals cannot exceed 30 wt. %."

This waste stream does not contain waste retrieved from earthen disposal pits (CCP-AK-LANL-009). Therefore, this criterion does not apply to these containers.

Conclusion:

Of the 4 containers included in this BoK evaluation, it has been determined that all four containers are compliant with the BoK criteria. These containers are listed in Attachment 1.

SOURCE DOCUMENTS

Tracking Number	Title
AKA08	Acceptable Knowledge Assessment of Containers from Acceptable Knowledge Summary Report CCP-AK-LANL-009 Waste Stream LA-MHD03.001
C450	Email RE: CMR Facility TRU Resins
CCE11	Chemical Compatibility Evaluation for Waste Stream LA-MHD03.001
D334	Results from Preparation and Testing of Sorbents Mixed with Potassium Nitrite
M154	Miscellaneous MSDSs
M244	NUGEN TWSRS for LA-MHD03.001
M367	TA-50/54 Repackaging Waste Profile Forms
M391	TA-03 Waste Profile Forms
P159	WCRRF Waste Characterization Glovebox Operations
P356	Absorption of Non-Hazardous Liquid Waste

REFERENCES

1. DOE/WIPP-17-3589, *Basis of Knowledge for Evaluating Oxidizing Chemicals in TRU Waste*
2. CCP-AK-LANL-009, *Central Characterization Program Acceptable Knowledge Summary Report for Los Alamos National Laboratory Chemistry And Metallurgy Research (CMR) Facility*
3. LA-UR-16-27276, *Results from Preparation and Testing of Sorbents Mixed with Potassium Nitrite*

ATTACHMENT 1

APPROVED CONTAINERS

	Container ID	Container Type	Closure Date	Applicable Criteria
1	LA00000069044	55G	12/21/2013	Section 4.5 - Organic Sorbents Section 4.5.2 - Wipes
2	LA00000069506	55G	03/02/2014	Section 4.5 - Organic Sorbents Section 4.5.2 - Wipes
3	LA00000072861	55G	09/23/2020	Section 4.5.2 - Wipes Section 4.9 - Contaminated Surfaces
4	LA00000072887	55G	11/18/2020	Section 4.5.2 - Wipes Section 4.6 - Zeolite Section 4.9 - Contaminated Surfaces

TA-55 Information Release Form

This form is to be completed and submitted to the Records Management Coordinator with copies BEFORE you present or submit for release any technical work. AK-TA55-21-856	Package for review must include: 1. Copy of submission 2. Completed **TA-55 Information Release Form** and **Cover sheet** on each submission. 3. Completed **Records Submittal Form** for each submission submitted to RMDC.

1. Author(s) name(s)

Last	First
Ams	Bridget

2. Title of Article (in caps: spell out all symbols):
BOK20 - Basis of Knowledge Criteria Evaluation for Containers in Waste Stream LA-MHD03.001, Addendum 5

3. Type of Information:

X Acceptable Knowledge (AK) reports, radioisotope data, and/or source documents

☐ Other (**Must be TA-55, specific):**

4. Intended For:

CCP & Public Release

5. Particulars: NONE

6. Z number, Name and Phone of contact for notification of release

224089, Amy Johns, 575-302-8669 (cell)

Mail Stop

J962

7. Typed/Printed Name of Derivative Classifier

Matt Bush

Signature and Date Matt Bush Digitally signed by Matt Bush Date: 2021.12.16 06:08:08 -07'00'

☒ Unclassified

No UCNI

☐ Unclassified, Limited

Explain:

8. TA-55 Public Release Official

NPI-6 Authorized Reviewer - See Certified Signature

Signature and Date: Matt Bush Digitally signed by Matt Bush Date: 2021.12.16 06:08:42 -07'00'

9. Typed/Printed Name of Responsible Author/Requestor

Amy Johns

Signature and Date:

Amy Johns Digitally signed by Amy Johns Date: 2021.12.15 15:40:26 -07'00'

CCP Documentation
for
NCR-LANL-0285-21

Attachment 1 – CCP Nonconformance Report (NCR)

CCP NONCONFORMANCE REPORT (NCR)

(Use NCR Continuation, Attachment 3, if necessary)

NCR No. NCR-LANL-0285-21 Revision 1

1. Lot No., Heat No., or Serial No. (if applicable): N/A	2. Process (e.g., NDA, NDE, VE, Other): AK	3. Batch Data Report #(s): N/A
4. Order/Work Order/Job Control Number (if applicable): N/A	5. PO # (if applicable): N/A	Container #(s): 73668, 74392, 74720, 74722
	6. Supplier (if applicable): N/A	

DESCRIPTION OF NONCONFORMANCE

7a. NCR Description: ☐ < 100 nCi/g ☐ Prohibited Item ☐ E-Flag ☐ Receipt Inspection ☐ Transportation ☐ WWIS/WDS ☒ Other

7b. Requirement(s) (Enter Implementing Procedure No., Revision, Section No., & Quoted Text):
CCP-PO-002, Revision 31 *CCP Transuranic Waste Certification Plan*
Section 3.5.1 Pyrophoric Materials
Section 3.5.1 [A.1] "Nonradionuclide pyrophoric materials are not acceptable at the WIPP."

7c. Actual Condition:
Containers identified in Block 3 may contain potentially pyrophoric titanium material.

Reason for Revision 1: Changed requirement and re-worded actual condition to better capture condition of potential non-conformance.

7d. Have the CCP HOLD TAGS associated with this NCR been applied? ☒ YES ☐ NO If no is checked, explain:
VB 3/18/2021

8. NCR Originator:
Lisa Calder (printed name) Lisa Calder (signature) 3/15/2021 (date)

9. Does the identified condition have the potential to impact AK? If YES or INDETERMINATE, enter Trend Code L in Block 10. ☒ YES ☐ NO ☐ INDETERMINATE

10. Trend Code: L

11. Responsible Manager: Lisa Calder

12. Recurring Condition? ☐ YES ☒ NO (If Yes, list NCRs and WIPP Forms):

13. Significant Condition? ☐ YES ☒ NO (If Yes, enter WIPP Form No.):

14. QA Engineer or QA Designee validation:
Veronica Ballew (printed name) Veronica Ballew (signature) 3/15/2021 (date)

CCP RECORDS ORIGINAL
DATE REC'D 10-17-21

1 QC Check Performed By: BCastaneda Date: 12/20/21

2 QC Check Performed By: CMelvin Date: 12/20/21

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0285-21 Revision 1

INTERIM DISPOSITION

15a. Interim Disposition (Check Only One):
☐ N/A (See Final Disposition) ☒ Hold ☐ Conditionally Accept ☐ Conditionally Use
☐ Sort ☐ Reinspect or Retest ☐ Remediate

15b. Instructions for Completion of the Interim Disposition:
AKE to further evaluate and with SPM determine path forward.

INTERIM DISPOSITION APPROVALS

16a. Responsible Manager or Individual:

Lisa Calder	Lisa Calder	3/15/2021
printed name	signature	date

16b. QA Engineer or QA Designee:

Veronica Balken	Veronica Balken	3/15/2021
printed name	signature	date

COMPLETION OF INTERIM DISPOSITION

17. Interim Disposition Complete – Responsible Manager or Individual

David Fry	DAVID FRY (Affiliate) Digitally signed by DAVID FRY (Affiliate) Date: 2021.10.25 11:29:56 -06'00'	10/25/2021
printed name	signature	date

18. Interim Disposition Verified – QA Engineer:

Katie Gentry	Katie Gentry	10/25/2021
printed name	signature	date

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0285-21 Revision 1

FINAL DISPOSITION

19. Final Disposition (Check Only One: Use-As-Is, Repair, Reject, Rework, or Scrap):
☒ Use-As-Is ☐ Repair

19a. Technical Justification – Required for Use-As-Is or Repair dispositions. [☐ N/A for Reject, Rework, or Scrap]

An evaluation performed by NWP Packaging Engineers and documented in source document D339, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation and the containers in Block 3 having been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.

☐ Reject ☐ Rework ☐ Scrap

19b. Instructions for Completion – Required for Reject, Repair, Rework, or Scrap [☒ N/A for Use-As-Is]

19c. Corrective Actions (Actions to Prevent Recurrence – For Repair or Rework, if applicable.
[☒ N/A if not applicable, and for Use-As-Is, Reject, and Scrap]

FINAL DISPOSITION APPROVALS

20. Responsible Manager or Individual:

David Fry	DAVID FRY (Affiliate) Digitally signed by DAVID FRY (Affiliate) Date: 2021.10.25 11:30:19 -06'00'	10/25/2021
printed name	signature	date

21. QA Engineer or QA Designee:

Katie Gentry	Katie Gentry	10/25/2021
printed name	signature	date

CLOSURE

22. Final Disposition Complete - Responsible Manager or Individual:

David Fry	DAVID FRY (Affiliate) Digitally signed by DAVID FRY (Affiliate) Date: 2021.10.25 11:30:44 -06'00'	10/25/2021
printed name	signature	date

23. Attachments: 1-Reportability Emails 2. Hold Tag info. 3. Interim Closure Documentation 4. Hold Tag Removal 74722 5 - Hold Tag Removal (73668, 74392, 74720)

24a. HOLD TAG removal has been verified and reconciled for all nonconforming items on the NCR: ☒
24b. If HOLD TAG is not applicable, check: ☐ and explain:

25. Final Disposition Verified – NCR Closed

Katie Gentry	QA Engineer KATELYN GENTRY (Affiliate) Digitally signed by KATELYN GENTRY (Affiliate) Date: 2021.12.13 14:23:06 -07'00'	12-13-2021
printed name	signature	date

Design Document Review

1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag	2. System Number: PT00	
3. Document Number: PLD-CAL-0003	4. Document Revision: 0	5. Page: 1 of 1

6. Summary and Justification of Changes

Change	Justification
N/A	New issue.

7. Reviewers (Do Not Sign Until All Comments Are Resolved)

Reviewer	Name	Signature	Date
Document Preparer:	Brad Day	BRAD DAY (Affiliate) 2021.03.17 14:44:42 -06'00'	3/17/2021
Independent Reviewer:	Kyle Moyant	KYLE MOYANT (Affiliate) Digitally signed by KYLE MOYANT (Affiliate) Date: 2021.03.17 15:09:07 -06'00'	3/17/2021
Independent Reviewer:	Mike Lastra	MICHAEL LASTRA (Affiliate) Digitally signed by MICHAEL LASTRA (Affiliate) Date: 2021.03.18 10:29:47 -06'00'	N/A
Project Manager: (or Designee)	J. Biedscheid for Murthy Devarakonda	JENNIFER BIEDSCHEID (Affiliate) Digitally signed by JENNIFER BIEDSCHEID (Affiliate) Date: 2021.03.18 10:48:29 -06'00'	3/18/2021
Cognizant Manager: (or Designee)	A. Donner for Todd Sellmer	ANTHONY DONNER (Affiliate) Digitally signed by ANTHONY DONNER (Affiliate) Date: 2021.03.18 11:38:09 -06'00'	3/18/2021
QA Manager: (or Designee)	D. S. Tanner	DAVID TANNER (Affiliate) Digitally signed by DAVID TANNER (Affiliate) Date: 2021.03.18 10:57:09 -06'00'	3/18/2021

8. Calculation Review Method(s) (Check All That Apply; Attach Results)

	Independent Design Software Name	Version
■ One-Over-One Calculation Review		
■ Independent Calculation	1. Mathcad	15.0
■ Using Independent Design Software	2.	

9. Reviewer Comments and Resolutions

Reviewer	Comment	Resolution
All	Various	Comments and resolutions summarized in EDMS

10. Required Screenings *Exempt from WIPP screenings, for external use by LANL

USQ ☐ WP 02-AR3001 USQ#: N/A	EC/NEPA ☐ WP 02-EC3801
ALARA ☐ WP 12-2	HWFP ☐ WP 02-PC3001
CC ☐ WP 02-PC3003	

Calculation Cover Sheet

1. Document Title:		2. System Number:
Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		PT00
3. Document Number:	4. Document Revision:	5. Page:
PLD-CAL-0003	0	1 of 42

6. Summary Description

This calculation report documents the estimation of air concentration as a function of time that results from air infiltration via diffusion and permeation into a 4-mil polyethylene inner bag with a twist & tape closure that was previously subject to an inert argon gas atmosphere. The concentration profile is calculated for conditions where the bag is directly exposed to atmospheric air and also for conditions where the bag is surrounded by multiple confinement layers within a filtered 55-gallon drum. The purpose of the estimated concentration profiles is to provide input to subsequent evaluations that may consider the impact of air infiltration (e.g., oxidation) on bag waste contents.

7. Software Usage

	Software Name	Version
1.	Python (qualified per WP 16-2 through STP-PLN-0006 on March 11, 2020)	3.7
2.		
3.		
4.		

8. Preparer

Name	Signature	Date
Brad Day	BRAD DAY (Affiliate)	2021.03.17 14:43:28 -06'00'

9. Independent Reviewer(s)

Name	Signature	Date
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Name	Signature	Date
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Revision Number	Pages Affected	Revision Description
0	All	New Issue

1.0 INTRODUCTION

An energy release event at Los Alamos National Laboratory (LANL) on February 26, 2021, was experienced during a TRU waste drum loading process. The initial investigation conjectured that the event was initiated by breaching of a previously-inerted 4-mil polyethylene inner bag containing two HEPA filters laden with titanium and tantalum fume dust [Ref. 1]. Potential further evaluation of the event may require estimation of the time required for atmospheric air to infiltrate the 4-mil polyethylene inner bag in order to assess the degree to which the bag waste contents may have been exposed to oxygen as an inert gas atmosphere was displaced.

The time-dependent air concentration within the initially inerted 4-mil polyethylene inner bag, both for conditions of direct exposure to atmospheric conditions or when located within multiple layers of confinement initially containing air within a filtered 55-gallon TRU waste drum, can be determined through the solution of mass transport differential equations that model the transport of gases in the layer resistance network via diffusion and permeation mechanisms [Ref. 2].

2.0 SUMMARY OF RESULTS

A summary of the times to achieve a greater than 10, 20, 30, 40, 50, 60, 70, 80, and 90 percent air concentration within an initially inerted 4-mil polyethylene inner bag subject to conditions of a) direct exposure to atmospheric conditions and b) when located within multiple layers of confinement initially containing air within a filtered 55-gallon TRU waste drum is given in Table 1. Figure 1 provides the inner bag air concentration profiles for the two exposure conditions. The layer of confinement descriptions, modeling methodology, assumptions, and detailed modeling results are provided in Section 4.0. Additional solution sensitivity results associated with variable inner bag void volume assumptions for the directly exposed bag case are provided in Appendix A.1.

Table 1 – Summary of Time to Greater Than 90% Air Concentration in Inner Bag

Exposure Condition	Exposure Duration (days)	Air Concentration (%)
Bag (direct exposure)	5	12.164
	9	20.821
	14	30.452
	20	40.476
	27	50.359
	36	60.695
	47	70.452
	63	80.489
	89	90.060
Bag within 55-gal drum layers	5	10.549
	11	20.910
	18	30.804
	27	40.838
	38	50.089
	55	60.066
	83	70.143
	134	80.106
	236	90.047

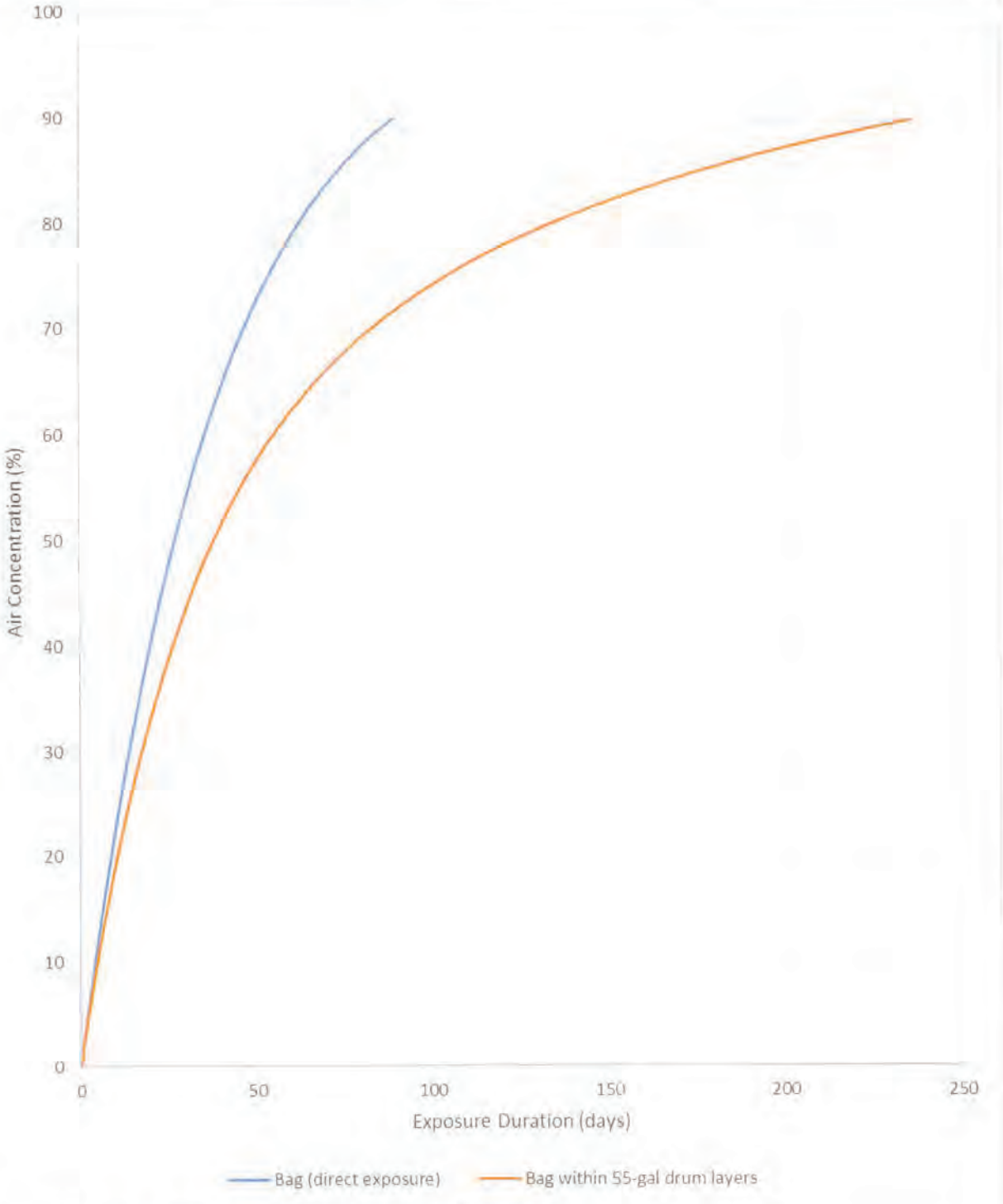

Figure 1 – Inner Bag Air Concentration Profiles

3.0 METHODOLOGY

3.1 Method

Following the AltMeth methodology defined in the CH-TRU Payload Appendix 3.10 [Ref. 2], the mass transport of air across serial layers of confinement via diffusion through the various closure types or filter vents and permeation through plastic bag layers are defined generally as follows for i = 1, n layers:

$$\frac{dX_i}{dt} = \frac{C_g RT}{V_i P}\left(86{,}400\frac{\text{sec}}{\text{day}}\right) - \frac{Q_i}{V_i}(X_i - X_{i+1})$$

$$\frac{dX_{i+1}}{dt} = \frac{Q_i}{V_{i+1}}(X_i - X_{i+1}) - \frac{Q_{i+1}}{V_{i+1}}(X_{i+1} - X_{i+2})$$

...

$$\frac{dX_n}{dt} = \frac{Q_{n-1}}{V_n}(X_{n-1} - X_n) - \frac{Q_n}{V_n}\left(X_n - \cancel{X_{n+1}}^{\,0}\right)$$

where:

C_g	=	innermost layer gas generation rate (mole/sec)
Q_i	=	release rate of gas across layer i (liters/day)
V_i	=	void volume inside layer i (liters)
X_i	=	mole fraction of gas within the void space layer i (mf)
P	=	pressure (atm)
R	=	gas constant = 0.08206 atm-liter/mole-K
T	=	temperature (K)

This system of equations are solved simultaneously by numerical integration through the use of an ordinary differential equation (ODE) solver (Python Scipy ODEINT) to determine the transport of air from the ambient environment across the defined layers of confinement.

Note that a more general form of the above equations are implemented in the Python script and solved numerically utilizing a nodal network model that allows for the solution of the mass balance as defined by the serial and/or parallel communication of gas between the interconnected nodes without the necessity to have the resistance factor and gas generation rate of parallel nodes identical.

3.2 Inputs

3.2.1 Layers of Confinement

The layers of confinement that are modeled are based on the two general cases defined (i.e., bag directly exposed to environment and bag within 55-gallon drum layers). Table 2 lists the prescribed layers of confinement and closure/filter attributes that were prescribed by Bush [Ref. 3].

Table 2 – Layer of Confinement Descriptions

Exposure Condition	Description
Bag (direct exposure)	Layer 1 (innermost layer): Inner bag (catch bag) is 4 mil LDPE with a size of 13" x 12" x 24" that is twist, tie, taped (TTT) before being removed from the inert (argon) box. This is moved into the drop box on a regular air box and will stay there until there is enough waste to perform a bag out.
Bag within 55-gal drum layers	Layer 1 (innermost layer): Same as above.
	Layer 2: LANL SPVC filtered bag-out bag that is also TTT when it goes into the drum. This bag is assumed to be an inner bag with a filtration of 1.075E-05 mol/s/mf, meeting the minimum requirement of the CH-TRAMPAC [Ref. 2 and 4].
	Layer 3: A 5-mil liner bag (fold/tape) [Ref. 2 and 4].
	Layer 4: A 12-mil filtered drum liner bag. This bag is assumed to have a filtration of 1.075E-05 mol/s/mf, meeting the minimum requirement of the CH-TRAMPAC [Ref. 2 and 4].
	Layer 5: A 90-mil rigid liner. This rigid liner is assumed to include a 0.3-inch diameter hole in the rigid liner lid, meeting the minimum requirement of the CH-TRAMPAC [Ref. 2 and 4].
	Layer 6: 55-gallon drum with a NucFil-019 filter. The NucFil-019 filter has a minimum hydrogen diffusivity value of 1.85E-05 mol/s/mf [Ref. 5].

3.3 Significant Assumptions

The modeling assumptions used to implement solution of the governing equations defined in Section 3.1 are as follows:

1. The directly exposed bag or drum has been modeled inside a very large enclosure of air (i.e., outside).
2. Only the innermost bag is initially purged of all air, and the remaining layers have a regular air atmosphere.
3. Transport ignores pressure-induced flow from barometric pressure or diurnal temperature changes (i.e., diffusion and permeation are the only transport mechanisms modeled).
4. Hydrogen diffusion-only resistance factors are taken from CH-TRU Payload Appendix 2.2 [Ref. 2], with the liner bag closure diffusion equal to the inner bag closure diffusion. Hydrogen permeation release rates are calculated from INEL-95/121 equation 2 [Ref. 6].
5. Air diffusion release rate is proportional to hydrogen release rate (i.e., assumed proportional to the square root of the inverse ratio of molar masses per Graham's Law of Diffusion).
6. Hydrogen permeation through polyethylene is given by CH-TRU Payload Appendix 6.13 [Ref. 2], normalized via the methods of Van Krevelen [Ref. 7] to oxygen bounding dry air.
7. Layer 1 (innermost layer) is assumed to be 25% full with a volume defined by its dimensions, the volume of Layer 2 is estimated to be 10% larger than Layer 1, and the volumes of Layers 3 and 4 are estimated as 10% progressively smaller than the rigid liner volume.
8. All diffusion mass transport coefficients utilized are minimum values. For the purposes of deriving a minimum wait time for a given quantity of air to infiltrate the inner bag under the prescribed environmental conditions, this is a conservative modelling assumption.

3.4 Acceptance Criteria

There is no explicit acceptance criteria for this calculation report.

4.0 ANALYSIS

4.1 Model Input Parameters

4.1.1 Initial Conditions

Initial conditions for the concentration of air within the inerted inner bag is zero, with any other layers non-inerted having an initial air concentration of 100%. There is no air generation term within the inner layer of confinement, so $C_g = 0$. The simulation is conducted under ambient conditions of 1 atm pressure and 77 °F (298.15 K) utilizing an ideal gas constant R = 0.08206 (atm L)/(mol K).

4.1.2 Diffusion and Permeation Coefficients and Physical Input Parameters

Reference values for hydrogen diffusion in air and hydrogen permeation through low-density polyethylene bag layers are obtained from the CH-TRU Payload Appendix 2.2 in the form of resistance factors and from CH-TRU Payload Appendix 2.13 in the form of a hydrogen permeation coefficient [Ref. 2 and 4]. The hydrogen values are corrected to equivalent air release rates by two methods. To convert the resistance-based diffusion coefficient from a hydrogen basis to air basis, the diffusion release rates are correlated based on the molecular weight of hydrogen vs air by assuming they are proportional to the square root of the inverse ratio of the molar masses (Graham's Law). With the molecular weight of hydrogen = 2.01588 g/mol and air = 28.9647 g/mol, the conversion factor is given as follows:

$$DF_{h2\_air} = \frac{1}{\sqrt{\frac{MW_{h2}}{MW_{air}}}} = \frac{1}{\sqrt{\frac{2.01588}{28.9647}}} = 3.79$$

The hydrogen to air correction factor for permeation through low-density polyethylene is based on a comparison of established non-dimensional comparative permeability ratios for nitrogen = 1, oxygen = 3.8, and hydrogen = 22.5 [Ref. 7]. To ensure a conservative permeation transport estimate with respect to oxygen, which is the oxidizing constituent of interest in air, selection of the oxygen permeability factor is utilized in comparison with the hydrogen permeability factor to result in the following hydrogen to air (oxygen) permeation coefficient correction factor:

$$PF_{h2\_air} = \frac{22.5}{3.8} = 5.92$$

Hydrogen-based diffusion resistance factors for various twist and tape bag closures and various filter specifications are provided in CH-TRU Payload Appendix 2.2 [Ref. 2]. Because twist and tape inner bag closures were experimentally evaluated and corrected to isolate the release mechanism to only consider diffusion, inner bag resistance factors for twist and taped closures are applied to all applicable confinement layers (i.e., drum liner bags) employing that closure

method to obtain a diffusion-only resistance factor. The relevant hydrogen diffusion-only resistance factors are summarized in Table 3.

Table 3 – Diffusion Resistance Factors

Resistance Factor	Layer Description
17922	TTT inner bag closure
931	1.075E-5 mol/s/mf bag filter
197	0.3 in. hole in rigid liner
541	1.85E-5 mol/s/mf bag filter

Determination of the hydrogen release rate and associated resistance factors for permeation through bag layers is possible as a function of the bag surface area, bag thickness, gas pressure, and permeability coefficient [Ref. 6]. The requisite volumes of the layers of confinement can be ascertained from the layers of confinement description of the size of the inner bag and the known fixed sizes of the drum and rigid liner. The confinement layers were previously provided in Table 2.

The volume of the innermost inner bag (Layer 1) is calculated from the 4-mil inner bag dimensions along with the specified thickness as follows:

$$IV_1 = (13\text{in} \times 12\text{in} \times 24\text{in})\left(\frac{1\text{L}}{61.0237\text{in}^3}\right) = 61.35\text{L}$$

$$xp_1 = (0.004\text{in})\left(\frac{2.54\text{cm}}{\text{in}}\right) = 0.010\text{cm}$$

Assuming the next layer (Layer 2) is 10% larger to surround the previous inner layer, the volume of the filtered inner bag is calculated along with the assumed 5-mil standard bag thickness as follows:

$$IV_2 = (IV_1)(1.1) = 67.49\text{L}$$

$$xp_2 = (0.005\text{in})\left(\frac{2.54\text{cm}}{\text{in}}\right) = 0.013\text{cm}$$

The internal volume of a 55-gallon drum (Layer 6) has been previously established as follows [Ref. 8]:

$$IV_6 = 216\text{L}$$

Using dimensional data for the rigid liner (Layer 5), its internal and external volume is given as follows (note that diffusion-only release through the lid hole is credited, not permeation through the liner body/lid or diffusion release at the lid to body interface)[Ref. 9]:

$$IV_5 = 198.77\text{L}$$

$$OV_5 = 203.18\text{L}$$

The 12-mil filtered liner bag (Layer 4) and the 5-mil twist and tape drum liner bag (Layer 3) are assumed to be progressively 10% smaller than the next outer layer such that the volumes and specified permeation thicknesses are as follows:

$$IV_4 = \frac{IV_5}{1.1} = 180.70\,L$$

$$xp_4 = 0.012\,in\left(\frac{2.54\,cm}{1\,in}\right) = 0.030\,cm$$

$$IV_3 = \frac{IV_4}{1.1} = 164.27\,L$$

$$xp_3 = 0.005\,in\left(\frac{2.54\,cm}{1\,in}\right) = 0.013\,cm$$

With the volumes of each layer established, the surface area of bag layers can be determined through an assumption that each bag takes on the shape of a stub-cylinder (diameter and length equal) and the void volumes within each layer can also be determined conservatively by ignoring interim layer waste components as follows, along with the corresponding characteristic diameter that correlates volume to surface area:

Layer 1

$$d_1 = \left(\frac{4}{\pi} IV_1\right)^{1/3} = 42.75\,cm$$

$V_1 = 0.75 IV_1 = 46.01\,L$ inner bag assumed 25% full of waste

$$ap_1 = \frac{3\pi}{2}(d_1)^2 = 8611.38\,cm^2$$

Layer 2

$$d_2 = \left(\frac{4}{\pi} IV_2\right)^{1/3} = 44.13\,cm$$

$V_2 = IV_2 - IV_1 = 6.14\,L$ bag thickness assumed sufficiently small to ignore

$$ap_2 = \frac{3\pi}{2}(d_2)^2 = 9176.30\,cm^2$$

Layer 3

$$d_3 = \left(\frac{4}{\pi} IV_3\right)^{1/3} = 59.36\,cm$$

$V_3 = IV_3 - IV_2 = 96.78\,L$ bag thickness assumed sufficiently small to ignore

$$ap_3 = \frac{3\pi}{2}(d_3)^2 = 16604.46\,cm^2$$

Layer 4

$$d_4 = \left(\frac{4}{\pi} IV_4\right)^{1/3} = 61.28\,\text{cm}$$

$V_4 = IV_4 - IV_3 = 16.43\,\text{L}$ bag thickness assumed sufficiently small to ignore

$$ap_4 = \frac{3\pi}{2}(d_4)^2 = 17693.75\,\text{cm}^2$$

Layer 5

$V_5 = IV_5 - IV_4 = 18.07\,\text{L}$ bag thickness assumed sufficiently small to ignore

Layer 6

$V_6 = IV_6 - OV_5 = 12.82\,\text{L}$ liner thickness incorporated due to 90-mil thickness

Layer 7

$V_7 = 1\times10^7\,\text{L}$ assumed large exterior for ambient

With the values established above, the permeation resistance factors for the plastic bag layers can be established, first for hydrogen release and later corrected for air release, and combined with the diffusion resistance factors in parallel (as applicable for the layer). The hydrogen permeation release rate (Q_{ph2_bag}) and resistance factor (R_{ph2_bag}) for each bag layer is calculated from Leikhus [Ref. 6] using the established hydrogen permeation coefficient through polyethylene (8.60E-10 cm^3 [STP] cm/cm^2 s cmHg) given in the CH-TRU Payload Appendix 6.13 [Ref. 2] as follows:

$$Q_{ph2\_bag} = \left(4.46136\times10^{-5}\frac{\text{mol}}{\text{cm}^3}\right)\left(8.60\times10^{-10}\frac{\text{cm}^3[\text{STP}]\text{cm}}{\text{cm}^2\,\text{s cmHg}}\right)\left(\frac{P_{hg}\,ap}{xp}\right)$$

$$= 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\,\text{s}}\left(\frac{ap}{xp}\right)$$

where

$$P_{hg} = P\left(\frac{76\,\text{cmHg}}{1\,\text{atm}}\right)$$

and

$$R_{ph2\_bag} = \left(\frac{1}{100\,Q_{ph2\_bag}}\right)$$

Utilizing the parameters and equations previously defined, the hydrogen diffusion and permeation resistance factors for each layer are determined below, converted to equivalent air resistance parameters, and then combined in parallel (where applicable) to result in a total air resistance factor. Finally, the air resistance factors (R) are converted to air release rates (Q) at the specified temperature and pressure conditions (2.1139E6 (L/day)/(mol/s) at 77 °F and 1 atm).

Layer 1

$$Q_{ph2\_1} = 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\,\text{s}}\left(\frac{8611.38\text{cm}^2}{0.010\text{cm}}\right) = 2.47\times10^{-6}\frac{\text{mol}}{\text{s}}$$

$$R_{ph2\_1} = \left(\frac{1}{100\left(2.47\times10^{-6}\right)}\right) = 4046.15$$

$$R_{pair\_1} = (5.92)(4046.15) = 23957.45$$

$$R_{dair\_1} = (3.79)(17922) = 67934.23$$

$$R_1 = \text{Roundup}\left(\frac{1}{\left(\frac{1}{23957.45}\right)+\left(\frac{1}{67934.23}\right)}\right) = 17712$$

$$Q_1 = \left(\frac{1}{100(17712)}\right)\left(2.1139\times10^{6}\right) = 1.19\frac{\text{L}}{\text{day}}$$

Layer 2

$$Q_{ph2\_2} = 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\,\text{s}}\left(\frac{9176.31\text{cm}^2}{0.013\text{cm}}\right) = 2.11\times10^{-6}\frac{\text{mol}}{\text{s}}$$

$$R_{ph2\_2} = \left(\frac{1}{100\left(2.11\times10^{-6}\right)}\right) = 4746.31$$

$$R_{pair\_2} = (5.92)(4746.31) = 28103.18$$

$$R_{dair\_2} = (3.79)(931) = 3529.00$$

$$R_2 = \text{Roundup}\left(\frac{1}{\left(\frac{1}{28103.18}\right)+\left(\frac{1}{3529.00}\right)}\right) = 3136$$

$$Q_2 = \left(\frac{1}{100(3136)}\right)\left(2.1139\times10^{6}\right) = 6.74\frac{\text{L}}{\text{day}}$$

Layer 3

$$Q_{ph2\_3} = 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\,\text{s}}\left(\frac{16604.73\,\text{cm}^2}{0.013\,\text{cm}}\right) = 3.81\times10^{-6}\frac{\text{mol}}{\text{s}}$$

$$R_{ph2\_3} = \left(\frac{1}{100\left(3.81\times10^{-6}\right)}\right) = 2622.97$$

$$R_{pair\_3} = (5.92)(2622.97) = 15530.72$$

$$R_{dair\_3} = (3.79)(17922) = 67934.23$$

$$R_3 = \text{Roundup}\left(\frac{1}{\left(\frac{1}{15530.72}\right)+\left(\frac{1}{67934.23}\right)}\right) = 12641$$

$$Q_3 = \left(\frac{1}{100(12641)}\right)\left(2.1139\times10^{6}\right) = 1.67\frac{\text{L}}{\text{day}}$$

Layer 4

$$Q_{ph2\_4} = 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\,\text{s}}\left(\frac{17694.03\,\text{cm}^2}{0.030\,\text{cm}}\right) = 1.69\times10^{-6}\frac{\text{mol}}{\text{s}}$$

$$R_{ph2\_4} = \left(\frac{1}{100\left(1.69\times10^{-6}\right)}\right) = 5907.57$$

$$R_{pair\_4} = (5.92)(5907.57) = 34979.02$$

$$R_{dair\_4} = (3.79)(931) = 3529.00$$

$$R_4 = \text{Roundup}\left(\frac{1}{\left(\frac{1}{34979.02}\right)+\left(\frac{1}{3529.00}\right)}\right) = 3206$$

$$Q_4 = \left(\frac{1}{100(3206)}\right)\left(2.1139\times10^{6}\right) = 6.59\frac{\text{L}}{\text{day}}$$

Layer 5

$Q_{ph2\_5} = 0$ assumed zero due to thickness of liner

$R_{ph2\_5} = \text{N/A}$

$R_{pair\_5} = \text{N/A}$

$R_{dair\_5} = (3.79)(197) = 746.74$

$R_5 = \text{Roundup}(746.47) = 747$

$$Q_5 = \left(\frac{1}{100(747)}\right)\left(2.1139\times10^{6}\right) = 28.30\frac{\text{L}}{\text{day}}$$

Layer 6

$Q_{ph2\_6} = 0$ assumed no permeation through drum gasket

$R_{ph2\_6} = \text{N/A}$

$R_{pair\_6} = \text{N/A}$

$R_{dair\_6} = (3.79)(541) = 2050.69$

$R_6 = \text{Roundup}(2050.69) = 2051$

$$Q_6 = \left(\frac{1}{100(2051)}\right)\left(2.1139\times10^{6}\right) = 10.31\frac{\text{L}}{\text{day}}$$

Layer 7

$R_7 = 1\times10^{20}$ assumed large resistance due to no losses to ambient

$$Q_7 = \left(\frac{1}{100\left(1\times10^{20}\right)}\right)\left(2.1139\times10^{6}\right) = 0.00\frac{\text{L}}{\text{day}}$$

4.2 Analysis and Results

The input parameters calculated in Section 4.1 were configured as text input decks for use by the Python 3.7 script provided in Appendix A.3, which were executed on a Windows 10 workstation (S028540) to solve the governing equations defined in Section 3.1 The input decks and associated output files are provided in Appendix A.2 for the analysis cases. The analyses were set up to evaluate the air concentration due to infiltration from the ambient environment through the layers of confinement into the initially inerted innermost bag layer (Layer 1). [Note that the layer and node references in the input deck are script-specific and generally inverted from those presented in the main body of the report]. Table 1 and Figure 1 in Section 2.0 summarize the results of the primary evaluations for a) the inerted bag exposed to ambient air and b) the inerted inner bag placed within the defined layers of confinement to provide the air concentration as a function of time up to 90% air concentration. The duration of time to reach the minimum

concentration thresholds of 10 to 90% (in increments of 10%) were summarized. The bag exposed directly to the ambient environment reached an air concentration of at least 90% in 89 days whereas the bag within the drum layers of confinement required 236 days to achieve the same.

In addition, a series of sensitivity studies on the assumed waste fill percentage of the inerted bag was also performed utilizing the same inputs but without Layers 2 thru 6 present in the system of equations (i.e., bag exposed to ambient air). The purpose of the sensitivity study was to evaluate the effects of air concentration on bags that were filled with waste at percentages which deviated from the assumed 25% fill. As shown in Appendix A.1, and as expected, the concentration of air within the initially inerted bag is hastened by a greater fill percentage, with the 25% fill considered a reasonably conservative lower-bound for the LANL waste drums under consideration. The assumed waste fill percentages of 1, 25, 50, 75, and 99% resulted in 118, 89, 60, 30, and 2 days, respectively to achieve a minimum 90% air concentration.

4.3 Summary and Conclusions

The analyses described herein and associated results indicate that diffusion plus permeation air transport from the ambient environment through one or more layers of confinement into the initially inerted inner bag will occur within a time frame that is generally less than a year in duration. Particularly, neglecting the effects of pressure-induced flow present as a result of temperature fluctuations and barometric pressure changes tend to make the included calculations conservative in estimating the time duration to achieve air infiltration.

5.0 REFERENCES

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9. J.M. Nevarez, *POC Rigid Drum Liner*, POC-DWG-0011, Rev. 1, Nuclear Waste Partnership LLC, Carlsbad, New Mexico, August 2013.

APPENDIX A

A.1 Void Volume of Inner Bag Sensitivity Evaluation

The time to achieve 90% air concentration in an initially inerted inner bag exposed to the ambient environment was evaluated for various assumed waste fill percentages to determine the sensitivity of results to this assumed parameter. As shown in Figure 2, the time duration to reach 90% air concentration is very sensitive to the assumed percentage of waste fill of the inner bag. In the absence of specific waste fill data, the base case analysis selection of 25% is considered a reasonable general assumption.

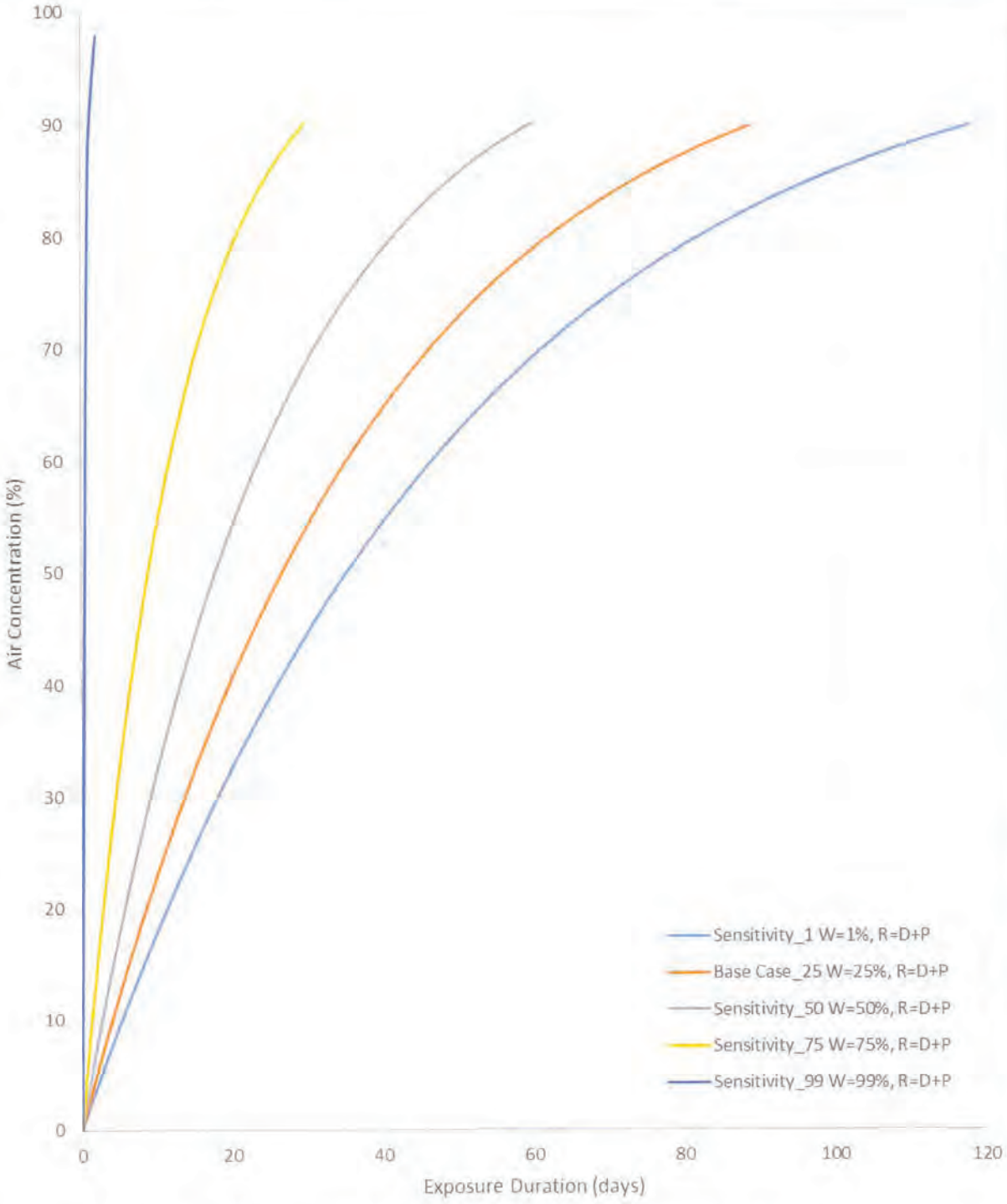


Figure 2 – Waste Fill Sensitivity Results for Directly Exposed Bag

A.2 Computer Run Listings

A.2.1 Bag (direct exposure) - 25% waste fill

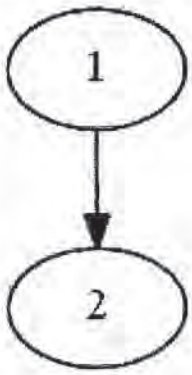
Input File: Bag_direct.i

```
Bag (direct exposure) - 25% waste fill
T1,T2,R,P,nday,Iconc,Itest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,46.01,1,17712.0,1,0.0000E+00,0.0
```

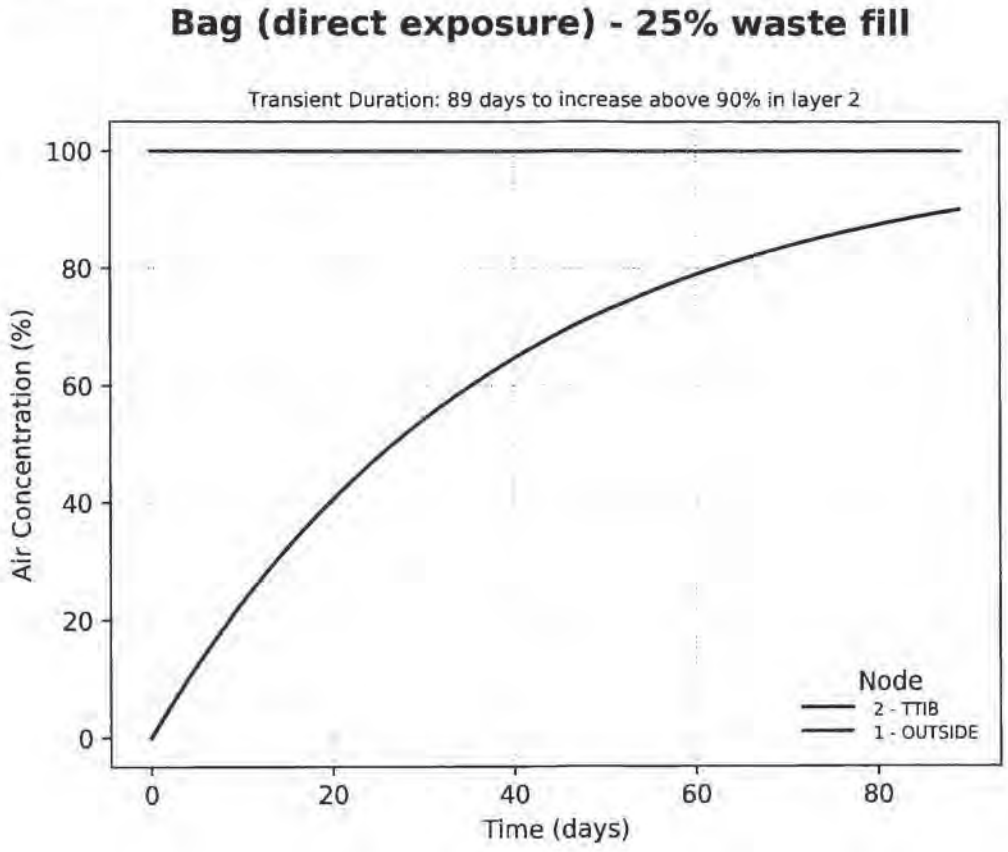
Output File: Bag_direct.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:58:55.347202

Title: Bag (direct exposure) - 25% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 89 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                  vvol lqty       rfac  rqty          cg
   1       0      1  OUTSIDE                     1e+07    1      1e+20     1           0
   2       1      2  TTIB                          46     1   1.77e+04     1           0


Results Summary ----------------------
node  description                   xci       xc       xz      pss
   1  OUTSIDE                   100.000    0.000  100.000      inf
   2  TTIB                        0.000    0.000   90.060      inf

Run completed (elapsed time): 0:00:01.762114
```

Network Map:



Transient Plot:



A.2.2 Bag (within 55-gal drum) - 25% waste fill

Input File: Bag_indrum.i

```
Bag (within 55-gal drum) - 25% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,7,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,55GD,12.82,1,2051.0,1,0.0000E+00,100.0
3,2,RLH,18.07,1,747.0,1,0.0000E+00,100.0
4,3,FDLB,16.43,1,3206.0,1,0.0000E+00,100.0
5,4,TTDLB,96.79,1,12641.0,1,0.0000E+00,100.0
6,5,FIB,6.14,1,3136.0,1,0.0000E+00,100.0
7,6,TTIB,46.01,1,17712.0,1,0.0000E+00,0.0
```

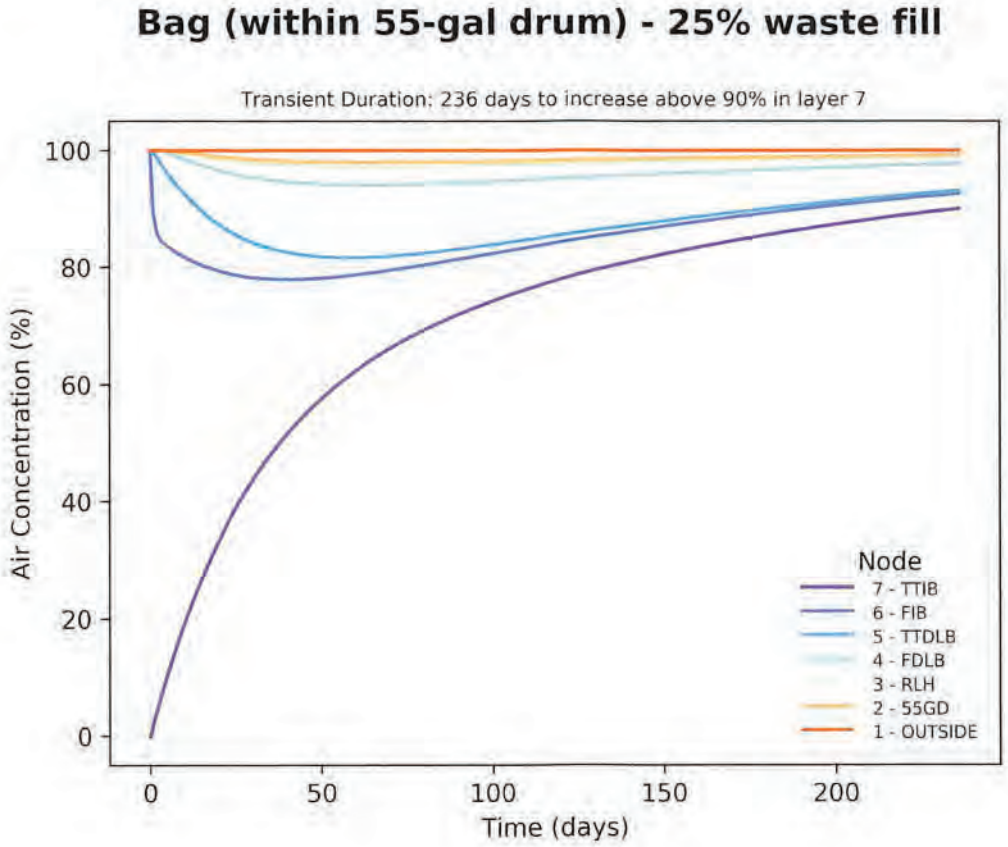
Output File: Bag_indrum.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 13:31:53.310400

Title: Bag (within 55-gal drum) - 25% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 236 days to increase above 90% in layer 7

Input Summary ----------------------
node  parent  layer  description                    vvol lqty       rfac  rqty          cg
   1       0      1  OUTSIDE                       1e+07    1      1e+20     1           0
   2       1      2  55GD                           12.8    1   2.05e+03     1           0
   3       2      3  RLH                            18.1    1        747     1           0
   4       3      4  FDLB                           16.4    1   3.21e+03     1           0
   5       4      5  TTDLB                          96.8    1   1.26e+04     1           0
   6       5      6  FIB                            6.14    1   3.14e+03     1           0
   7       6      7  TTIB                             46    1   1.77e+04     1           0


Results Summary ----------------------
node  description                    xci       xc       xz      pss
   1  OUTSIDE                    100.000    0.000  100.000      inf
   2  55GD                       100.000    0.000   99.206      inf
   3  RLH                        100.000    0.000   98.920      inf
   4  FDLB                       100.000    0.000   97.709      inf
   5  TTDLB                      100.000    0.000   93.085      inf
   6  FIB                        100.000    0.000   92.590      inf
   7  TTIB                         0.000    0.000   90.047      inf

Run completed (elapsed time): 0:00:03.265302
```

Network Map:

1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		2. System Number: PT00
3. Document Number: PLD-CAL-0003	4. Document Revision: 0	5. Page: 25 of 42

Transient Plot:



A.2.3 Bag (direct exposure) - Sensitivity with 1% waste fill

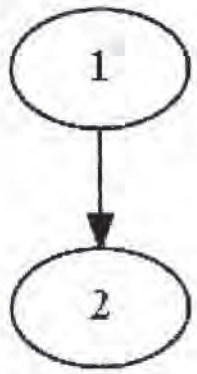
Input File: Sensitivity_1.i

```
Bag (direct exposure) - Sensitivity with 1% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,60.74,1,17712.0,1,0.0000E+00,0.0
```

Output File: Sensitivity_1.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:59:00.894972

Title: Bag (direct exposure) - Sensitivity with 1% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 118 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                vvol  lqty       rfac  rqty          cg
   1       0      1  OUTSIDE                   1e+07     1      1e+20     1           0
   2       1      2  TTIB                       60.7     1   1.77e+04     1           0


Results Summary ----------------------
node  description                  xci       xc       xz      pss
   1  OUTSIDE                  100.000    0.000   99.999      inf
   2  TTIB                       0.000    0.000   90.158      inf

Run completed (elapsed time): 0:00:00.835379
```

Network Map:



1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		2. System Number: PT00
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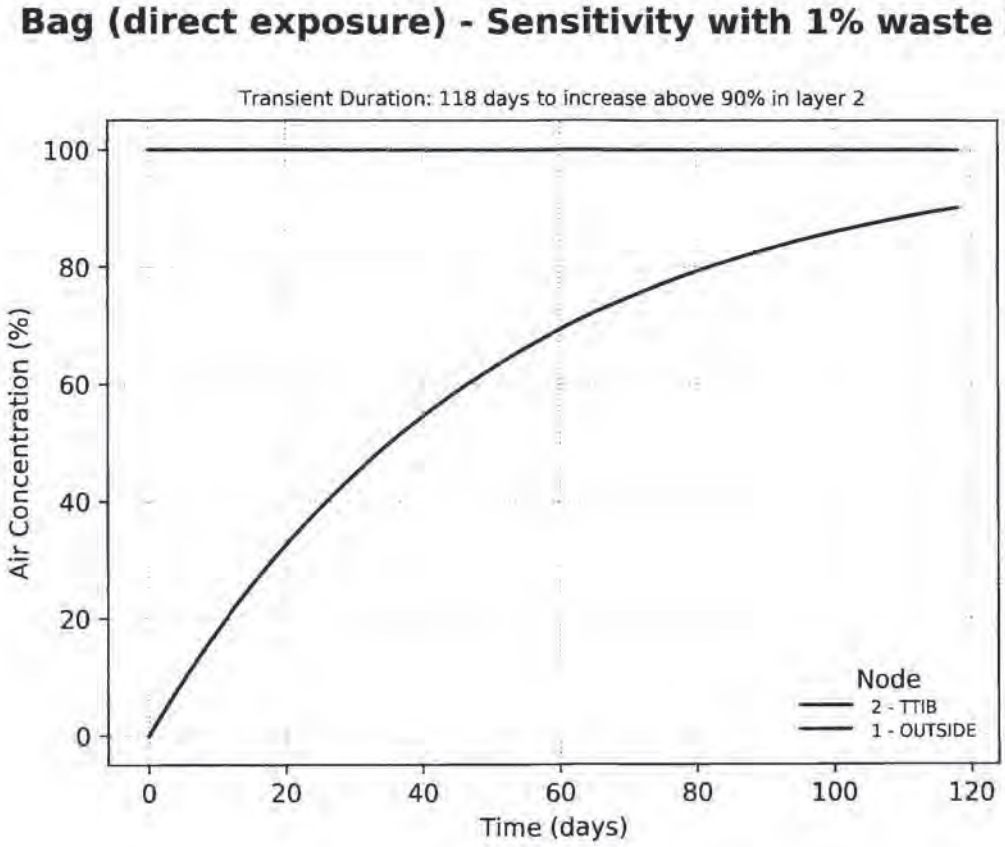
Transient Plot:



A.2.4 Bag (direct exposure) - Sensitivity with 50% waste fill

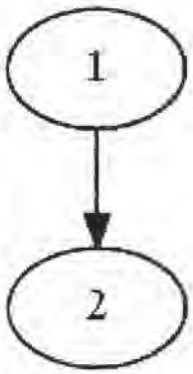
Input File: Sensitivity_50.i

```
Bag (direct exposure) - Sensitivity with 50% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,30.68,1,17712.0,1,0.0000E+00,0.0
```

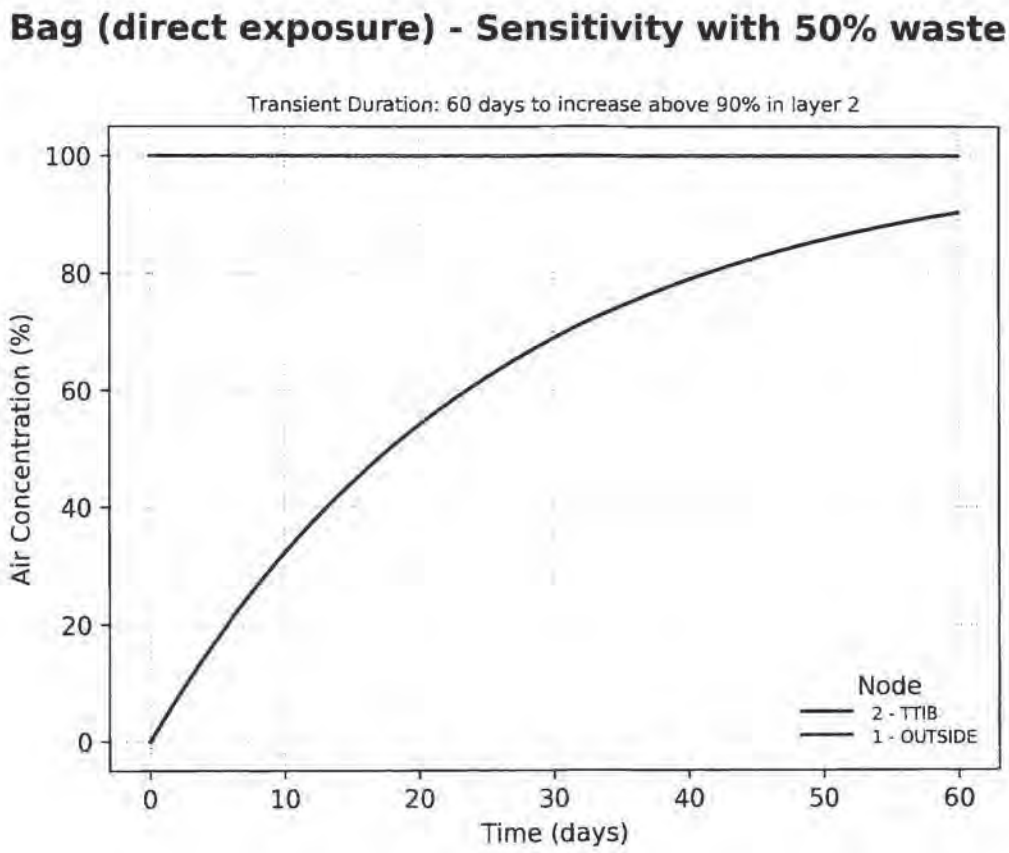
Output File: Sensitivity_50.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:59:02.651919

Title: Bag (direct exposure) - Sensitivity with 50% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 60 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                  vvol lqty       rfac  rqty            cg
   1       0      1  OUTSIDE                     1e+07    1      1e+20     1             0
   2       1      2  TTIB                         30.7    1   1.77e+04     1             0


Results Summary ----------------------
node  description                   xci       xc       xz      pss
   1  OUTSIDE                   100.000    0.000  100.000      inf
   2  TTIB                        0.000    0.000   90.309      inf

Run completed (elapsed time): 0:00:00.867170
```

Network Map:



Transient Plot:



A.2.5 Bag (direct exposure) - Sensitivity with 75% waste fill

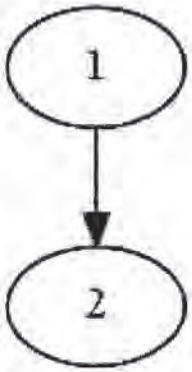
Input File: Sensitivity_75.i

```
Bag (direct exposure) - Sensitivity with 75% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,15.34,1,17712.0,1,0.0000E+00,0.0
```

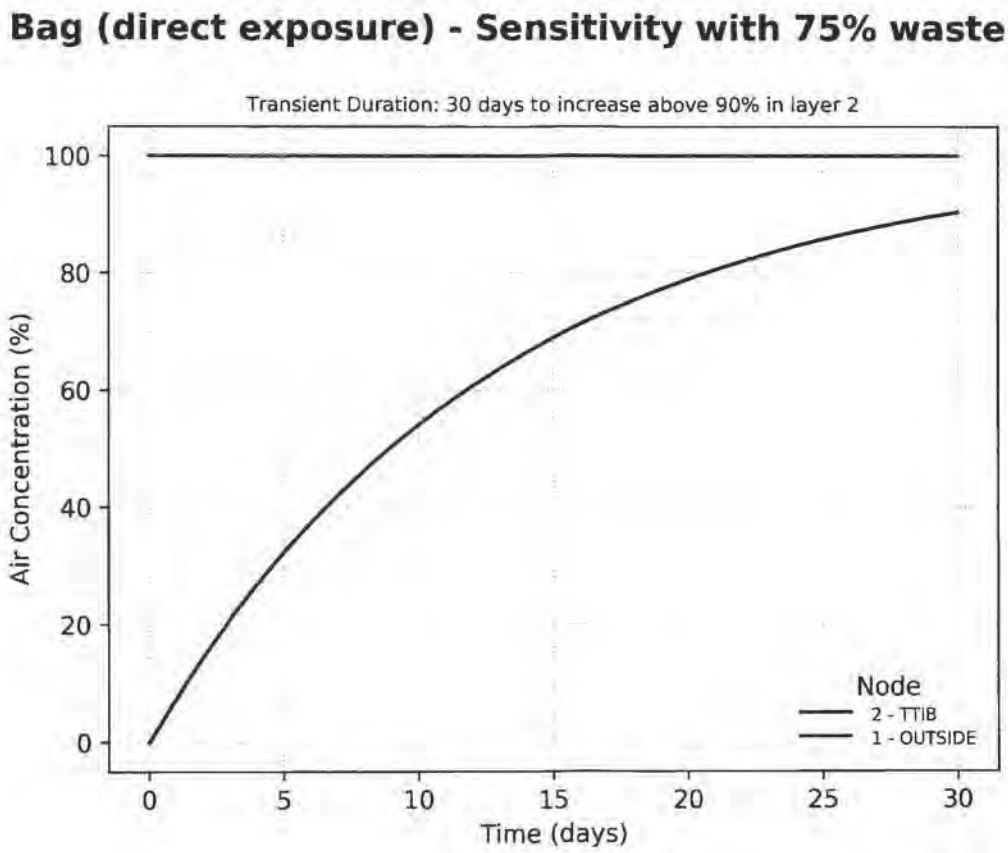
Output File: Sensitivity_75.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:59:04.938941

Title: Bag (direct exposure) - Sensitivity with 75% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 30 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                    vvol lqty       rfac  rqty            cg
   1       0      1  OUTSIDE                       1e+07    1      1e+20     1             0
   2       1      2  TTIB                           15.3    1   1.77e+04     1             0


Results Summary ----------------------
node  description                    xci      xc      xz      pss
   1  OUTSIDE                    100.000   0.000 100.000      inf
   2  TTIB                         0.000   0.000  90.310      inf

Run completed (elapsed time): 0:00:00.882689
```

Network Map:



Transient Plot:



A.2.6 Bag (direct exposure) - Sensitivity with 99% waste fill

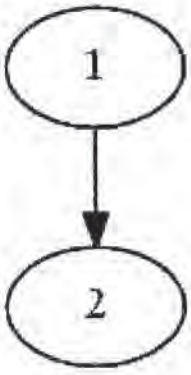
Input File: Sensitivity_99.i

```
Bag (direct exposure) - Sensitivity with 99% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,0.61,1,17712.0,1,0.0000E+00,0.0
```

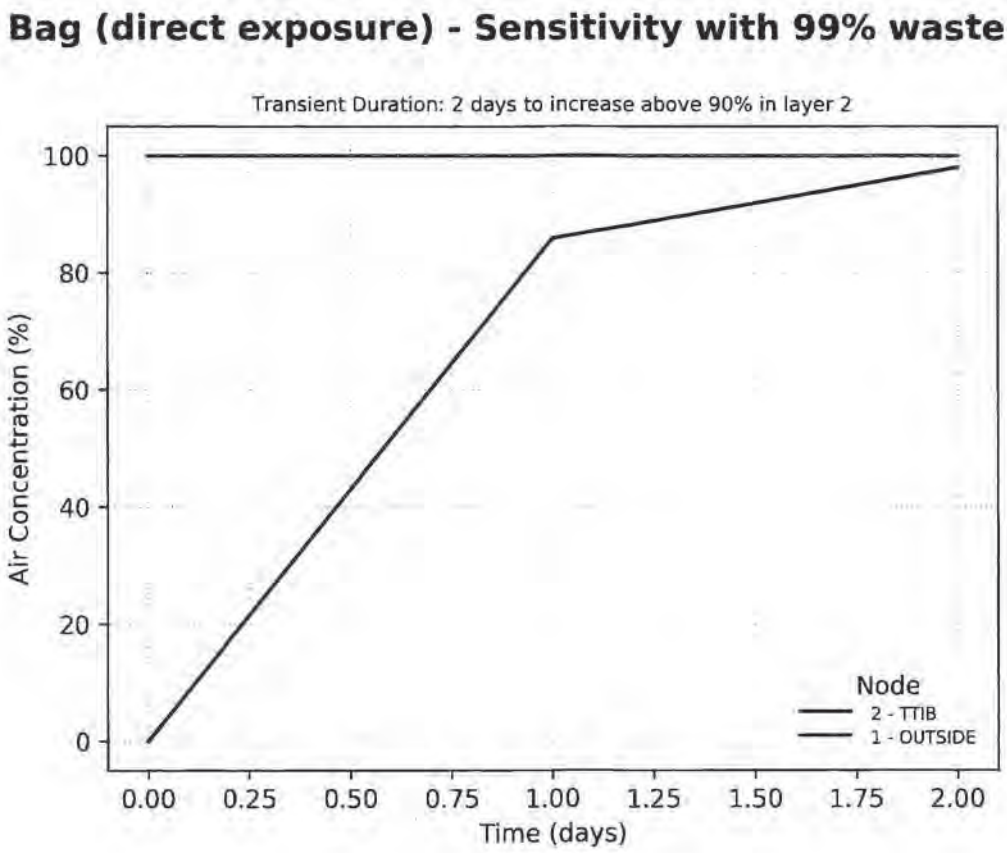
Output File: Sensitivity_99.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:59:06.767903

Title: Bag (direct exposure) - Sensitivity with 99% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 2 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                    vvol lqty       rfac  rqty            cg
   1       0      1  OUTSIDE                       1e+07    1      1e+20     1             0
   2       1      2  TTIB                           0.61    1   1.77e+04     1             0


Results Summary ----------------------
node  description                    xci       xc       xz       pss
   1  OUTSIDE                    100.000    0.000  100.000       inf
   2  TTIB                         0.000    0.000   98.002       inf

Run completed (elapsed time): 0:00:00.878876
```

Network Map:



Transient Plot:



A.3 Python Script Listing

```
""" [illegible]
"""

import argparse
import datetime
import os
import sys
import numpy as np
import scipy.optimize
from scipy import integrate
import networkx as nx
import matplotlib.pyplot as plt
from docx import Document
from docx.shared import Inches


def [illegible](timecsv, concentrationcsv, ofname):
#
#   Write inner layer concentration vs time to csv file
#
    outname = ofname +
    dfo = open(outname,   )
    for i in range(0, len(timecsv)):
        dfo.write(    %timecsv[i] +    +       %concentrationcsv[i] +    )
    dfo.close()
    return


def [illegible](x, node, parent, layer, cggr, rcon, nnum):
#
#   Define steady-state system of equations for mass flow via diffusion
#   Variables:
#   - fin = mass flow into node
#   - fout = mass flow out of node
#   - fx = equation for total mass flow in/out of a node, including [illegible]
#
    fin = np.zeros(nnum)
    fout = np.zeros(nnum)
    fx = np.zeros(nnum)
#   Calculate inflow
    for i in range(0,nnum):
        for j in range(0,nnum):
            if layer[i] != np.amax(layer):
                if parent[j] == node[i]:
                    fin[i] = fin[i] + rcon[j]*(x[j]-x[i])
        if layer[i] == np.amax(layer):
            fin[i] = 0.
#   Calculate outflow
    for i in range(0,nnum):
        for j in range(0,nnum):
```

```
            if layer[i] != np.amin(layer):
                if parent[i] == node[j]:
                    fout[i] = rcon[i]*(x[i]-x[j])
        if layer[i] == np.amin(layer):
            fout[i] = rcon[i]*(x[i])
#   Generate mass balance sums
    fx = cggr + fin - fout
    return fx


def [illegible](x, t, xp, node, parent, vvol, layer, cggr, rcon, nnum):
#
#   Define transient system of equations for mass flow via diffusion
#   Variables:
#   - fin = mass fraction flow into node
#   - fout = mass fraction flow out of node
#   - fx = equation for total mass fraction flow in/out of a node, including internal generation
#
    fin = np.zeros(nnum)
    fout = np.zeros(nnum)
#   Calculate inflow
    for i in range(0,nnum):
        for j in range(0,nnum):
            if layer[i] != np.amax(layer):
                if parent[j] == node[i]:
                    fin[i] = fin[i] + rcon[j]*(x[j]-x[i])/vvol[i]
        if layer[i] == np.amax(layer):
            fin[i] = 0.
#   Calculate outflow
    for i in range(0,nnum):
        for j in range(0,nnum):
            if layer[i] != np.amin(layer):
                if parent[i] == node[j]:
                    fout[i] = rcon[i]*(x[i]-x[j])/vvol[i]
        if layer[i] == np.amin(layer):
            fout[i] = rcon[i]*(x[i])/vvol[i]
#   Generate mass balance sums
    xp = cggr/vvol + fin - fout
    return xp


def [illegible](start, vvol, node, parent, layer, cggr, rcon, nnum):
#
#   Determine steady-state results based on start condition (0 = outermost layer not present,
#   1 or 2 = outermost layer present) and set initial conditions for transient calculations based
#   on start condition (0 = SS ICs in all but outermost layer, 1 = zero ICs for all layers, 2 = as prescribed
#   Variables:
#   - tmp* = temporary variables to hold outermost layer when removed from steady-state evaluation
#
    if start == 0:
        xinit = np.zeros(nnum)
        xc = np.zeros(nnum)
        tmprcon = rcon[0]
        tmpvvol = vvol[0]
        rcon[0] = 1.e12
        vvol[0] = 1.e12
        olstatus = "[illegible]
        xc = 100.*scipy.optimize.fsolve(fss, xinit, args=(node, parent, layer, cggr, rcon, nnum))
        rcon[0] = tmprcon
        vvol[0] = tmpvvol
        xinit = xc/100.
    else:
        xinit = np.zeros(nnum)
        xc = np.zeros(nnum)
        if start == 1:
            olstatus = "[illegible]
        else:
            olstatus = "[illegible]
        xc = 100.*scipy.optimize.fsolve(fss, xinit, args=(node, parent, layer, cggr, rcon, nnum))
    return xc, olstatus, xinit


def [illegible](ifname):
#
#   Read input from data file specified by the command line
#   Variables:
#   - fi = input file handle
#   - title = user-defined title of evaluation
#   - a1* = temporary variables to facilitate input file reads
#   - T1 = temperature for gas generation rates (K)
#   - T2 = temperature for release rates (K)
#   - R = gas constant (L atm / mol K)
#   - P = pressure (atm)
#   - nday = number of days requested for transient evaluation (0, = run until [illegible] satisfied)
#   - lconc = concentration (%) to use as stop condition for transient run
#   - ltest = layer (#) to evaluate the concentration test against
#   - start = flag to indicate transient initial condition type (0 = start at steady-state for all internal
#       layers, outermost layer ignored; 1 = start at zero for all layers, outermost layer present;
#   - end = flag to indicate whether gas generation rates should be scaled to achieve the specified lconc
#       and ltest conditions (0 = no scale, 1 = scale)
#   - data = temporary variable to red input lines
```

Calculation Continuation Sheet

1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		2. System Number: PT00
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```
#   - node = list of node numbers (i = 0, nnum-1)
#   - parent = list of parent node numbers associated with each node (i = 0, nnum-1)
#   - layer = list of layers numbers counting from outside in (1 = outermost, 2 = next outermost, ...)
#   - descr = string describing node characteristics, layers of confinement, etc. (i = 0, nnum-1)
#   - vvol = void volume for node (i = 0, nnum-1)
#   - lqty = number of duplicate layers of confinement represented by the node (i = 0, nnum-1)
#   - rfac = resistance factor for node, see CH-TRU Payload Appendix 2.2 (i = 0, nnum-1)
#   - rqty = quantity of rfac applied to node, e.g., number of filters/punctures (i = 0, nnum-1)
#   - cg = gas generation rate within each node (mol/sec) (i = 0, nnum-1)
#   - xci = initial concentration within each node (i = 0, nnum-1)
#   - lconctmp = temporary variable to determine if condition is entered as  of SA value
#   - percss = flag to specify how lconc is to be interpreted (0 = as concentration, 1 = as  of SA)

    fi = open(ifname, "r")
    title = fi.readline().rstrip('\n')
    si1 = fi.readline().strip().split('#')
    si2 = fi.readline().strip().split(',')
    T1 = float(si2[0])
    T2 = float(si2[1])
    R = float(si2[2])
    P = float(si2[3])
    nday = float(si2[4])
    lconctmp = str(si2[5])
    if  lconctmp[-1] == '%':
        lconc = float(lconctmp[:-1]) / 100.
        percss = 1
    else:
        lconc = float(si2[5])
        percss = 0
    ltest = int(si2[6])
    start = int(si2[7])
    end = int(si2[8])
    data = np.loadtxt(ifname, dtype='    ', delimiter=",", comments="#", skiprows=4)
    node = np.array(data[:,0], dtype='    ')
    parent = np.array(data[:,1], dtype='    ')
    descr = np.array(data[:,2], dtype='    ')
    vvol = np.array(data[:,3], dtype='    ')
    lqty = np.array(data[:,4], dtype='    ')
    rfac = np.array(data[:,5], dtype='    ')
    rqty = np.array(data[:,6], dtype='    ')
    cg = np.array(data[:,7], dtype='    ')
    if start == 2:
        xci = np.array(data[:,8], dtype='    ')
    else:
        xci = np.zeros(len(node))
    fi.close()
    return title, T1, T2, R, P, nday, lconc, ltest, start, end, node, parent, descr, vvol, lqty, \
      rfac, rqty, cg, xci, percss


def lookup(nask, nnum, node, parent):
#
#   Lookup the parent associated with a specified node
#   Variables:
#   - nask = node given for search
#   - parans = associated parent node given as answer
#
    for i in range(0,nnum):
        if node[i] == nask:
            parans = parent[i]
    return parans


def ...ring(nnum, parent, node, npar, ofname, plotflag):
#
#   Create network adjacency list, read as graph, and plot
#   Variables:
#   - hds, hdf, G = variables to store hierarchy, adjacency list of nodes and parents in graph form
#
    hds = []
    for i in range(0,nnum):
        tmp = []
        k = 0
        for j in range(0,nnum):
            if parent[j] == node[i]:
                if k == 0:
                    tmp.append(parent[j])
                    tmp.append(node[j])
                    k = k + 1
                else:
                    tmp.append(node[j])
        hds.append(tmp)
    hdf = [e for e in hds if e]
    if plotflag == '1' or plotflag == 'T' or plotflag == 't':
        ft = open("...", "w")
        for i in range (0,npar):
            ft.write(str(hdf[i])[1:-1].replace(',', '') + '\n')
        ft.close()
        fh = open("...", 'rb')
        G = nx.read_adjlist(fh,create_using=nx.DiGraph())
        fh.close()
```

```
        os.remove('  ~.  ')
        nodechart = nx.nx_agraph.to_agraph(G)
        nodechart.layout('  ')
        nodechart.draw(ofname + '.   ')
    return


def p  r(ifname):
#
#   Write temporary input files if input file contains more than one phase
#   Variables:
#   - phasenum = counter for number of phases contained in primary input file
#   - phaseflag = flag to indicate whether multiple phases are required (0 = no, 1 =
#
    phaseflag = 0
    phasenum = 0
    fi = open(ifname , ' ')
    line = fi.readline()
    if line[:5]  == '  ':
        phaseflag = 1
        phasenum = phasenum + 1
        fo = open('.' + ifname + '      ' + str(phasenum), ' ')
        while line:
            line = fi.readline()
            if line[:5]  == '  ':
                fo.close()
                phasenum = phasenum + 1
                fo = open('.' + ifname + '      ' + str(phasenum), ' ')
            else:
                fo.write(line)
    if phaseflag == 1: fo.close()
    fi.close()
    return phasenum, phaseflag


def  ():
#
#   Calculate steady-state concentrations and transient buildup
#   Variables:
#   - args = list of arguments passed from command line input
#   - ifname = input file name
#   - ofname = output file name
#   - plotflag = flat to indicate desire to plot nodal connectivity and transient buildup
#     (T/1 = true, F/0 = false)
#   - nnum = count of number of nodes
#   - npar = count of number of unique parents
#   - conv = conversion constant from mol/sec to L/day
#   - rcon = flow conductance (L/day) (i = 0, nnum-1)
#   - qgz = gas generation rate within each node (L/day) (i = 0, nnum-1)
#   - minit = initial concentrations ( ) for each node (i = 0, nnum-1)
#   - xc = final steady-state concentrations ( ) for each node ( : i = 0, nnum-1)
#   - olstats = string to summarize start condition flag application to steady-state evaluation
#   - tinit = start time (day), 0
#   - ndayf = final day for evaluation, set to 1. if nday is 0. and then incremented until condition met
#   - tend = final time (day)
#   - time = array defining time with output increment = nday - 1
#   - xp = derivative of xz transient concentrations ( ) with respect to time for each node (i = 0, nnum-1)
#   - xz = transient concentrations ( ) at each node (i = 0, nnum-1; time)
#   - pss = percent of steady-state reached by xz at the final time
#   - itmp', imax' = temporary variables to determine maximum concentration reached at the end of time
#     for the layer being tracked
#   - endf = flag to indicate end of incrementing days
#   - lnum = array index associated with the ifeat condition
#   - now = current date and time at start of run
#   - now2 = current date and time and end of run
#   - lconctst = layer concentration test
#   - timehistory = concatenation of time history
#   - conchistory = concatenation of concentration history
#   - plottitle = plot title
#   - plotsubtitle = plot subtitle
#   - maxstep = maximum number of integration steps for solver
#   - atol = absolute integration error tolerance for solver
#   - rtol = relative integration error tolerance for solver
#   - tmin = minimum absolute time step for solver
#   - tmax = maximum absolute time step for solver
#
#   Get date and time
    now = datetime.datetime.now()
#
#   Read command line arguments
    parser = argparse.ArgumentParser(description='          ')
    parser.add_argument('   ','       ', help='                ', required=True)
    parser.add_argument('   ','--     ',help='                 ', required=True)
    parser.add_argument('   ','       ',help='                 ', required=True)
    parser.add_argument('   ','--     ',help='                 ', required=False)
    parser.add_argument('   ','       ',help='                                  ', required=False)
    parser.add_argument('   ','--     ',help='                                  ', required=False)
    parser.add_argument('   ','       ',help='                                  ', required=False)
    parser.add_argument('   ','--     ',help='                 ', required=False)
    parser.add_argument('   ','       ',help='                 ', required=False)
    args = parser.parse_args()
```

Calculation Continuation Sheet

1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		2. System Number: PT00
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```
    ifname = args.input
    ofname = args.output
    plotflag = args.plotting
    if args.legend == None:
        legendloc = 0
    else:
        legendloc = int(args.legend)
    mxstep = args.mxstep
    rtol = args.rtol
    atol = args.atol
    tmin = args.tmin
    tmax = args.tmax
#   Set integration options based on command line inputs
    if mxstep == None:
        mxstep = 0
    else:
        mxstep = int(mxstep)
    if rtol == None:
        rtol = 1.49012e-8
    else:
        rtol = float(rtol)
    if atol == None:
        atol = 1.49012e-8
    else:
        atol = float(atol)
    if tmin == None:
        tmin = 0
    else:
        tmin = float(tmin)
    if tmax == None:
        tmax = 0
    else:
        tmax = float(tmin)
#
#   Open files for writing results
    fo = open(ofname, "w")
    dfi = open(ifname, "r")
    dfo = open(ofname, "r")
#
#   Read data file to determine phase type
    phasenum, phaseflag = phasefileprep(ifname)
#
#   Loop over the number of concentration build up phases
#
    if phaseflag == 0:
        phasenum = 1
#
    for phases in range(0, phasenum):
#
#   Read input from data file
        if phaseflag == 1:
            ifpname = "." + ifname + "." + str(phases+1)
            title, T1, T2, R, P, nday, lconc, ltest, start, end, node, parent, descr, vvol, lqty, \
              rfac, rqty, cg, xci, percss = readin(ifpname)
        else:
            title, T1, T2, R, P, nday, lconc, ltest, start, end, node, parent, descr, vvol, lqty, \
              rfac, rqty, cg, xci, percss = readin(ifname)
#
#   Determine number of nodes and unique parents
        nnum = len(node)
        npar = len(np.unique(parent))-1
#
#   Determine layer level of each node
        tmplayer = np.zeros(nnum)
        for i in range(0,nnum):
            nask = node[i]
            while True:
                parns = findpar(nask, nnum, node, parent)
                if parns == 0:
                    break
                nask = parns
                tmplayer[i] = tmplayer[i] + 1
        layer = tmplayer + 1
#
#   Determine index of lconc test layer and save building, lconc as lconctst
        lconctst = lconc
        for i in range(0,nnum):
            if layer[i] == ltest:
                inum = i
#
#   Conversion for gas generation rates from mol/s to L/day at T1
        conv1 = R * T1 * 86400 / P
#
#   Conversion for release rates from mol/s to L/day at T2
        conv2 = R * T2 * 86400 / P
#
#   Convert resistance factors to conductance in L/day at T1
        rcon = np.zeros(nnum)
        for i in range(0,nnum):
            if rfac[i] == 0.:
                rcon[i] = 0.
```

Calculation Continuation Sheet

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```
            else:
                rcon[i] = ((1./(lqty[i]*rfac[i]*100.))*rqty[i])*conv2
#
#   Loop to scale gas generation rates to meet end condition (0 = no scale, 1 = scale)
#
        endf = 0
        while True:
#
#   Convert gas generation rate from mc./set to L/day at T1
            cggr = cg*conv1
#
#   Calculate steady-state conditions
            xc, olstatus, xinit = calcss(start, vvol, node, parent, layer, cggr, rcon, nnum)
#
#   Initialize time variables
            tinit = 0.
            if nday == 0.:
                ndayf = 1.
            else:
                ndayf = nday
            tend = ndayf
#
#   Overwrite initial conditions if conditions are specified in input file (start = 2) or
#   analysis phases dictate using previous run final transient conditions as initial conditions;
#   set initial conditions for priming equal to those set in SS calculation (start = 0
            if start == 2 and phaseflag == 0 and phases == 0:
                xinit = xci/100.
            if start == 0 and phaseflag == 0 and phases == 0:
                xci = xinit*100.
            if phaseflag == 1 and phases > 0:
                start == 2
                olstatus = "
                xci = np.zeros(nnum)
                for i in range(0, nnum):
                    xci[i] = xz[nfinal,i]
                xinit = xci/100.
#
#   Integrate system of equations to get transient concentrations
#
            while True:
                time = np.linspace(tinit, tend, int(ndayf + 1))
                xp = np.zeros(nnum)
                xz = integrate.odeint(xprime, xinit, time, \
                  args=(xp, node, parent, vvol, layer, cggr, rcon, nnum), \
                  mxstep = mxstep, rtol = rtol, atol = atol, hmin = tmin, hmax = tmax)
                xz = 100.*xz
#
#   Calculate lconc as percent of SS in specific layer and determine concentration slope
                if ndayf <= 1. or nday != 0.:
                    if ltest == 0:
                        concslope = xz[int(ndayf),0] - xz[int(ndayf)-1,0]
                    else:
                        concslope = xz[int(ndayf),lnum] - xz[int(ndayf)-1,lnum]
                    if concslope > 0. and endf == 0 and percss == 1:
                        lconc = xc[lnum]*lconctst
                    if concslope < 0. and endf == 0 and percss == 1:
                        lconc = xc[lnum]/lconctst
#
#   Determine if concentration in specified layer and end of the analysis reaches the defined value,
#   if it can or has reached the specified stop conditions
                if nday == 0. and end == 0:
                    if concslope > 0.:
                        if xz[int(ndayf),lnum] >= lconc:
                            print("                                                    ")
                            break
                        if xc[lnum] < 0.999*lconc and start == 1:
                            print("                                                    ")
                            break
                        if xz[int(ndayf),lnum] > 1.001*xc[lnum] and start == 1:
                            print("                                                    ")
                            break
                    if concslope < 0.:
                        if xz[int(ndayf),lnum] <= lconc:
                            print("                                                    ")
                            break
                        if xc[lnum] > 1.001*lconc and start == 1:
                            print("                                                    ")
                            break
                        if xz[int(ndayf),lnum] < 0.999*xc[lnum] and start == 1:
                            print("                                                    ")
                            break
                    if ndayf == nday:
                        print("                                                    ")
                        break
                    ndayf = ndayf + 100.
                    tend = ndayf
                if nday == 0. and end == 1:
                    print("                                                    ")
                    break
                if nday != 0.:
                    break
```

1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		2. System Number: PT00
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```
            print('                    ', ndayf)
#
#   Determine time at which solution meets the stop condition
        if nday == 0.:
            for i in range(0, int(ndayf)):
                if concslope > 0. and xz[i, lnum] > lconc:
                    nfinal = i
                    break
                elif concslope < 0. and xz[i, lnum] < lconc:
                    nfinal = i
                    break
                else:
                    nfinal = int(ndayf)
        else:
            nfinal = int(ndayf)
        print("                                        ", nfinal)
#
#   Calculate transient end concentration as a percent of steady-state (based on direction approached)
        if start == 0:
            pss = np.zeros(nnum)
            for i in range(1,nnum):
                if concslope > 0:
                    pss[i] = (xz[nfinal,i]/xc[i])*100.
                elif concslope < 0:
                    pss[i] = (xc[i]/xz[nfinal,i])*100.
        else:
            if concslope >= 0:
                pss = (xz[nfinal]/xc)*100.
            if concslope < 0:
                pss = (xc/xz[nfinal])*100.
#
#   Scale gas generation rates as required
        if nday == 0. or endf != 0:
            break
        if nday != 0. and end == 0:
            break
        if nday != 0. and end == 1:
            lscale = lconc/xz[int(nfinal),lnum]
            cg = cg * lscale
            endf = endf + 1
            print("                                        ")
#
#   Write results to output file
    if phases > 0:
        fo.write('    ' + '    ')
    else:
        fo.write("                                  " + str(now) +       +     ')
    fo.write("       " + title + '    ' + '   ')
    fo.write(olstatus + '    ' + '   ')

    print("         ", nday)
    print("         ", start)
    print("         ", ltest)
    print("         ", lconc)
    if ltest == 0:
        print("              ", xz[int(nfinal),0])
        print("              ", xc[0])
    else:
        print("              ", xz[int(nfinal),lnum])
        print("              ", xc[lnum])
    print("           ", nfinal)
    print("      ", end)

    if nday == 0 and concslope > 0 and xz[nfinal,lnum] > lconc and end == 0:
        stopsummary = "                    " + '      '%nfinal + "     " + "          " + '     '%lconc + \
        "          " + '     '%ltest
    if nday == 0 and concslope < 0 and xz[nfinal,lnum] < lconc and end == 0:
        stopsummary = "                    " + '      '%nfinal + "     " + "          " + '     '%lconc + \
        "          " + '     '%ltest
    if nday == 0 and concslope > 0 and xc[lnum] < lconc and start == 1 and end == 0:
        stopsummary = "                    " + '      '%nfinal + "     " + "          " + \
        '    '%lconc + "          " + '     '%ltest
    if nday == 0 and concslope < 0 and xc[lnum] > lconc and start == 1 and end == 0:
        stopsummary = "                    " + '      '%nfinal + "     " + "          " + \
        '    '%lconc + "          " + '     '%ltest
    if ndayf == nday and end == 0:
        stopsummary = "                    " + '      '%nfinal + "     "
    if ndayf == nday and end != 0:
        stopsummary = "                    " + '      '%nfinal + "     " + "     " + "     " + '     '%lconc + \
        "          " + '     '%ltest +          "     " + '     '%lscale
    if nday == 0 and xz[nfinal,lnum] > xc[lnum] and start == 1 and end != 0:
        stopsummary = "                    " + '      '%nfinal + "     " + "     " + "     " + '     '%lconc + \
        "          " + '     '%ltest
    if nday == 0 and end == 1:
        stopsummary = "                    " + '      '%nfinal + "                                " + \
        "     "
    stopsum = " ".join(stopsummary.split())
    fo.write(stopsum + '    ' + '   ')

    fo.write("                                        " + '   ')
    fo.write("                                                          " + \
```

Calculation Continuation Sheet

1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		2. System Number: PT00
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```
                                                    " + '  ')
        for i in range(0, nnum):
            fo.write('  '%node[i] + "    " + '  '%parent[i] + "  " + '  '%layer[i] + '  ' + \
                '  '%descr[i] + '  ' + '  '%vvol[i] + '  ' + '  '%lqty[i] + '  ' + '  '%rfac[i] + \
              ' " + '  '%rqty[i] + '  ' + '  '%cg[i] + '  ' + '  ')
        fo.write('  ' + '  ')
        fo.write('  ' + '  ')
        fo.write('  ' + '  ')
        for i in range(0, nnum):
            fo.write('  '%node[i] + "  " + '  ' + '%descr[i] + "  " + '  '%xci[i] + '  ' + \
                '  '%xc[i] + "  " + '  '%xz[nfinal,i] + "  " + '  '%pss[i] + '  ')
#
#   Concatenate time and concentration histories for plotting
        if phases == 0:
            timehistory = time[:nfinal+1]
            conchistory = np.zeros((nfinal+1,nnum))
            for i in range(0,nnum):
                for j in range(0,nfinal+1):
                    conchistory[j,i] = xz[j,i]
            plottitle = title
            if phaseflag == 1:
                plotsubtitle = "  " + str(phases+1) + "  " + stopsum
            else:
                plotsubtitle = stopsum
        if phases > 0:
            time = time[:nfinal] + float(len(timehistory))
            timehistory = np.hstack([timehistory,time])
            conchistorytmp = np.zeros((nfinal,nnum))
            for i in range(0,nnum):
                for j in range(1,nfinal+1):
                    conchistorytmp[j-1,i] = xz[j,i]
            conchistory = np.vstack([conchistory,conchistorytmp])
            plottitle = plottitle + "  " + title
            plotsubtitle = plotsubtitle + "  " + '  ' + str(phases+1) + "  " + stopsum
#
#   Create and plot network map  last phase, as applicable
    netmap(nnum, parent, node, npar, ofname, plotflag)
#
#   Plot transient results to png files
    lloc = ('  ', '  ', '  ', '  ', '  ', '  ', \
            '  ', '  ', '  ', '  ', '  ', '  ')
    plt.clf()
    if plotflag == '  or plotflag == '  or plotflag == '  ':
        fig, ax = plt.subplots()
        colormap = plt.cm.rainbow
        plt.gca().set_prop_cycle('  ', [colormap(i) for i in np.linspace(0, 0.9, nnum)])
        for i in range(nnum-1, -1, -1):
            plt.plot(timehistory, conchistory[:,i], label=str(node[i]) + '  ' + descr[i])
        if phases == 0:
            fig.suptitle(plottitle, fontsize=14, fontweight='  ')
            fig.subplots_adjust(top=0.85)
        else:
            fig.suptitle(plottitle, fontsize=10, fontweight='  ')
            fig.subplots_adjust(top=0.85-0.05*float(phases))
        ax.set_title(plotsubtitle, fontsize=8)
        ax.set_xlabel('  ')
        ax.set_ylabel('  ')
        plt.grid(True, linestyle='  ')
        art = []
        if nnum < 12:
            legend = plt.legend(title = '  ', loc=lloc[legendloc], labelspacing=0.1)
        else:
            legend = plt.legend(title = '  ', loc='  ', labelspacing=0.1, bbox_to_anchor=(0.5, -0.5), ncol=4)
        for label in legend.get_texts():
            label.set_fontsize('  ')
        if nnum >= 12:
            art.append(legend)
            plt.savefig(ofname + '  ' + '  ', dpi=600, additional_artists=art, bbox_inches='  ')
        else:
            plt.savefig(ofname + '  ' + '  ', dpi=600)
#
#   Get date and time and write elapsed and close output file
    now2 = datetime.datetime.now()
    fo.write('  ' + '  ' + '  ' + '%(now2-now) + '  ')
    fo.close()
#
#   Write data to a Word document, including figures
    document = Document()
    if phaseflag == 1:
        document.add_heading(plottitle, level=0)
    else:
        document.add_heading(title, level=0)
    intxt = dfi.read()
    document.add_heading(str('  ' + ifname), level=1)
    pinput = document.add_paragraph(intxt, style='  ')
    outxt = dfo.read()
    document.add_heading(str('  ' + ofname), level=1)
    poutput = document.add_paragraph(outxt, style='  ')
    document.add_heading('  ', level=1)
    document.add_picture(str(ofname + '  '), height=Inches(2.00))
    document.add_heading('  ', level=1)
```

Calculation Continuation Sheet

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```
    document.add_picture(str(ofname + "                "), width=Inches(6.00))
    document.save(str(ofname + ".    "))
#
#   Write csv data of innermost concentration vs time
    writecsvdata(timehistory, conchistory[:,-1], ofname)
#
#   Close remaining files, delete any temp files, and finish up
    dfi.close()
    fo.close()
    if phases > 0:
        for i in range(0,phasenum):
            os.remove("." + ifname + "        " + str(i+1))

if   name   == '          ':
    main()
```

CCP Documentation
for
NCR-LANL-0289-21

Attachment 1 – CCP Nonconformance Report (NCR)

CCP NONCONFORMANCE REPORT (NCR)

(Use NCR Continuation, Attachment 3, if necessary)

NCR No. NCR-LANL-0289-21 Revision 2

1. Lot No., Heat No., or Serial No. (if applicable): N/A	2. Process (e.g., NDA, NDE, VE, Other): AK	3. Batch Data Report #(s): N/A
4. Order/Work Order/Job Control Number (if applicable): N/A	5. PO # (if applicable): N/A	Container #(s): 73611, 74382, 73650, 73442
	6. Supplier (if applicable): N/A	

DESCRIPTION OF NONCONFORMANCE

7a. NCR Description: ☐ < 100 nCi/g ☐ Prohibited Item ☐ E-Flag ☐ Receipt Inspection ☐ Transportation ☐ WWIS/WDS ☒ Other

7b. Requirement(s) (Enter Implementing Procedure No., Revision, Section No., & Quoted Text):
CCP-PO-002, Revision 31 *CCP Transuranic Waste Certification Plan*
Section 3.5.1 Pyrophoric Materials
Section 3.5.1 [A.1] "Nonradionuclide pyrophoric materials are not acceptable at the WIPP."

7c. Actual Condition:
Containers identified in Block 3 may contain potentially pyrophoric titanium material.

Reason for Revision 1: Removed container 72234 as this container is not a container of concern and added container 73442.
Reason for Revision 2: Changed requirement and re-worded actual condition to better capture condition of potential non-conformance.

7d. Have the CCP HOLD TAGS associated with this NCR been applied? ☒ YES ☐ NO If no is checked, explain:
Except for 73650

8. NCR Originator:
Lisa Calder (printed name) Lisa Calder (signature) 3/15/2021 (date)

9. Does the identified condition have the potential to impact AK? If YES or INDETERMINATE, enter Trend Code L in Block 10. ☒ YES ☐ NO ☐ INDETERMINATE

10. Trend Code: L

11. Responsible Manager: Lisa Calder

12. Recurring Condition? ☐ YES ☒ NO (If Yes, list NCRs and WIPP Forms):

13. Significant Condition? ☐ YES ☒ NO (If Yes, enter WIPP Form No.):

14. QA Engineer or QA Designee validation:
Veronica Ballew (printed name) Veronica Ballew (signature) 3/15/2021 (date)

CCP RECORDS ORIGINAL
DATE REC'D 12-14-22

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0289-21 Revision 2

INTERIM DISPOSITION

15a. Interim Disposition (Check Only One):

☐ N/A (See Final Disposition) ☒ Hold ☐ Conditionally Accept ☐ Conditionally Use

☐ Sort ☐ Reinspect or Retest ☐ Remediate

15b. Instructions for Completion of the Interim Disposition:
AKE to further evaluate and with SPM determine path forward.

INTERIM DISPOSITION APPROVALS

16a. Responsible Manager or Individual:

Lisa Calder	Lisa Calder	3/15/2021
printed name	signature	date

16b. QA Engineer or QA Designee:

Veronica Ballew	Veronica Ballew	3/15/2021
printed name	signature	date

COMPLETION OF INTERIM DISPOSITION

17. Interim Disposition Complete – Responsible Manager or Individual:

David Fry	David Fry	3/16/2022
printed name	signature	date

18. Interim Disposition Verified – QA Engineer:

Katie Gentry	Katie Gentry	3-16-22
printed name	signature	date

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0289-21 Revision 2

FINAL DISPOSITION

19. Final Disposition (Check Only One: Use-As-Is, Repair, Reject, Rework, or Scrap):
☒ Use-As-Is ☐ Repair

19a. Technical Justification – Required for Use-As-Is or Repair dispositions. [☐ N/A for Reject, Rework, or Scrap]

An evaluation performed by NWP Packaging Engineers and documented in source document D399, calculated that pyrophoric titanium waste contents in a 4-mil bag contained within a 55 gallon drum would sufficiently oxidize within 236 days. Based off of that evaluation, and the fact that the containers in Block 3 have been packaged for more than 236 days, it has been concluded that these containers do not have pyrophoric titanium waste components and are therefore compliant.

☐ Reject ☐ Rework ☐ Scrap

19b. Instructions for Completion – Required for Reject, Repair, Rework, or Scrap [☒ N/A for Use-As-Is]

19c. Corrective Actions (Actions to Prevent Recurrence – For Repair or Rework, if applicable.
[☒ N/A if not applicable, and for Use-As-Is, Reject, and Scrap]

FINAL DISPOSITION APPROVALS

20. Responsible Manager or Individual:

David Fry	David Fry	3/16/2022
printed name	signature	date

21. QA Engineer or QA Designee:

Katie Gentry	Katie Gentry	3/16/2022
printed name	signature	date

CLOSURE

22. Final Disposition Complete - Responsible Manager or Individual:

David Fry	David Fry	3/17/2022
printed name	signature	date

23. Attachments: 1. Reportability Emails 2. Hold Tag Applied ~~73442~~ 73442 3. Hold Tag Applied 73611 4. Hold Tag Applied 74382 5. Interim Closure Documents 6. Hold Tag Removed 73442 7. Hold Tag Removal 74382 8. Hold Tag Removal 73611

24a. HOLD TAG removal has been verified and reconciled for all nonconforming items on the NCR: ☒

24b. If HOLD TAG is not applicable, check: ☐ and explain:

25. Final Disposition Verified – NCR Closed QA Engineer:

Katie Gentry	Katie Gentry	12/13/2022
printed name	signature	date

Fry, David - NWP

From: Papp, Michael John <papp@lanl.gov>
Sent: Wednesday, March 16, 2022 10:56 AM
To: Fry, David - NWP; McCabe, Diana
Subject: Containers Generated from an Inert Glovebox Evaluation

Hi David,

Containers 73442, 73611, 73650, and 74382 were originally evaluated and conservatively NCR'd due to the presence of filter material generated in an inert glovebox environment (reference NCR-LANL-0289-21, R2). This was done in an effort to identify any waste containers with potential pyrophoric material after the filter sparking event at LANL on 02/26/2021. Since that event, it has been determined the maximum time it would take for waste previously packaged in a drum to be exposed to at least 90% air is 236 days (i.e., at 236 days any potential pyrophoric materials are expected to have oxidized). The containers referenced above were packaged on 12/12/2018, 9/17/2019, 3/12/2020, and 2/21/2020, respectively. Therefore, they have all exceeded the 236 days and are acceptable to ship. Please let me know if you have any questions.

Hi Diana,

Please delete "Contains HEPA filters which may have been used in an operation that generated a prohibited waste form which could be trapped in the HEPA filter matrix" from the Special_Info column of containers 73611 and 74382.

Thank you.

Michael J. Papp, CCP AKE
Technical Specialists
Nuclear Waste Partnership, LLC
Contractor for the U. S. Department of Energy
Office #: 303-254-7959
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Design Document Review

1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		2. System Number: PT00
3. Document Number: PLD-CAL-0003	4. Document Revision: 0	5. Page: 1 of 1

6. Summary and Justification of Changes

Change	Justification
N/A	New issue.

7. Reviewers (Do Not Sign Until All Comments Are Resolved)

Reviewer	Name	Signature	Date
Document Preparer:	Brad Day	BRAD DAY (Affiliate) 2021.03.17 14:44:42 -06'00'	3/17/2021
Independent Reviewer:	Kyle Moyant	KYLE MOYANT (Affiliate) Digitally signed by KYLE MOYANT (Affiliate) Date: 2021.03.17 15:09:07 -06'00'	3/17/2021
Independent Reviewer:	Mike Lastra	MICHAEL LASTRA (Affiliate) Digitally signed by MICHAEL LASTRA (Affiliate) Date: 2021.03.18 10:29:47 -06'00'	N/A
Project Manager: (or Designee)	J. Biedscheid for Murthy Devarakonda	JENNIFER BIEDSCHEID (Affiliate) Digitally signed by JENNIFER BIEDSCHEID (Affiliate) Date: 2021.03.18 10:48:29 -06'00'	3/18/2021
Cognizant Manager: (or Designee)	A. Donner for Todd Sellmer	ANTHONY DONNER (Affiliate) Digitally signed by ANTHONY DONNER (Affiliate) Date: 2021.03.18 11:38:09 -06'00'	3/18/2021
QA Manager: (or Designee)	D. S. Tanner	DAVID TANNER (Affiliate) Digitally signed by DAVID TANNER (Affiliate) Date: 2021.03.18 10:57:09 -06'00'	3/18/2021

8. Calculation Review Method(s) (Check All That Apply; Attach Results)

	Independent Design Software Name	Version
■ One-Over-One Calculation Review		
■ Independent Calculation	1. Mathcad	15.0
■ Using Independent Design Software	2.	

9. Reviewer Comments and Resolutions

Reviewer	Comment	Resolution
All	Various	Comments and resolutions summarized in EDMS

10. Required Screenings *Exempt from WIPP screenings, for external use by LANL

USQ ☐ WP 02-AR3001 USQ#: N/A	EC/NEPA ☐ WP 02-EC3801
ALARA ☐ WP 12-2	HWFP ☐ WP 02-PC3001
CC ☐ WP 02-PC3003	

Calculation Cover Sheet

1. Document Title:		2. System Number:
Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		PT00
3. Document Number:	4. Document Revision:	5. Page:
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6. Summary Description

This calculation report documents the estimation of air concentration as a function of time that results from air infiltration via diffusion and permeation into a 4-mil polyethylene inner bag with a twist & tape closure that was previously subject to an inert argon gas atmosphere. The concentration profile is calculated for conditions where the bag is directly exposed to atmospheric air and also for conditions where the bag is surrounded by multiple confinement layers within a filtered 55-gallon drum. The purpose of the estimated concentration profiles is to provide input to subsequent evaluations that may consider the impact of air infiltration (e.g., oxidation) on bag waste contents.

7. Software Usage

	Software Name	Version
1.	Python (qualified per WP 16-2 through STP-PLN-0006 on March 11, 2020)	3.7
2.		
3.		
4.		

8. Preparer

Name	Signature	Date
Brad Day	BRAD DAY (Affiliate)	2021.03.17 14:43:28 -06'00'

9. Independent Reviewer(s)

Name	Signature	Date
Kyle Moyant	KYLE MOYANT (Affiliate)	Digitally signed by KYLE MOYANT (Affiliate) Date: 2021.03.17 15:08:05 -06'00'
Mike Lastra	MICHAEL LASTRA (Affiliate)	Digitally signed by MICHAEL LASTRA (Affiliate) Date: 2021.03.18 04:23:16 -06'00'
Jennifer Biedscheid	JENNIFER BIEDSCHEID (Affiliate)	Digitally signed by JENNIFER BIEDSCHEID (Affiliate) Date: 2021.03.18 08:11:30 -06'00'

10. Project Manager

Name	Signature	Date
J. Biedscheid for Murthy Devarakonda	JENNIFER BIEDSCHEID (Affiliate)	Digitally signed by JENNIFER BIEDSCHEID (Affiliate) Date: 2021.03.18 08:37:50 -06'00'

11. QA Manager

Name	Signature	Date
D. Steve Tanner (Designee)	DAVID TANNER (Affiliate)	Digitally signed by DAVID TANNER (Affiliate) Date: 2021.03.18 11:01:39 -06'00'

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Revision Number	Pages Affected	Revision Description
0	All	New Issue

1.0 INTRODUCTION

An energy release event at Los Alamos National Laboratory (LANL) on February 26, 2021, was experienced during a TRU waste drum loading process. The initial investigation conjectured that the event was initiated by breaching of a previously-inerted 4-mil polyethylene inner bag containing two HEPA filters laden with titanium and tantalum fume dust [Ref. 1]. Potential further evaluation of the event may require estimation of the time required for atmospheric air to infiltrate the 4-mil polyethylene inner bag in order to assess the degree to which the bag waste contents may have been exposed to oxygen as an inert gas atmosphere was displaced.

The time-dependent air concentration within the initially inerted 4-mil polyethylene inner bag, both for conditions of direct exposure to atmospheric conditions or when located within multiple layers of confinement initially containing air within a filtered 55-gallon TRU waste drum, can be determined through the solution of mass transport differential equations that model the transport of gases in the layer resistance network via diffusion and permeation mechanisms [Ref. 2].

2.0 SUMMARY OF RESULTS

A summary of the times to achieve a greater than 10, 20, 30, 40, 50, 60, 70, 80, and 90 percent air concentration within an initially inerted 4-mil polyethylene inner bag subject to conditions of a) direct exposure to atmospheric conditions and b) when located within multiple layers of confinement initially containing air within a filtered 55-gallon TRU waste drum is given in Table 1. Figure 1 provides the inner bag air concentration profiles for the two exposure conditions. The layer of confinement descriptions, modeling methodology, assumptions, and detailed modeling results are provided in Section 4.0. Additional solution sensitivity results associated with variable inner bag void volume assumptions for the directly exposed bag case are provided in Appendix A.1.

Table 1 – Summary of Time to Greater Than 90% Air Concentration in Inner Bag

Exposure Condition	Exposure Duration (days)	Air Concentration (%)
Bag (direct exposure)	5	12.164
	9	20.821
	14	30.452
	20	40.476
	27	50.359
	36	60.695
	47	70.452
	63	80.489
	89	90.060
Bag within 55-gal drum layers	5	10.549
	11	20.910
	18	30.804
	27	40.838
	38	50.089
	55	60.066
	83	70.143
	134	80.106
	236	90.047

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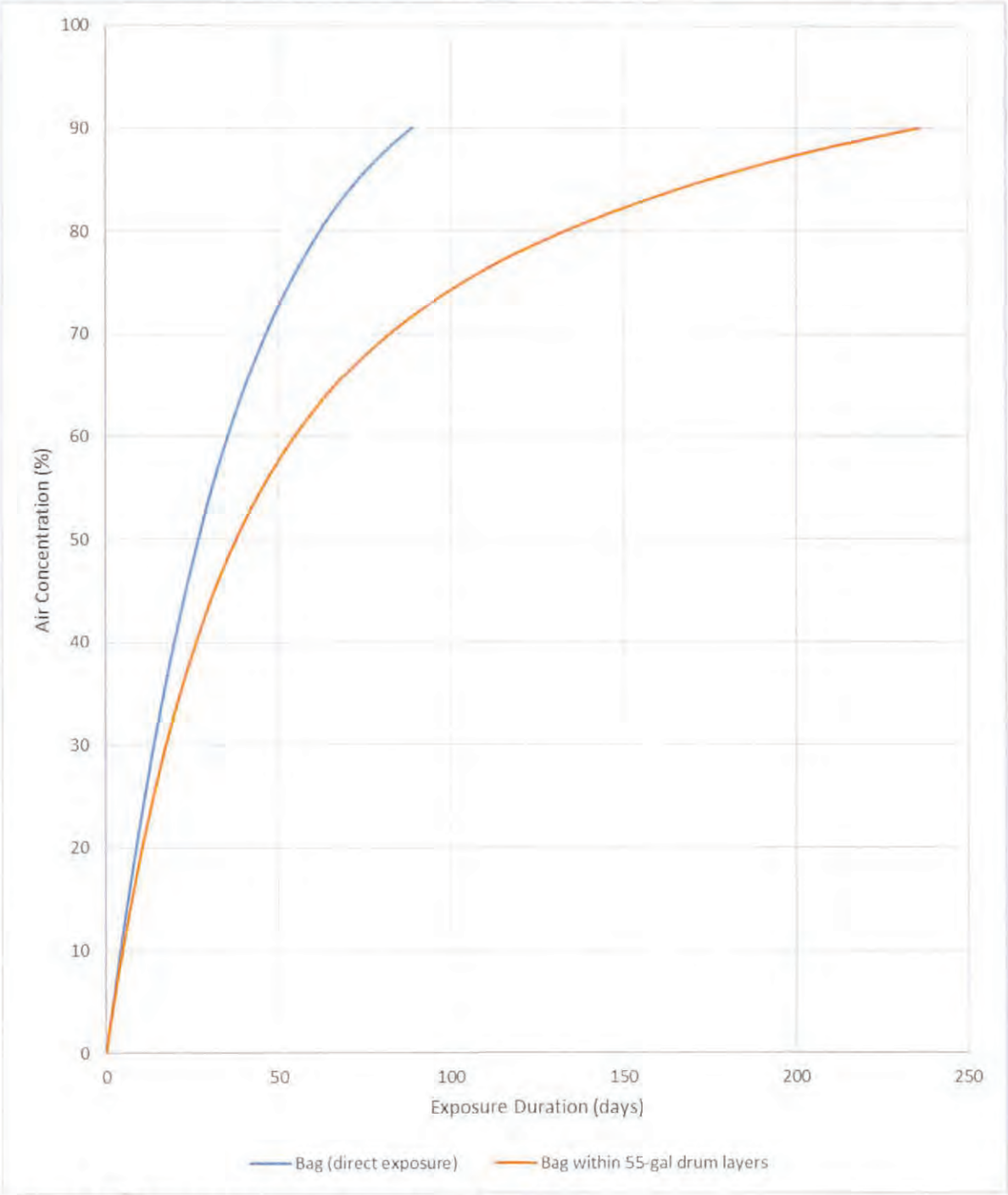

Figure 1 – Inner Bag Air Concentration Profiles

3.0 METHODOLOGY

3.1 Method

Following the AltMeth methodology defined in the CH-TRU Payload Appendix 3.10 [Ref. 2], the mass transport of air across serial layers of confinement via diffusion through the various closure types or filter vents and permeation through plastic bag layers are defined generally as follows for i = 1, n layers:

$$\frac{dX_i}{dt} = \frac{C_g RT}{V_i P}\left(86{,}400\frac{\text{sec}}{\text{day}}\right) - \frac{Q_i}{V_i}(X_i - X_{i+1})$$

$$\frac{dX_{i+1}}{dt} = \frac{Q_i}{V_{i+1}}(X_i - X_{i+1}) - \frac{Q_{i+1}}{V_{i+1}}(X_{i+1} - X_{i+2})$$

...

$$\frac{dX_n}{dt} = \frac{Q_{n-1}}{V_n}(X_{n-1} - X_n) - \frac{Q_n}{V_n}\left(X_n - \cancel{X_{n+1}}^{0}\right)$$

where:

C_g	=	innermost layer gas generation rate (mole/sec)
Q_i	=	release rate of gas across layer i (liters/day)
V_i	=	void volume inside layer i (liters)
X_i	=	mole fraction of gas within the void space layer i (mf)
P	=	pressure (atm)
R	=	gas constant = 0.08206 atm-liter/mole-K
T	=	temperature (K)

This system of equations are solved simultaneously by numerical integration through the use of an ordinary differential equation (ODE) solver (Python Scipy ODEINT) to determine the transport of air from the ambient environment across the defined layers of confinement.

Note that a more general form of the above equations are implemented in the Python script and solved numerically utilizing a nodal network model that allows for the solution of the mass balance as defined by the serial and/or parallel communication of gas between the interconnected nodes without the necessity to have the resistance factor and gas generation rate of parallel nodes identical.

3.2 Inputs

3.2.1 Layers of Confinement

The layers of confinement that are modeled are based on the two general cases defined (i.e., bag directly exposed to environment and bag within 55-gallon drum layers). Table 2 lists the prescribed layers of confinement and closure/filter attributes that were prescribed by Bush [Ref. 3].

Table 2 – Layer of Confinement Descriptions

Exposure Condition	Description
Bag (direct exposure)	Layer 1 (innermost layer): Inner bag (catch bag) is 4 mil LDPE with a size of 13" x 12" x 24" that is twist, tie, taped (TTT) before being removed from the inert (argon) box. This is moved into the drop box on a regular air box and will stay there until there is enough waste to perform a bag out.
Bag within 55-gal drum layers	Layer 1 (innermost layer): Same as above.
	Layer 2: LANL SPVC filtered bag-out bag that is also TTT when it goes into the drum. This bag is assumed to be an inner bag with a filtration of 1.075E-05 mol/s/mf, meeting the minimum requirement of the CH-TRAMPAC [Ref. 2 and 4].
	Layer 3: A 5-mil liner bag (fold/tape) [Ref. 2 and 4].
	Layer 4: A 12-mil filtered drum liner bag. This bag is assumed to have a filtration of 1.075E-05 mol/s/mf, meeting the minimum requirement of the CH-TRAMPAC [Ref. 2 and 4].
	Layer 5: A 90-mil rigid liner. This rigid liner is assumed to include a 0.3-inch diameter hole in the rigid liner lid, meeting the minimum requirement of the CH-TRAMPAC [Ref. 2 and 4].
	Layer 6: 55-gallon drum with a NucFil-019 filter. The NucFil-019 filter has a minimum hydrogen diffusivity value of 1.85E-05 mol/s/mf [Ref. 5].

3.3 Significant Assumptions

The modeling assumptions used to implement solution of the governing equations defined in Section 3.1 are as follows:

1. The directly exposed bag or drum has been modeled inside a very large enclosure of air (i.e., outside).
2. Only the innermost bag is initially purged of all air, and the remaining layers have a regular air atmosphere.
3. Transport ignores pressure-induced flow from barometric pressure or diurnal temperature changes (i.e., diffusion and permeation are the only transport mechanisms modeled).
4. Hydrogen diffusion-only resistance factors are taken from CH-TRU Payload Appendix 2.2 [Ref. 2], with the liner bag closure diffusion equal to the inner bag closure diffusion. Hydrogen permeation release rates are calculated from INEL-95/121 equation 2 [Ref. 6].
5. Air diffusion release rate is proportional to hydrogen release rate (i.e., assumed proportional to the square root of the inverse ratio of molar masses per Graham's Law of Diffusion).
6. Hydrogen permeation through polyethylene is given by CH-TRU Payload Appendix 6.13 [Ref. 2], normalized via the methods of Van Krevelen [Ref. 7] to oxygen bounding dry air.
7. Layer 1 (innermost layer) is assumed to be 25% full with a volume defined by its dimensions, the volume of Layer 2 is estimated to be 10% larger than Layer 1, and the volumes of Layers 3 and 4 are estimated as 10% progressively smaller than the rigid liner volume.
8. All diffusion mass transport coefficients utilized are minimum values. For the purposes of deriving a minimum wait time for a given quantity of air to infiltrate the inner bag under the prescribed environmental conditions, this is a conservative modelling assumption.

3.4 Acceptance Criteria

There is no explicit acceptance criteria for this calculation report.

4.0 ANALYSIS

4.1 Model Input Parameters

4.1.1 Initial Conditions

Initial conditions for the concentration of air within the inerted inner bag is zero, with any other layers non-inerted having an initial air concentration of 100%. There is no air generation term within the inner layer of confinement, so $C_g = 0$. The simulation is conducted under ambient conditions of 1 atm pressure and 77 °F (298.15 K) utilizing an ideal gas constant R = 0.08206 (atm L)/(mol K).

4.1.2 Diffusion and Permeation Coefficients and Physical Input Parameters

Reference values for hydrogen diffusion in air and hydrogen permeation through low-density polyethylene bag layers are obtained from the CH-TRU Payload Appendix 2.2 in the form of resistance factors and from CH-TRU Payload Appendix 2.13 in the form of a hydrogen permeation coefficient [Ref. 2 and 4]. The hydrogen values are corrected to equivalent air release rates by two methods. To convert the resistance-based diffusion coefficient from a hydrogen basis to air basis, the diffusion release rates are correlated based on the molecular weight of hydrogen vs air by assuming they are proportional to the square root of the inverse ratio of the molar masses (Graham's Law). With the molecular weight of hydrogen = 2.01588 g/mol and air = 28.9647 g/mol, the conversion factor is given as follows:

$$DF_{h2\_air} = \frac{1}{\sqrt{\frac{MW_{h2}}{MW_{air}}}} = \frac{1}{\sqrt{\frac{2.01588}{28.9647}}} = 3.79$$

The hydrogen to air correction factor for permeation through low-density polyethylene is based on a comparison of established non-dimensional comparative permeability ratios for nitrogen = 1, oxygen = 3.8, and hydrogen = 22.5 [Ref. 7]. To ensure a conservative permeation transport estimate with respect to oxygen, which is the oxidizing constituent of interest in air, selection of the oxygen permeability factor is utilized in comparison with the hydrogen permeability factor to result in the following hydrogen to air (oxygen) permeation coefficient correction factor:

$$PF_{h2\_air} = \frac{22.5}{3.8} = 5.92$$

Hydrogen-based diffusion resistance factors for various twist and tape bag closures and various filter specifications are provided in CH-TRU Payload Appendix 2.2 [Ref. 2]. Because twist and tape inner bag closures were experimentally evaluated and corrected to isolate the release mechanism to only consider diffusion, inner bag resistance factors for twist and taped closures are applied to all applicable confinement layers (i.e., drum liner bags) employing that closure

method to obtain a diffusion-only resistance factor. The relevant hydrogen diffusion-only resistance factors are summarized in Table 3.

Table 3 – Diffusion Resistance Factors

Resistance Factor	Layer Description
17922	TTT inner bag closure
931	1.075E-5 mol/s/mf bag filter
197	0.3 in. hole in rigid liner
541	1.85E-5 mol/s/mf bag filter

Determination of the hydrogen release rate and associated resistance factors for permeation through bag layers is possible as a function of the bag surface area, bag thickness, gas pressure, and permeability coefficient [Ref. 6]. The requisite volumes of the layers of confinement can be ascertained from the layers of confinement description of the size of the inner bag and the known fixed sizes of the drum and rigid liner. The confinement layers were previously provided in Table 2.

The volume of the innermost inner bag (Layer 1) is calculated from the 4-mil inner bag dimensions along with the specified thickness as follows:

$$IV_1 = (13\text{in} \times 12\text{in} \times 24\text{in})\left(\frac{1\text{L}}{61.0237\text{in}^3}\right) = 61.35\text{L}$$

$$xp_1 = (0.004\text{in})\left(\frac{2.54\text{cm}}{\text{in}}\right) = 0.010\text{cm}$$

Assuming the next layer (Layer 2) is 10% larger to surround the previous inner layer, the volume of the filtered inner bag is calculated along with the assumed 5-mil standard bag thickness as follows:

$$IV_2 = (IV_1)(1.1) = 67.49\text{L}$$

$$xp_2 = (0.005\text{in})\left(\frac{2.54\text{cm}}{\text{in}}\right) = 0.013\text{cm}$$

The internal volume of a 55-gallon drum (Layer 6) has been previously established as follows [Ref. 8]:

$$IV_6 = 216\text{L}$$

Using dimensional data for the rigid liner (Layer 5), its internal and external volume is given as follows (note that diffusion-only release through the lid hole is credited, not permeation through the liner body/lid or diffusion release at the lid to body interface)[Ref. 9]:

$$IV_5 = 198.77\text{L}$$

$$OV_5 = 203.18\text{L}$$

The 12-mil filtered liner bag (Layer 4) and the 5-mil twist and tape drum liner bag (Layer 3) are assumed to be progressively 10% smaller than the next outer layer such that the volumes and specified permeation thicknesses are as follows:

$$IV_4 = \frac{IV_5}{1.1} = 180.70\,L$$

$$xp_4 = 0.012\,in\left(\frac{2.54\,cm}{1\,in}\right) = 0.030\,cm$$

$$IV_3 = \frac{IV_4}{1.1} = 164.27\,L$$

$$xp_3 = 0.005\,in\left(\frac{2.54\,cm}{1\,in}\right) = 0.013\,cm$$

With the volumes of each layer established, the surface area of bag layers can be determined through an assumption that each bag takes on the shape of a stub-cylinder (diameter and length equal) and the void volumes within each layer can also be determined conservatively by ignoring interim layer waste components as follows, along with the corresponding characteristic diameter that correlates volume to surface area:

Layer 1

$$d_1 = \left(\frac{4}{\pi} IV_1\right)^{1/3} = 42.75\,cm$$

$V_1 = 0.75\,IV_1 = 46.01\,L$ inner bag assumed 25% full of waste

$$ap_1 = \frac{3\pi}{2}(d_1)^2 = 8611.38\,cm^2$$

Layer 2

$$d_2 = \left(\frac{4}{\pi} IV_2\right)^{1/3} = 44.13\,cm$$

$V_2 = IV_2 - IV_1 = 6.14\,L$ bag thickness assumed sufficiently small to ignore

$$ap_2 = \frac{3\pi}{2}(d_2)^2 = 9176.30\,cm^2$$

Layer 3

$$d_3 = \left(\frac{4}{\pi} IV_3\right)^{1/3} = 59.36\,cm$$

$V_3 = IV_3 - IV_2 = 96.78\,L$ bag thickness assumed sufficiently small to ignore

$$ap_3 = \frac{3\pi}{2}(d_3)^2 = 16604.46\,cm^2$$

Layer 4

$$d_4 = \left(\frac{4}{\pi} IV_4\right)^{1/3} = 61.28\,cm$$

$V_4 = IV_4 - IV_3 = 16.43\,L$ bag thickness assumed sufficiently small to ignore

$$ap_4 = \frac{3\pi}{2}(d_4)^2 = 17693.75\,cm^2$$

Layer 5

$V_5 = IV_5 - IV_4 = 18.07\,L$ bag thickness assumed sufficiently small to ignore

Layer 6

$V_6 = IV_6 - OV_5 = 12.82\,L$ liner thickness incorporated due to 90-mil thickness

Layer 7

$V_7 = 1\times10^7\,L$ assumed large exterior for ambient

With the values established above, the permeation resistance factors for the plastic bag layers can be established, first for hydrogen release and later corrected for air release, and combined with the diffusion resistance factors in parallel (as applicable for the layer). The hydrogen permeation release rate (Q_{ph2_bag}) and resistance factor (R_{ph2_bag}) for each bag layer is calculated from Leikhus [Ref. 6] using the established hydrogen permeation coefficient through polyethylene (8.60E-10 cm^3 [STP] cm/cm^2 s cmHg) given in the CH-TRU Payload Appendix 6.13 [Ref. 2] as follows:

$$Q_{ph2\_bag} = \left(4.46136\times10^{-5}\frac{mol}{cm^3}\right)\left(8.60\times10^{-10}\frac{cm^3[STP]cm}{cm^2\,s\,cmHg}\right)\left(\frac{P_{hg}\,ap}{xp}\right)$$

$$= 2.92\times10^{-12}\frac{cm\,mol}{cm^2\,s}\left(\frac{ap}{xp}\right)$$

where

$$P_{hg} = P\left(\frac{76\,cmHg}{1\,atm}\right)$$

and

$$R_{ph2\_bag} = \left(\frac{1}{100\,Q_{ph2\_bag}}\right)$$

Utilizing the parameters and equations previously defined, the hydrogen diffusion and permeation resistance factors for each layer are determined below, converted to equivalent air resistance parameters, and then combined in parallel (where applicable) to result in a total air resistance factor. Finally, the air resistance factors (R) are converted to air release rates (Q) at the specified temperature and pressure conditions (2.1139E6 (L/day)/(mol/s) at 77 °F and 1 atm).

Layer 1

$$Q_{ph2\_1} = 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\,\text{s}}\left(\frac{8611.38\text{cm}^2}{0.010\text{cm}}\right) = 2.47\times10^{-6}\frac{\text{mol}}{\text{s}}$$

$$R_{ph2\_1} = \left(\frac{1}{100\left(2.47\times10^{-6}\right)}\right) = 4046.15$$

$$R_{pair\_1} = (5.92)(4046.15) = 23957.45$$

$$R_{dair\_1} = (3.79)(17922) = 67934.23$$

$$R_1 = \text{Roundup}\left(\frac{1}{\left(\frac{1}{23957.45}\right)+\left(\frac{1}{67934.23}\right)}\right) = 17712$$

$$Q_1 = \left(\frac{1}{100(17712)}\right)\left(2.1139\times10^{6}\right) = 1.19\frac{\text{L}}{\text{day}}$$

Layer 2

$$Q_{ph2\_2} = 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\,\text{s}}\left(\frac{9176.31\text{cm}^2}{0.013\text{cm}}\right) = 2.11\times10^{-6}\frac{\text{mol}}{\text{s}}$$

$$R_{ph2\_2} = \left(\frac{1}{100\left(2.11\times10^{-6}\right)}\right) = 4746.31$$

$$R_{pair\_2} = (5.92)(4746.31) = 28103.18$$

$$R_{dair\_2} = (3.79)(931) = 3529.00$$

$$R_2 = \text{Roundup}\left(\frac{1}{\left(\frac{1}{28103.18}\right)+\left(\frac{1}{3529.00}\right)}\right) = 3136$$

$$Q_2 = \left(\frac{1}{100(3136)}\right)\left(2.1139\times10^{6}\right) = 6.74\frac{\text{L}}{\text{day}}$$

Layer 3

$$Q_{ph2\_3} = 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\text{s}}\left(\frac{16604.73\text{cm}^2}{0.013\text{cm}}\right) = 3.81\times10^{-6}\frac{\text{mol}}{\text{s}}$$

$$R_{ph2\_3} = \left(\frac{1}{100\left(3.81\times10^{-6}\right)}\right) = 2622.97$$

$$R_{pair\_3} = (5.92)(2622.97) = 15530.72$$

$$R_{dair\_3} = (3.79)(17922) = 67934.23$$

$$R_3 = \text{Roundup}\left(\frac{1}{\left(\frac{1}{15530.72}\right)+\left(\frac{1}{67934.23}\right)}\right) = 12641$$

$$Q_3 = \left(\frac{1}{100(12641)}\right)\left(2.1139\times10^{6}\right) = 1.67\frac{\text{L}}{\text{day}}$$

Layer 4

$$Q_{ph2\_4} = 2.92\times10^{-12}\frac{\text{cm mol}}{\text{cm}^2\text{s}}\left(\frac{17694.03\text{cm}^2}{0.030\text{cm}}\right) = 1.69\times10^{-6}\frac{\text{mol}}{\text{s}}$$

$$R_{ph2\_4} = \left(\frac{1}{100\left(1.69\times10^{-6}\right)}\right) = 5907.57$$

$$R_{pair\_4} = (5.92)(5907.57) = 34979.02$$

$$R_{dair\_4} = (3.79)(931) = 3529.00$$

$$R_4 = \text{Roundup}\left(\frac{1}{\left(\frac{1}{34979.02}\right)+\left(\frac{1}{3529.00}\right)}\right) = 3206$$

$$Q_4 = \left(\frac{1}{100(3206)}\right)\left(2.1139\times10^{6}\right) = 6.59\frac{\text{L}}{\text{day}}$$

Layer 5

$Q_{ph2\_5} = 0$ assumed zero due to thickness of liner

$R_{ph2\_5} = \text{N/A}$

$R_{pair\_5} = \text{N/A}$

$R_{dair\_5} = (3.79)(197) = 746.74$

$R_5 = \text{Roundup}(746.47) = 747$

$$Q_5 = \left(\frac{1}{100(747)}\right)\left(2.1139\times10^{6}\right) = 28.30\frac{\text{L}}{\text{day}}$$

Layer 6

$Q_{ph2\_6} = 0$ assumed no permeation through drum gasket

$R_{ph2\_6} = \text{N/A}$

$R_{pair\_6} = \text{N/A}$

$R_{dair\_6} = (3.79)(541) = 2050.69$

$R_6 = \text{Roundup}(2050.69) = 2051$

$$Q_6 = \left(\frac{1}{100(2051)}\right)\left(2.1139\times10^{6}\right) = 10.31\frac{\text{L}}{\text{day}}$$

Layer 7

$R_7 = 1\times10^{20}$ assumed large resistance due to no losses to ambient

$$Q_7 = \left(\frac{1}{100\left(1\times10^{20}\right)}\right)\left(2.1139\times10^{6}\right) = 0.00\frac{\text{L}}{\text{day}}$$

4.2 Analysis and Results

The input parameters calculated in Section 4.1 were configured as text input decks for use by the Python 3.7 script provided in Appendix A.3, which were executed on a Windows 10 workstation (S028540) to solve the governing equations defined in Section 3.1 The input decks and associated output files are provided in Appendix A.2 for the analysis cases. The analyses were set up to evaluate the air concentration due to infiltration from the ambient environment through the layers of confinement into the initially inerted innermost bag layer (Layer 1). [Note that the layer and node references in the input deck are script-specific and generally inverted from those presented in the main body of the report]. Table 1 and Figure 1 in Section 2.0 summarize the results of the primary evaluations for a) the inerted bag exposed to ambient air and b) the inerted inner bag placed within the defined layers of confinement to provide the air concentration as a function of time up to 90% air concentration. The duration of time to reach the minimum

concentration thresholds of 10 to 90% (in increments of 10%) were summarized. The bag exposed directly to the ambient environment reached an air concentration of at least 90% in 89 days whereas the bag within the drum layers of confinement required 236 days to achieve the same.

In addition, a series of sensitivity studies on the assumed waste fill percentage of the inerted bag was also performed utilizing the same inputs but without Layers 2 thru 6 present in the system of equations (i.e., bag exposed to ambient air). The purpose of the sensitivity study was to evaluate the effects of air concentration on bags that were filled with waste at percentages which deviated from the assumed 25% fill. As shown in Appendix A.1, and as expected, the concentration of air within the initially inerted bag is hastened by a greater fill percentage, with the 25% fill considered a reasonably conservative lower-bound for the LANL waste drums under consideration. The assumed waste fill percentages of 1, 25, 50, 75, and 99% resulted in 118, 89, 60, 30, and 2 days, respectively to achieve a minimum 90% air concentration.

4.3 Summary and Conclusions

The analyses described herein and associated results indicate that diffusion plus permeation air transport from the ambient environment through one or more layers of confinement into the initially inerted inner bag will occur within a time frame that is generally less than a year in duration. Particularly, neglecting the effects of pressure-induced flow present as a result of temperature fluctuations and barometric pressure changes tend to make the included calculations conservative in estimating the time duration to achieve air infiltration.

5.0 REFERENCES

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2. U.S. Department of Energy, Carlsbad Field Office, *CH-TRU Payload Appendices*, NRC Docket 71-9218, Rev 25, November 2020.
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4. U.S. Department of Energy, Carlsbad Field Office, *CH-TRAMPAC*, NRC Docket 71-9218, Rev 25, November 2020.
5. U.S. Department of Energy, Carlsbad Field Office, *CBFO Approved Filter Vents*, DOE/WIPP-11-3384, Rev. 18, December 2020.
6. K.J. Leikhus, et. al., *Validation of Gas Transport Modeling Computer Codes*, INEL-95/121, Idaho National Engineering Laboratory, Idaho Falls, Idaho, June 1995.
7. D. W. Van Krevelen, *Polymer Properties*, Elsevier, Amsterdam, The Netherlands, 1990.
8. B.A. Day, *Calculation of CH and RH Payload Container Waste Volumes*, PLD-CAL-0001, Rev. 1, Nuclear Waste Partnership LLC, Carlsbad, New Mexico, December 2013.
9. J.M. Nevarez, *POC Rigid Drum Liner*, POC-DWG-0011, Rev. 1, Nuclear Waste Partnership LLC, Carlsbad, New Mexico, August 2013.

APPENDIX A

A.1 Void Volume of Inner Bag Sensitivity Evaluation

The time to achieve 90% air concentration in an initially inerted inner bag exposed to the ambient environment was evaluated for various assumed waste fill percentages to determine the sensitivity of results to this assumed parameter. As shown in Figure 2, the time duration to reach 90% air concentration is very sensitive to the assumed percentage of waste fill of the inner bag. In the absence of specific waste fill data, the base case analysis selection of 25% is considered a reasonable general assumption.

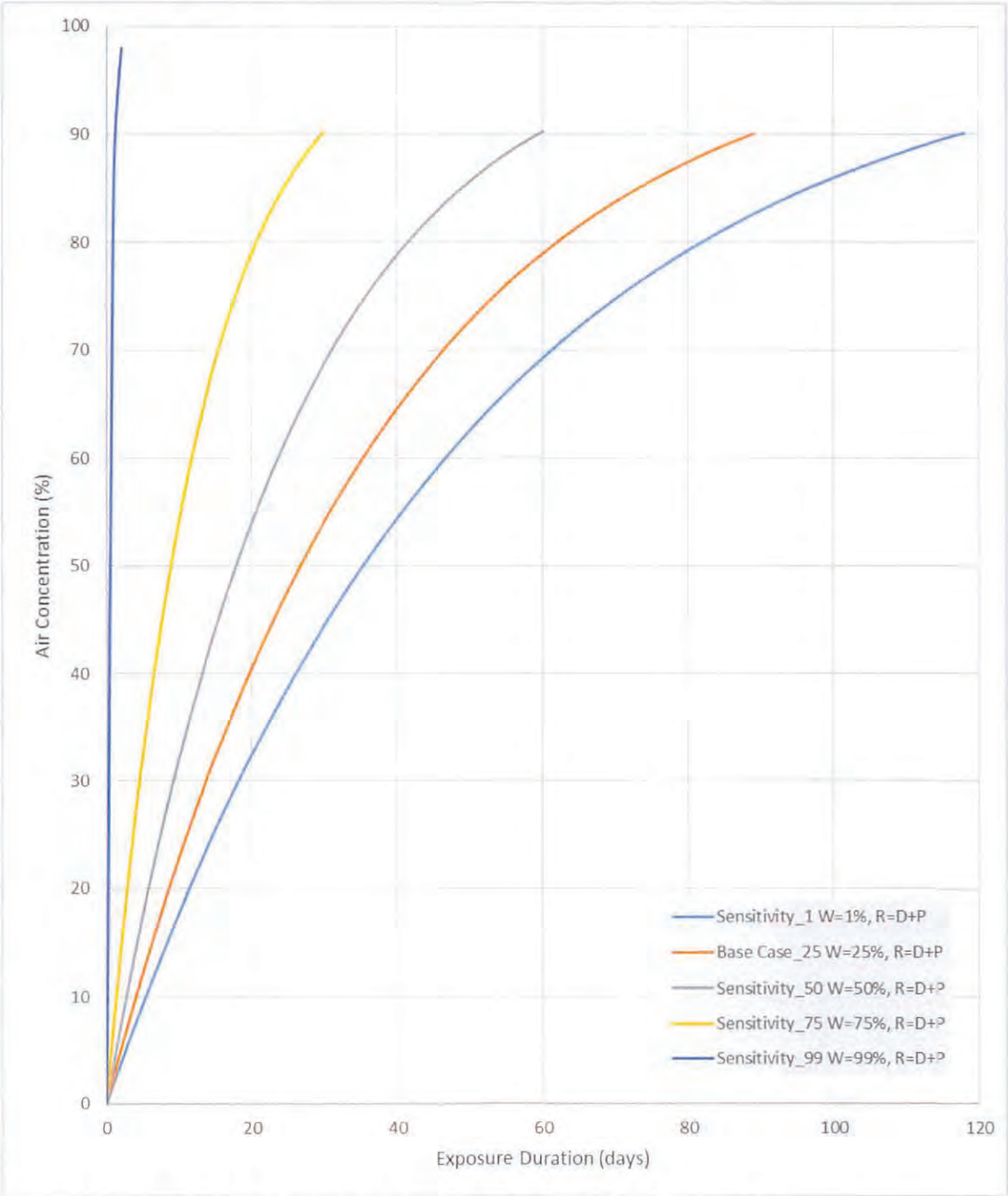


Figure 2 – Waste Fill Sensitivity Results for Directly Exposed Bag

A.2 Computer Run Listings

A.2.1 Bag (direct exposure) - 25% waste fill

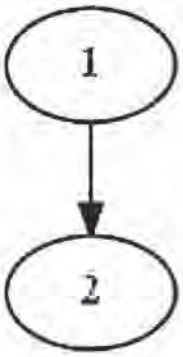
Input File: Bag_direct.i

```
Bag (direct exposure) - 25% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,46.01,1,17712.0,1,0.0000E+00,0.0
```

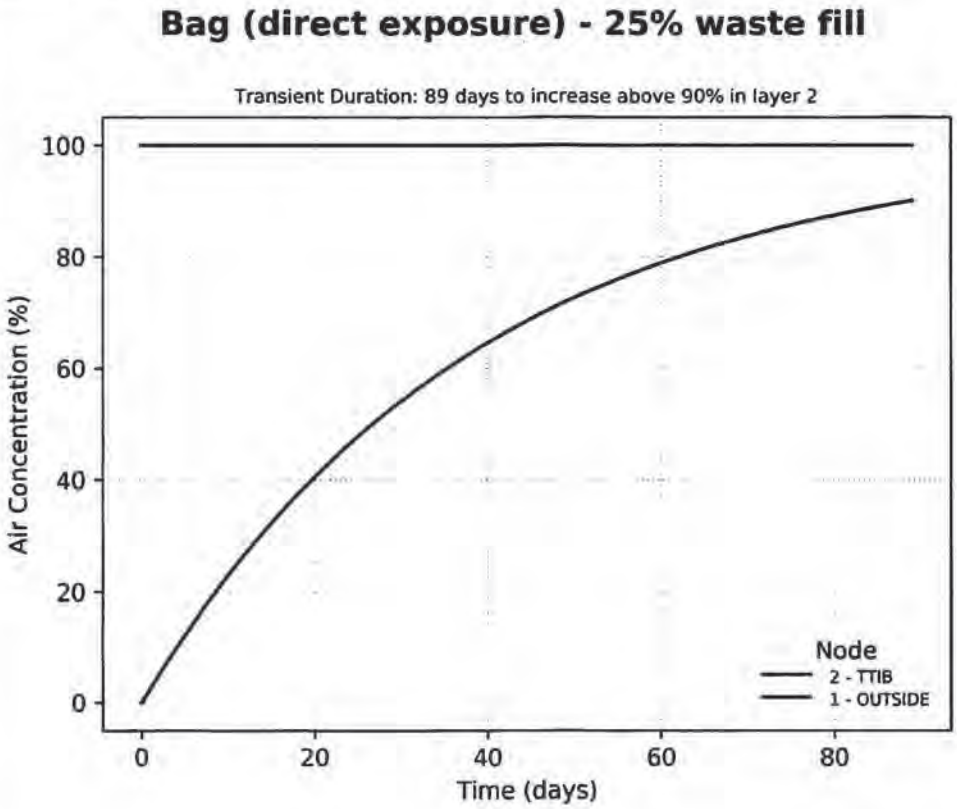
Output File: Bag_direct.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:58:55.347202

Title: Bag (direct exposure) - 25% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 89 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                    vvol lqty       rfac  rqty            cg
   1       0      1  OUTSIDE                       1e+07    1       1e+20     1             0
   2       1      2  TTIB                            46     1   1.77e+04     1             0


Results Summary ----------------------
node  description                   xci       xc       xz      pss
   1  OUTSIDE                   100.000    0.000  100.000      inf
   2  TTIB                        0.000    0.000   90.060      inf

Run completed (elapsed time): 0:00:01.762114
```

Network Map:



Transient Plot:



A.2.2 Bag (within 55-gal drum) - 25% waste fill

Input File: Bag_indrum.i

```
Bag (within 55-gal drum) - 25% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,7,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,55GD,12.82,1,2051.0,1,0.0000E+00,100.0
3,2,RLH,18.07,1,747.0,1,0.0000E+00,100.0
4,3,FDLB,16.43,1,3206.0,1,0.0000E+00,100.0
5,4,TTDLB,96.79,1,12641.0,1,0.0000E+00,100.0
6,5,FIB,6.14,1,3136.0,1,0.0000E+00,100.0
7,6,TTIB,46.01,1,17712.0,1,0.0000E+00,0.0
```

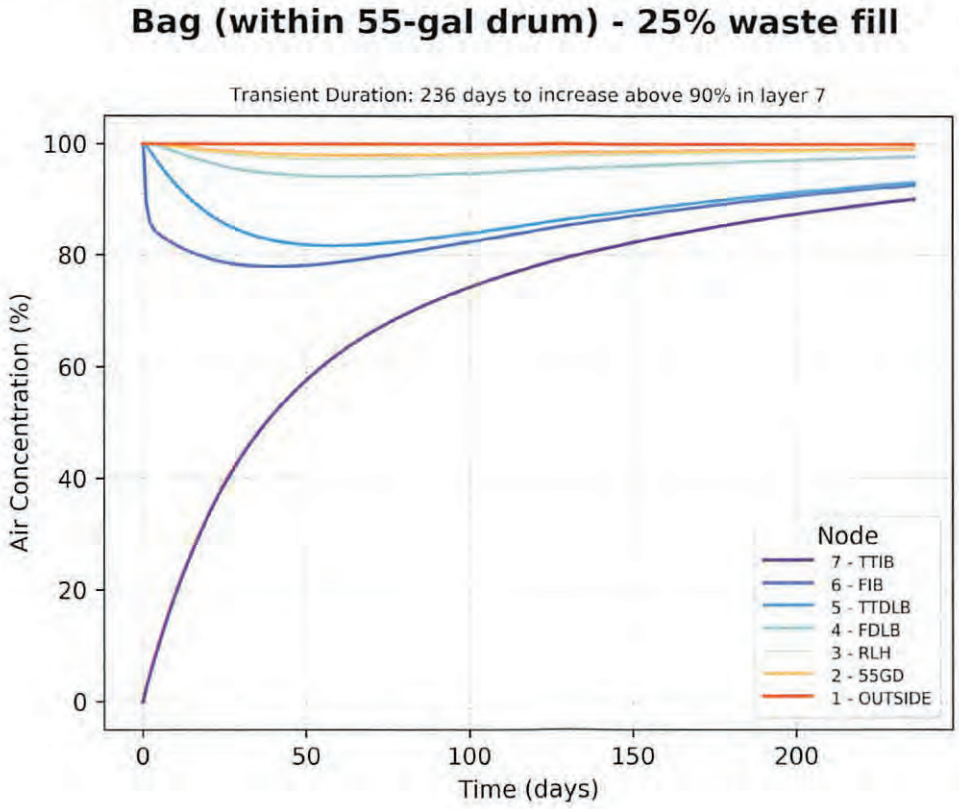
Output File: Bag_indrum.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 13:31:53.310400

Title: Bag (within 55-gal drum) - 25% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 236 days to increase above 90% in layer 7

Input Summary ----------------------
node  parent  layer  description                    vvol lqty       rfac  rqty          cg
   1       0      1  OUTSIDE                       1e+07    1      1e+20     1           0
   2       1      2  55GD                           12.8    1   2.05e+03     1           0
   3       2      3  RLH                            18.1    1        747     1           0
   4       3      4  FDLB                           16.4    1   3.21e+03     1           0
   5       4      5  TTDLB                          96.8    1   1.26e+04     1           0
   6       5      6  FIB                            6.14    1   3.14e+03     1           0
   7       6      7  TTIB                             46    1   1.77e+04     1           0


Results Summary ----------------------
node  description                    xci       xc       xz      pss
   1  OUTSIDE                    100.000    0.000  100.000      inf
   2  55GD                       100.000    0.000   99.206      inf
   3  RLH                        100.000    0.000   98.920      inf
   4  FDLB                       100.000    0.000   97.709      inf
   5  TTDLB                      100.000    0.000   93.085      inf
   6  FIB                        100.000    0.000   92.590      inf
   7  TTIB                         0.000    0.000   90.047      inf

Run completed (elapsed time): 0:00:03.265302
```

Network Map:

1. Document Title:		2. System Number:
Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		PT00
3. Document Number:	4. Document Revision:	5. Page:
PLD-CAL-0003	0	25 of 42

Transient Plot:



A.2.3 Bag (direct exposure) - Sensitivity with 1% waste fill

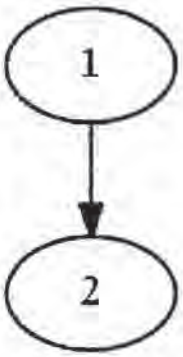
Input File: Sensitivity_1.i

```
Bag (direct exposure) - Sensitivity with 1% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,60.74,1,17712.0,1,0.0000E+00,0.0
```

Output File: Sensitivity_1.o

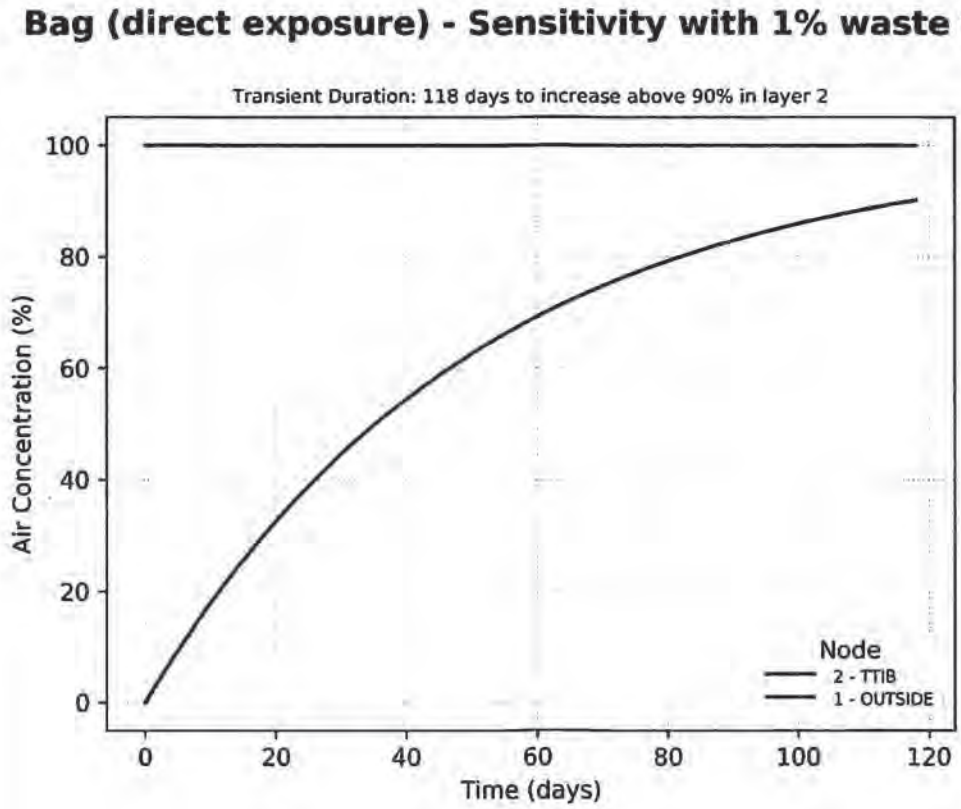
```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:59:00.894972

Title: Bag (direct exposure) - Sensitivity with 1% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 118 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                    vvol lqty       rfac  rqty            cg
   1       0      1  OUTSIDE                       1e+07    1      1e+20     1             0
   2       1      2  TTIB                           60.7    1   1.77e+04     1             0


Results Summary ---------------------
node  description                   xci       xc       xz      pss
   1  OUTSIDE                   100.000    0.000   99.999      inf
   2  TTIB                        0.000    0.000   90.158      inf

Run completed (elapsed time): 0:00:00.835379
```

Network Map:



1. Document Title: Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		2. System Number: PT00
3. Document Number: PLD-CAL-0003	4. Document Revision: 0	5. Page: 27 of 42

Transient Plot:



A.2.4 Bag (direct exposure) - Sensitivity with 50% waste fill

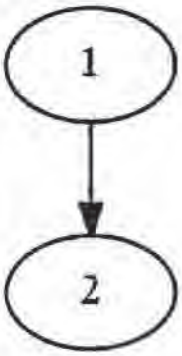
Input File: Sensitivity_50.i

```
Bag (direct exposure) - Sensitivity with 50% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,30.68,1,17712.0,1,0.0000E+00,0.0
```

Output File: Sensitivity_50.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:59:02.651919

Title: Bag (direct exposure) - Sensitivity with 50% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 60 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                    vvol lqty       rfac  rqty            cg
   1       0      1  OUTSIDE                       1e+07    1       1e+20     1             0
   2       1      2  TTIB                           30.7    1   1.77e+04     1             0


Results Summary ----------------------
node  description                    xci       xc       xz      pss
   1  OUTSIDE                    100.000    0.000  100.000      inf
   2  TTIB                         0.000    0.000   90.309      inf

Run completed (elapsed time): 0:00:00.867170
```

Network Map:



1. Document Title:		2. System Number:
Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		PT00
3. Document Number:	4. Document Revision:	5. Page:
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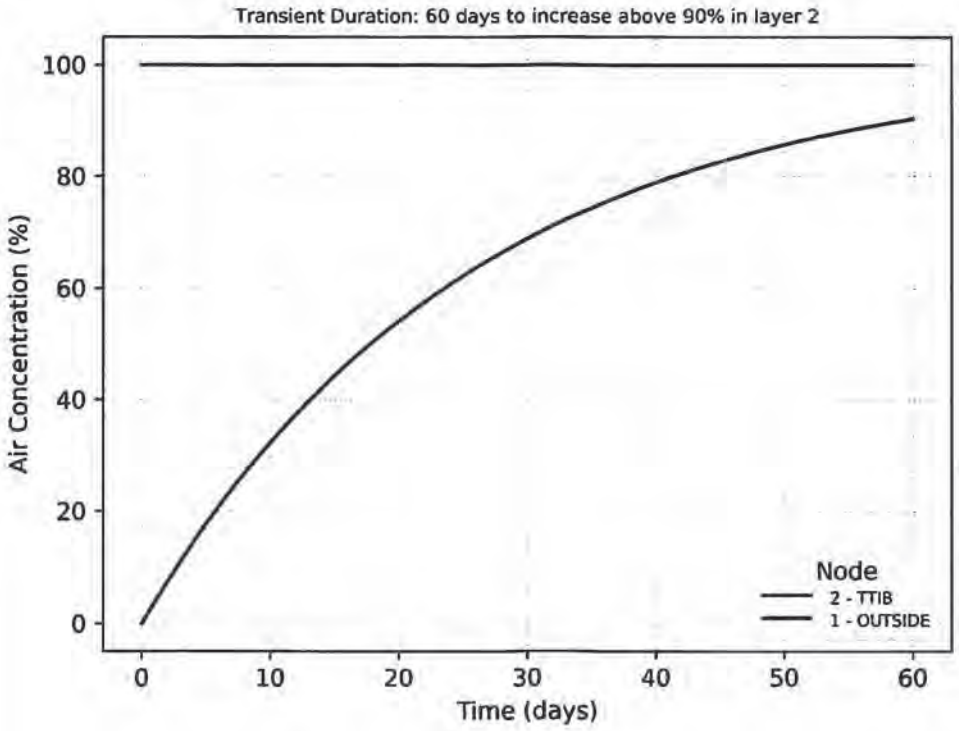
Transient Plot:

Bag (direct exposure) - Sensitivity with 50% waste fill



A.2.5 Bag (direct exposure) - Sensitivity with 75% waste fill

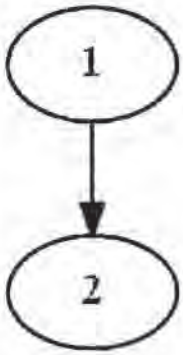
Input File: Sensitivity_75.i

```
Bag (direct exposure) - Sensitivity with 75% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,15.34,1,17712.0,1,0.0000E+00,0.0
```

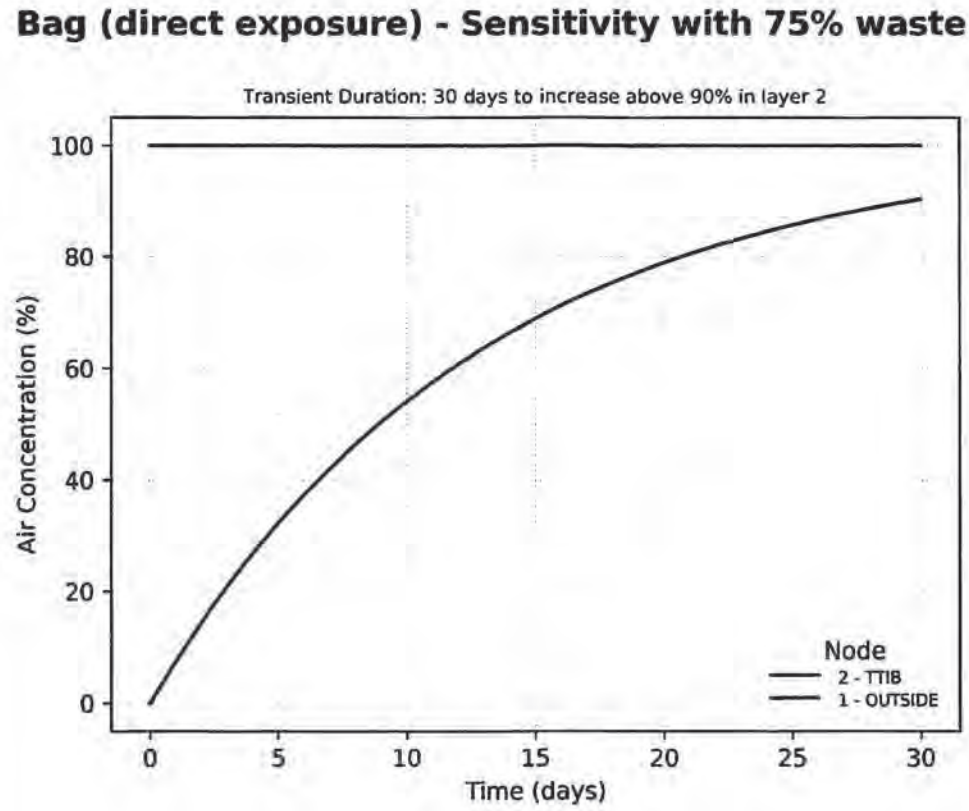
Output File: Sensitivity_75.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:59:04.938941

Title: Bag (direct exposure) - Sensitivity with 75% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 30 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                    vvol  lqty       rfac  rqty          cg
   1       0      1  OUTSIDE                       1e+07     1       1e+20     1           0
   2       1      2  TTIB                           15.3     1    1.77e+04     1           0


Results Summary ----------------------
node  description                   xci       xc       xz      pss
   1  OUTSIDE                   100.000    0.000  100.000      inf
   2  TTIB                        0.000    0.000   90.310      inf

Run completed (elapsed time): 0:00:00.882689
```

Network Map:



Transient Plot:



A.2.6 Bag (direct exposure) - Sensitivity with 99% waste fill

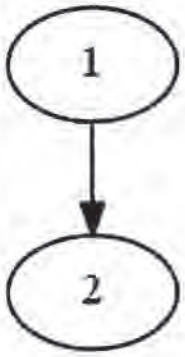
Input File: Sensitivity_99.i

```
Bag (direct exposure) - Sensitivity with 99% waste fill
T1,T2,R,P,nday,lconc,ltest,start,end
298.15,298.15,0.08206,1.0,0,90,2,2,0
node,parent,descr,vvol,lqty,rfac,rqty,cg,xci
1,0,OUTSIDE,1.0E+7,1,1.0E+20,1,0.0000E+00,100.0
2,1,TTIB,0.61,1,17712.0,1,0.0000E+00,0.0
```

Output File: Sensitivity_99.o

```
Code: COBRA2.1 for Python - executed @ 2021-03-17 07:59:06.767903

Title: Bag (direct exposure) - Sensitivity with 99% waste fill

Initial Conditions - as prescribed with outermost layer present (2)

Transient Duration: 2 days to increase above 90% in layer 2

Input Summary ----------------------
node  parent  layer  description                    vvol lqty       rfac  rqty            cg
   1       0      1  OUTSIDE                       1e+07    1       1e+20     1             0
   2       1      2  TTIB                           0.61    1   1.77e+04     1             0


Results Summary ----------------------
node  description                   xci       xc       xz      pss
   1  OUTSIDE                   100.000    0.000  100.000      inf
   2  TTIB                        0.000    0.000   98.002      inf

Run completed (elapsed time): 0:00:00.878876
```

Network Map:



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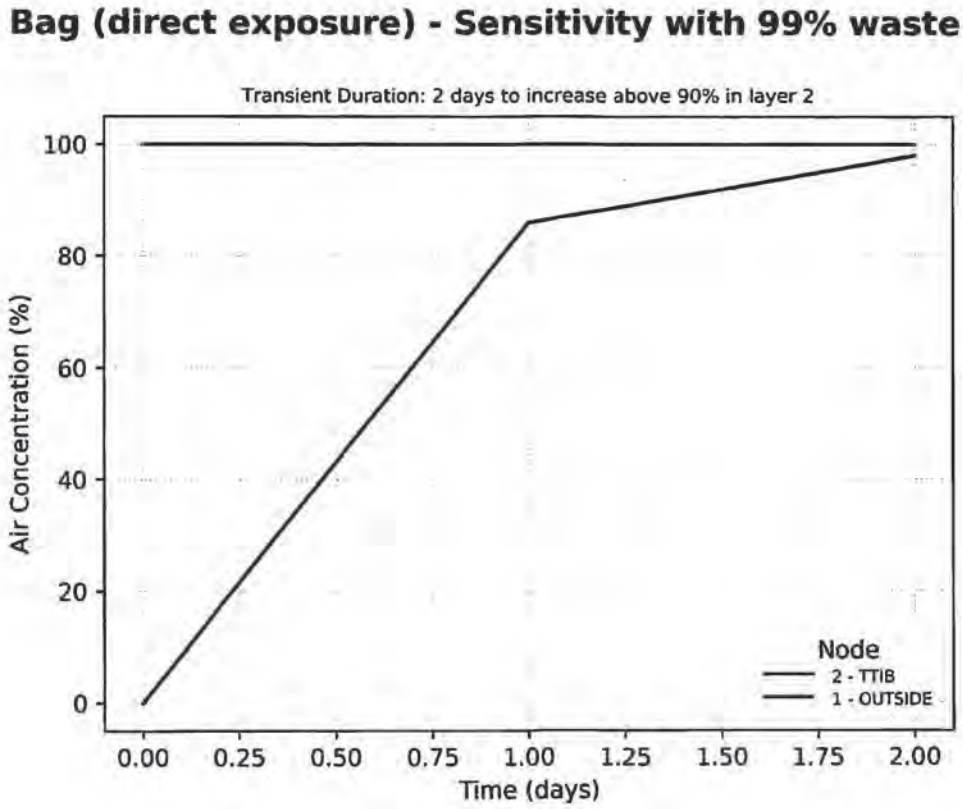
Transient Plot:



A.3 Python Script Listing

```
""" cobra2.1 air.py - Python Implementation of AltMeth
    Coded by: Stan Day, Nuclear Waste Partnership
    Date: 4/24/2018
    Last: 11/12/2019 - conversion from Python 2.7 to Python 3.7; add integration controls
          3/25/2021 - modified plot to indicate air instead of hydrogen
                      added output of csv files for inner concentration data vs time
    Description:

    Command Line: python cobra2.1 air.py -i inputfile -o outputfile -p plotflag -l [illegible] -m maxstep -t rtol -a atol
-n tmin -x tmax)

    Model of diffusion gas transport across a network of layers of confinement
    calculates the time to achieve a defined gas concentration in a specified
    layer of confinement for a given set of layers and gas generation rates,
    or calculates the gas generation rates required to achieve a specified
    gas concentration for a given set of layers and time, or simply determines
    the gas concentrations resulting from a given set of layers, gas generation
    rates, and time; initial conditions can be specified as
    start at zero concentration with all layers present (start = 1) or
    start at steady state concentration with outermost layer not present
    (start = 0), or start at a given concentration with all layers present (start = [illegible]

    This program is written in Python and utilizes Scipy subroutine for
    mathematical applications. The Scipy subroutine solves a series of
    first-order ordinary differential equations.

    Expanded to write output to word document.

    Revised to read in initial concentrations when start flag = 2

    Revised to read input file that has multiple concentration buildup phases
    and aggregate concentration history from results of prior phases,
    feeding the starting concentrations of previous into subsequent phases.
    Also added ability to specify tconc as a percentage of the steady state value

    Adjusted print operations to properly deal with 2-phase buildup to stop conditions

    Added options to specify integration controls from command line

"""

import argparse
import datetime
import os
import sys
import numpy as np
import scipy.optimize
from scipy import integrate
import networkx as nx
import matplotlib.pyplot as plt
from docx import Document
from docx.shared import Inches


def writecsvdata(timecsv, concentrationcsv, ofname):
#
#   Write inner layer concentration vs time to csv file
#
    outname = ofname + '[illegible]'
    dfo = open(outname, "[illegible]")
    for i in range(0, len(timecsv)):
        dfo.write("[illegible]"%timecsv[i] + "," + "[illegible]"%concentrationcsv[i] + "[illegible]")
    dfo.close()
    return


def fss(x, node, parent, layer, cggr, rcon, nnum):
#
#   Define steady-state system of equations for mass flow via diffusion
#   Variables:
#   - fin = mass flow into node
#   - fout = mass flow out of node
#   - fx = equation for total mass flow in/out of a node, including internal generation
#
    fin = np.zeros(nnum)
    fout = np.zeros(nnum)
    fx = np.zeros(nnum)
#   Calculate inflow
    for i in range(0,nnum):
        for j in range(0,nnum):
            if layer[i] != np.amax(layer):
                if parent[j] == node[i]:
                    fin[i] = fin[i] + rcon[j]*(x[j]-x[i])
        if layer[i] == np.amax(layer):
            fin[i] = 0.
#   Calculate outflow
    for i in range(0,nnum):
        for j in range(0,nnum):
```

```
            if layer[i] != np.amin(layer):
                if parent[i] == node[j]:
                    fout[i] = rcon[i]*(x[i]-x[j])
        if layer[i] == np.amin(layer):
            fout[i] = rcon[i]*(x[i])
#   Generate mass balance sums
    fx = cggr + fin - fout
    return fx


def epsse(x, t, xp, node, parent, vvol, layer, cggr, rcon, nnum):
#
#   Define transient system SS equations for mass flow via diffusion
#   Variables:
#   - fin = mass fraction flow into node
#   - fout = mass fraction flow out of node
#   - fx = equation for total mass fraction flow in/out of a node, including internal generation
#
    fin = np.zeros(nnum)
    fout = np.zeros(nnum)
#   Calculate inflow
    for i in range(0,nnum):
        for j in range(0,nnum):
            if layer[i] != np.amax(layer):
                if parent[j] == node[i]:
                    fin[i] = fin[i] + rcon[j]*(x[j]-x[i])/vvol[i]
        if layer[i] == np.amax(layer):
            fin[i] = 0.
#   Calculate outflow
    for i in range(0,nnum):
        for j in range(0,nnum):
            if layer[i] != np.amin(layer):
                if parent[i] == node[j]:
                    fout[i] = rcon[i]*(x[i]-x[j])/vvol[i]
        if layer[i] == np.amin(layer):
            fout[i] = rcon[i]*(x[i])/vvol[i]
#   Generate mass balance sums
    xp = cggr/vvol + fin - fout
    return xp


def calcss(start, vvol, node, parent, layer, cggr, rcon, nnum):
#
#   Determine steady-state results based on start condition (0 = outermost layer not present,
#   1 or 2 = outermost layer present) and set initial conditions for transient calculations based
#   on start condition (0 = SS ICs in all but outermost layer, 1 = zero ICs for all layers, 2 = as prescribed)
#   Variables:
#   - 'tmp' = temporary variables to hold outermost layer when removed from steady-state evaluation
#
    if start == 0:
        xinit = np.zeros(nnum)
        xc = np.zeros(nnum)
        tmprcon = rcon[0]
        tmpvvol = vvol[0]
        rcon[0] = 1.e12
        vvol[0] = 1.e12
        olstatus = '
        xc = 100.*scipy.optimize.fsolve(fss, xinit, args=(node, parent, layer, cggr, rcon, nnum))
        rcon[0] = tmprcon
        vvol[0] = tmpvvol
        xinit = xc/100.
    else:
        xinit = np.zeros(nnum)
        xc = np.zeros(nnum)
        if start == 1:
            olstatus = '
        else:
            olstatus =
        xc = 100.*scipy.optimize.fsolve(fss, xinit, args=(node, parent, layer, cggr, rcon, nnum))
    return xc, olstatus, xinit


def readin(ifname):
#
#   Read input from data file specified by the command line
#   Variables:
#   - fi = input file handle
#   - title = user-defined title of evaluation
#   - si* = temporary variables to facilitate input file reads
#   - T1 = temperature for gas generation rates (K)
#   - T2 = temperature for release rates (K)
#   - R = gas constant (L atm / mol K)
#   - P = pressure (atm)
#   - nday = number of days requested for transient evaluation (0 = run until lconc/ltest satisfied)
#   - lconc = concentration (%) to use as stop condition for transient run
#   - ltest = layer (#) to evaluate the concentration test against
#   - start = flag to indicate transient initial condition type (0 = start at steady-state for all internal
#       layers, outermost layer ignored; 1 = start at zero for all layers, outermost layer present)
#   - snn = flag to indicate whether gas generation rates should be scaled to achieve the specified lconc
#       and ltest conditions (0 = no scale, 1 = scale)
#   - data = temporary variable to red input lines
```

```
#   - node = list of node numbers (i = 0, nnum-1)
#   - parent = list of parent node numbers associated with each node (i = 0, nnum-1)
#   - layer = list of layers numbers counting from outside in (1 = outermost, 2 = next outermost, ...)
#   - descr = string describing node characteristics, layers of confinement, etc. (i = 0, nnum-1)
#   - vvol = void volume for node (i = 0, nnum-1)
#   - lqty = number of duplicate layers of confinement represented by the node (i = 0, nnum-1)
#   - rfac = resistance factor for node, see CH-TRU Payload Appendix 3.2 (i = 0, nnum-1)
#   - rqty = quantity of rfac applied to node, e.g., number of filters/punctures (i = 0, nnum-1)
#   - cg = gas generation rate within each node (mol/sec) (i = 0, nnum-1)
#   - xci = initial concentration within each node (-) (i = 0, nnum-1)
#   - lconctmp = temporary variable to determine if condition is entered as a % value
#   - percss = flag to specify how lconc is to be interpreted (0 = as concentration, 1 = as % of

    fi = open(ifname, 'r')
    title = fi.readline().rstrip('\n')
    si1 = fi.readline().strip().split('!')
    si2 = fi.readline().strip().split(',')
    T1 = float(si2[0])
    T2 = float(si2[1])
    R = float(si2[2])
    P = float(si2[3])
    nday = float(si2[4])
    lconctmp = str(si2[5])
    if lconctmp[-1] == '%':
        lconc = float(lconctmp[:-1]) / 100.
        percss = 1
    else:
        lconc = float(si2[5])
        percss = 0
    ltest = int(si2[6])
    start = int(si2[7])
    end = int(si2[8])
    data = np.loadtxt(ifname, dtype='i4, i4, i4, f8, f8, f8, f8', delimiter=',', comments='#', skiprows=4)
    node = np.array(data[:,0], dtype='i4')
    parent = np.array(data[:,1], dtype='i4')
    descr = np.array(data[:,2], dtype='i4')
    vvol = np.array(data[:,3], dtype='f8')
    lqty = np.array(data[:,4], dtype='f8')
    rfac = np.array(data[:,5], dtype='f8')
    rqty = np.array(data[:,6], dtype='f8')
    cg = np.array(data[:,7], dtype='f8')
    if start == 2:
        xci = np.array(data[:,8], dtype='f8')
    else:
        xci = np.zeros(len(node))
    fi.close()
    return title, T1, T2, R, P, nday, lconc, ltest, start, end, node, parent, descr, vvol, lqty, \
      rfac, rqty, cg, xci, percss


def lkuppa(nask, nnum, node, parent):
#
#   Lookup the parent associated with a specified node
#   Variables:
#   - nask = node given for search
#   - parans = associated parent node given as answer
#
    for i in range(0,nnum):
        if node[i] == nask:
            parans = parent[i]
    return parans


def netmap(nnum, parent, node, npar, ofname, plotflag):
#
#   Create network adjacency list, read as graph, and plot
#   Variables:
#   - hds, hdf, G = variables to store hierarchical association of nodes and parents in graph form
#
    hds = []
    for i in range(0,nnum):
        tmp = []
        k = 0
        for j in range(0,nnum):
            if parent[j] == node[i]:
                if k == 0:
                    tmp.append(parent[i])
                    tmp.append(node[j])
                    k = k + 1
                else:
                    tmp.append(node[j])
        hds.append(tmp)
    hdf = [e for e in hds if e]
    if plotflag == 'y' or plotflag == 'Y' or plotflag == 1:
        ft = open('netmap.txt', 'w')
        for i in range (0,npar):
            ft.write(str(hdf[i])[1:-1].replace(',', '') + '\n')
        ft.close()
        fh = open('netmap.txt', 'r')
        G = nx.read_adjlist(fh,create_using=nx.DiGraph())
        fh.close()
```

```
        os.remove('        ')
        nodechart = nx.nx_agraph.to_agraph(G)
        nodechart.layout('    ')
        nodechart.draw(ofname + '     ')
    return


def phase_prep(ifname):
#
#   Write temporary input files if input file contains more than one phase
#   Variables:
#   - phasenum - counter for number of phases contained in primary input file
#   - phaseflag - flag to indicate whether multiple phases are required (0 = no, 1 = yes)
#
    phaseflag = 0
    phasenum = 0
    fi = open(ifname , ' ')
    line = fi.readline()
    if line[:5] == "     ":
        phaseflag = 1
        phasenum = phasenum + 1
        fo = open(" " + ifname + "     " + str(phasenum), " ")
        while line:
            line = fi.readline()
            if line[:5] == "     ":
                fo.close()
                phasenum = phasenum + 1
                fo = open(" " + ifname + "     " + str(phasenum), " ")
            else:
                fo.write(line)
    if phaseflag == 1: fo.close()
    fi.close()
    return phasenum, phaseflag


def    ():
#
#   Calculate steady-state concentrations and transient buildup
#   Variables:
#   - args - list of arguments passed from command line input
#   - ifname - input file name
#   - ofname - output file name
#   - plotflag - flag to indicate desire to plot nodal connectivity and transient buildup
#       (T/t = true, F/f = false
#   - nnum - count of number of nodes
#   - npar - count of number of unique parents
#   - conv - conversion constant from mol/sec to L/day
#   - fcon - flow conductance (L/day   i = 0, nnum-1)
#   - vgit - gas generation rate within each node (L/day   (i = 0, nnum-1)
#   - xinit - initial concentrations (   for each node (i = 0, nnum-1)
#   - xs - final steady-state concentrations (  for each node ( ) (i = 0, nnum-1
#   - ststatus - string to summarize start condition flag application to steady-state evaluation
#   - tinit - start time (day), 0
#   - nday - final day for evaluation, set to 1, if nday is 0, and then incremented until condition met
#   - tend - final time (day)
#   - time - array defining time with output increment = nday + 1
#   - xp - derivative of xt transient concentrations ( ) with respect to time for each node (i = 0, nnum-1)
#   - xt - transient concentrations    at each node (i = 0, nnum-1; time)
#   - pss - percent of steady-state reached by xt at the final time ( )
#   - ltmp, lmax - temporary variables to determine maximum concentration reached at the end of time
#       for the layer being tracked
#   - endf - flag to indicate end of incrementing days
#   - lnum - array index associated with the ltest condition
#   - now - current date and time at start of run
#   - now2 - current date and time and end of run
#   - lconstat - layer concentration test
#   - timehistory - concatenation of time history
#   - conchistory - concatenation of concentration history
#   - plottitle - plot title
#   - plotsubtitle - plot subtitle
#   - mxstep - maximum number of integration steps for solver
#   - atol - absolute integration error tolerance for solver
#   - rtol - relative integration error tolerance for solver
#   - tmin - minimum absolute time step for solver
#   - tmax - maximum absolute time step for solver
#
#   Get date and time
    now = datetime.datetime.now()
#
#   Read command line arguments
    parser = argparse.ArgumentParser(description='                    ')
    parser.add_argument('- ','-       ', help='                  ', required=True)
    parser.add_argument('  ','--      ',help='                  ', required=True)
    parser.add_argument('  ','-        ',help='                  ', required=True)
    parser.add_argument('- ','--       ',help='                  ', required=False)
    parser.add_argument('- ','        ',help='                                   ', required=False)
    parser.add_argument('  ','-       ',help='                                   ', required=False)
    parser.add_argument('  ','--      ',help='                                   ', required=False)
    parser.add_argument('- ','--      ',help='                         ', required=False)
    parser.add_argument('- ','--      ',help='                         ', required=False)
    args = parser.parse_args()
```

```
    ifname = args.input
    ofname = args.output
    plotflag = args.plotting
    if args.legend == None:
        legendloc = 0
    else:
        legendloc = int(args.legend)
    mxstep = args.mxstep
    rtol = args.rtol
    atol = args.atol
    tmin = args.tmin
    tmax = args.tmax
#   Set integration options based on command line inputs
    if mxstep == None:
        mxstep = 0
    else:
        mxstep = int(mxstep)
    if rtol == None:
        rtol = 1.49012e-8
    else:
        rtol = float(rtol)
    if atol == None:
        atol = 1.49012e-8
    else:
        atol = float(atol)
    if tmin == None:
        tmin = 0
    else:
        tmin = float(tmin)
    if tmax == None:
        tmax = 0
    else:
        tmax = float(tmin)
#
#   Open files for writing results
    fo = open(ofname, "w")
    dfi = open(ifname, "r")
    dfo = open(ofname, "w")
#
#   Read data file to determine phase type
    phasenum, phaseflag = phasefileprep(ifname)
#
#   Loop over the number of concentration profile phases
#
    if phaseflag == 0:
        phasenum = 1
#
    for phases in range(0, phasenum):
#
#   Read input from data file
        if phaseflag == 1:
            ifpname = "./" + ifname + "." + str(phases+1)
            title, T1, T2, R, P, nday, lconc, ltest, start, end, node, parent, descr, vvol, lqty, \
              rfac, rqty, cg, xci, percss = readin(ifpname)
        else:
            title, T1, T2, R, P, nday, lconc, ltest, start, end, node, parent, descr, vvol, lqty, \
              rfac, rqty, cg, xci, percss = readin(ifname)
#
#   Determine number of nodes and unique parents
        nnum = len(node)
        npar = len(np.unique(parent))-1
#
#   Determine layer level of each node
        tmplayer = np.zeros(nnum)
        for i in range(0,nnum):
            nask = node[i]
            while True:
                parans = findpar(nask, nnum, node, parent)
                if parans == 0:
                    break
                nask = parans
                tmplayer[i] = tmplayer[i] + 1
        layer = tmplayer + 1
#
#   Determine index of lconc test (ltest) and save original lconc as lconctst
        lconctst = lconc
        for i in range(0,nnum):
            if layer[i] == ltest:
                lnum = i
#
#   Conversion for gas generation rates from mol/s to g/day at T1
        conv1 = R * T1 * 86400 / P
#
#   Conversion for release rates from mol/s to g/day at T2
        conv2 = R * T2 * 86400 / P
#
#   Convert resistance factors to consistency in g/day at T2
        rcon = np.zeros(nnum)
        for i in range(0,nnum):
            if rfac[i] == 0.:
                rcon[i] = 0.
```

```
            else:
                rcon[i] = ((1./(lqty[i]*rfac[i]*100.))*rqty[i])*conv2
#
#   Loop to scale gas generation rates to meet end condition (0 = no scale, 1 = scale)
#
        endf = 0
        while True:
#
#   Convert gas generation rate from mol/set to L/day at T1
            cggr = cg*conv1
#
#   Calculate steady-state conditions
            xc, olstatus, xinit = calcss(start, vvol, node, parent, layer, cggr, rcon, nnum)
#
#   Initialize time variables
            tinit = 0.
            if nday == 0.:
                ndayf = 1.
            else:
                ndayf = nday
            tend = ndayf
#
#   Overwrite initial conditions if conditions are specified in input file (start = 2) or
#   analysis phases dictate using previous run final transient conditions as initial conditions;
#   set initial conditions for printing equal to those set in SS calculation (start = 0).
            if start == 1 and phaseflag == 0 and phases == 0:
                xinit = xci/100.
            if start == 0 and phaseflag == 0 and phases == 0:
                xci = xinit*100.
            if phaseflag == 1 and phases > 0:
                start == 2
                olstatus = "
                xci = np.zeros(nnum)
                for i in range(0, nnum):
                    xci[i] = xz[nfinal,i]
                xinit = xci/100.
#
#   Integrate system of equations to get transient concentrations
#
            while True:
                time = np.linspace(tinit, tend, int(ndayf + 1))
                xp = np.zeros(nnum)
                xz = integrate.odeint(xprime, xinit, time, \
                  args=(xp, node, parent, vvol, layer, cggr, rcon, nnum), \
                  mxstep = mxstep, rtol = rtol, atol = atol, hmin = tmin, hmax = tmax)
                xz = 100.*xz
#
#   Calculate lconc as percent at SS in specified layer and determine concentration slope
                if ndayf <= 1. or nday != 0.:
                    if ltest == 0:
                        concslope = xz[int(ndayf),0] - xz[int(ndayf)-1,0]
                    else:
                        concslope = xz[int(ndayf),lnum] - xz[int(ndayf)-1,lnum]
                    if concslope > 0. and endf == 0 and percss == 1:
                        lconc = xc[lnum]*lconctst
                    if concslope < 0. and endf == 0 and percss == 1:
                        lconc = xc[lnum]/lconctst
#
#   Determine if concentration in specified layer and end of the analysis reaches the defined value,
#   if it can or has reached the specified stop conditions
                if nday == 0. and end == 0:
                    if concslope > 0.:
                        if xz[int(ndayf),lnum] >= lconc:
                            print("                                                    )
                            break
                        if xc[lnum] < 0.999*lconc and start == 1:
                            print("                                                    )
                            break
                        if xz[int(ndayf),lnum] > 1.001*xc[lnum] and start == 1:
                            print("                                                    )
                            break
                    if concslope < 0.:
                        if xz[int(ndayf),lnum] <= lconc:
                            print("                                                    )
                            break
                        if xc[lnum] > 1.001*lconc and start == 1:
                            print("                                                    )
                            break
                        if xz[int(ndayf),lnum] < 0.999*xc[lnum] and start == 1:
                            print("                                                    )
                            break
                    if ndayf == nday:
                        print("                                                    ")
                        break
                    ndayf = ndayf + 100.
                    tend = ndayf
                if nday == 0. and end == 1:
                    print("                                                    )
                    break
                if nday != 0.:
                    break
```

```
            print("                                    ", ndayf)
#
#   Determine time at which solution meets the stop condition
        if nday == 0.:
            for i in range(0, int(ndayf)):
                if concslope > 0. and xz[i, lnum] > lconc:
                    nfinal = i
                    break
                elif concslope < 0. and xz[i, lnum] < lconc:
                    nfinal = i
                    break
                else:
                    nfinal = int(ndayf)
        else:
            nfinal = int(ndayf)
        print("                                    ", nfinal)
#
#   Calculate transient end concentration as a percent of steady-state (based on selection approached)
        if start == 0:
            pss = np.zeros(nnum)
            for i in range(1,nnum):
                if concslope > 0:
                    pss[i] = (xz[nfinal,i]/xc[i])*100.
                elif concslope < 0:
                    pss[i] = (xc[i]/xz[nfinal,i])*100.
        else:
            if concslope >= 0:
                pss = (xz[nfinal]/xc)*100.
            if concslope < 0:
                pss = (xc/xz[nfinal])*100.
#
#   Table gas generation rates as required
        if nday == 0. or endf != 0:
            break
        if nday != 0. and end == 0:
            break
        if nday != 0. and end == 1:
            lscale = lconc/xz[int(nfinal),lnum]
            cg = cg * lscale
            endf = endf + 1
            print("                                                    ")
#
#   Write results to output file
    if phases > 0:
        fo.write("   " + "   ")
    else:
        fo.write("                                                    " + str(ncw) + "   " + "   ")
    fo.write("          " + title + "   " + "   ")
    fo.write(olstatus + "   " + "   ")

    print("          ", nday)
    print("          ", start)
    print("          ", ltest)
    print("          ", lconc)
    if ltest == 0:
        print("          ", xz[int(nfinal),0])
        print("          ", xc[0])
    else:
        print("          ", xz[int(nfinal),lnum])
        print("          ", xc[lnum])
    print("          ", nfinal)
    print("      ", end)

    if nday == 0 and concslope > 0 and xz[nfinal,lnum] > lconc and end == 0:
        stopsummary = "                    " + "    " + "%nfinal + "    " + "                    " + "    " + "%lconc + \
        "                    " + "    " + "%ltest
    if nday == 0 and concslope < 0 and xz[nfinal,lnum] < lconc and end == 0:
        stopsummary = "                    " + "    " + "%nfinal + "    " + "                    " + "    " + "%lconc + \
        "                    " + "    " + "%ltest
    if nday == 0 and concslope > 0 and xz[lnum] < lconc and start == 1 and end == 0:
        stopsummary = "                    " + "    " + "%nfinal + "    " + "                    " + "    " + \
        "%lconc + " + "    " + "%ltest
    if nday == 0 and concslope <  and xz[lnum] > lconc and start == 1 and end == 0:
        stopsummary = "                    " + "    " + "%nfinal + "    " + "                    " + "    " + \
        "%lconc + " + "    " + "%ltest
    if ndayf == nday and end == 0:
        stopsummary = "                    " + "    " + "%nfinal + "    "
    if ndayf == nday and end != 0:
        stopsummary = "                    " + "    " + "%nfinal + "    " + "                    " + "    " + "%lconc + \
        "                    " + "    " + "%ltest + "                    " + "    " + "%lscale
    if nday == 0 and xz[nfinal,lnum] > xc[lnum] and start == 1 and end != 0:
        stopsummary = "                    " + "    " + "%nfinal + "    " + "                    " + "    " + "%lconc + \
        "                    " + "    " + "%ltest
    if nday == 0 and end == 1:
        stopsummary = "                    " + "    " + "%nfinal = "                                                    " + \
        "                    "

    stopsum = "    ".join(stopsummary.split())
    fo.write(stopsum + "    " + "   ")

    fo.write("                                                    " + "   ")
    fo.write("                                                                    + \
```

```
                                  " + "  ")
    for i in range(0, nnum):
        fo.write('   '%node[i] + "    " + '   '%parent[i] + "    " + "   '%layer[i] + "   " + \
            ' -   '%descr[i] + "   " + '    '%vvol[i] + "   " + '   '%lqty[i] + "   " + '    '%rfac[i] + \
            "   " + '   '%rqty[i] + "   " + '   '%cg[i] + "   " + "  ")
    fo.write('  ' + '  ')
    fo.write("          ---------------------" + '  ')
    fo.write("                                                  " + "  ")
    for i in range(0, nnum):
        fo.write('   '%node[i] + "    " + '   '%descr[i] + "    " + '   '%xci[i] + "   " + \
            '    '%xc[i] + "    " + '   '%xz[nfinal,i] + "    " + '    '%pss[i] + "  ")
#
#   Concatenate time and concentration histories for plotting
    if phases == 0:
        timehistory = time[:nfinal+1]
        conchistory = np.zeros((nfinal+1,nnum))
        for i in range(0,nnum):
            for j in range(0,nfinal+1):
                conchistory[j,i] = xz[j,i]
        plottitle = title
        if phaseflag == 1:
            plotsubtitle = "         " + str(phases+1) + " - " + stopsum
        else:
            plotsubtitle = stopsum
    if phases > 0:
        time = time[:nfinal] + float(len(timehistory))
        timehistory = np.hstack([timehistory,time])
        conchistorytmp = np.zeros((nfinal,nnum))
        for i in range(0,nnum):
            for j in range(1,nfinal+1):
                conchistorytmp[j-1,i] = xz[j,i]
        conchistory = np.vstack([conchistory,conchistorytmp])
        plottitle = plottitle + " - " + title
        plotsubtitle = plotsubtitle + "  " + "      " + str(phases+1) + " - " + stopsum
#
#   Create and plot network map (last phase, as applicable
    netmap(nnum, parent, node, npar, ofname, plotflag)
#
#   Plot transient results to png files
    lloc = ('     ', '     ', '     ', '     ', '     ', '     ', \
        '     ', '     ', '     ', '     ', '     ')
    plt.clf()
    if plotflag == '   ' or plotflag == '  ' or plotflag == '  ':
        fig, ax = plt.subplots()
        colormap = plt.cm.rainbow
        plt.gca().set_prop_cycle('     ', [colormap(i) for i in np.linspace(0, 0.9, nnum)])
        for i in range(nnum-1, -1, -1):
            plt.plot(timehistory, conchistory[:,i], label=str(node[i]) + " - " + descr[i])
        if phases == 0:
            fig.suptitle(plottitle, fontsize=14, fontweight='    ')
            fig.subplots_adjust(top=0.85)
        else:
            fig.suptitle(plottitle, fontsize=10, fontweight='    ')
            fig.subplots_adjust(top=0.85-0.05*float(phases))
        ax.set_title(plotsubtitle, fontsize=8)
        ax.set_xlabel('        ')
        ax.set_ylabel('            ')
        plt.grid(True, linestyle='    ')
        art = []
        if nnum < 12:
            legend = plt.legend(title = "     ", loc=lloc[legendloc], labelspacing=0.1)
        else:
            legend = plt.legend(title = "     ", loc='       ', labelspacing=0.1, bbox_to_anchor=(0.5, -0.5), ncol=4)
        for label in legend.get_texts():
            label.set_fontsize('     ')
        if nnum >= 12:
            art.append(legend)
            plt.savefig(ofname + "       " + "     ", dpi=600, additional_artists=art, bbox_inches='      ')
        else:
            plt.savefig(ofname + "       " + "     ", dpi=600)
#
#   Get date and time and write elapsed and close output file
    now2 = datetime.datetime.now()
    fo.write('  ' + "                            " + '      '%(now2-now) + "  ")
    fo.close()
#
#   Write data to a word document, including figures
    document = Document()
    if phaseflag == 1:
        document.add_heading(plottitle, level=0)
    else:
        document.add_heading(title, level=0)
    intxt = dfi.read()
    document.add_heading(str("               " + ifname), level=1)
    pinput = document.add_paragraph(intxt, style="     ")
    outxt = dfo.read()
    document.add_heading(str("                 " + ofname), level=1)
    poutput = document.add_paragraph(outxt, style="     ")
    document.add_heading("              ", level=1)
    document.add_picture(str(ofname + "     "), height=Inches(2.00))
    document.add_heading("                 ", level=1)
```

Calculation Continuation Sheet

1. Document Title:		2. System Number:
Infiltrated Air Concentration Profile for an Inerted 4-mil Polyethylene Bag		PT00
3. Document Number:	4. Document Revision:	5. Page:
PLD-CAL-0003	0	42 of 42

```
    document.add_picture(str(ofname + "                    "), width=Inches(6.00))
    document.save(str(ofname + "          "))
#
#   Write csv data of inhere%' concentration vs time
    writecsvdata(timehistory, conchistory[:,-1], ofname)
#
#   Close remaining files, delete any temp files, and finish up
    dfi.close()
    fo.close()
    if phases > 0:
        for i in range(0,phasenum):
            os.remove(    + ifname +          + str(i+1))

if __name__ ==          :
    main()
```

ENCLOSURE 2

Response to the Request for Additional Information on Identified Containers in Fiscal Year 2022 Noncompliance Report

U.S. Department of Energy, Environmental Management, Los Alamos Field Office and Newport News Nuclear BWXT-Los Alamos, LLC

Date: May 12, 2023

U.S. Department of Energy,
Environmental Management Los Alamos Field Office, and
Newport News Nuclear BWXT-Los Alamos, LLC

Response to Request for Additional Information Fiscal Year 2022 Nonconformance Report

EM-LA/ Newport News Nuclear BWXT Los Alamos (N3B)

Reference Container ID	Information provided to Central Characterization Project (CCP) for Close Out (Close Out Information)	CCP Acceptance or Approval of Close Out Information	Reference Attachment
68273	Document C380 provided to CCP from N3B TRU Programs.	Closed NCR and email from Christina Poulos to David Fry concerning container status as it relates to BOK34 Addendum 1.	C380 and NCR-LANL-0343-21
68278	Document C380 provided to CCP from N3B TRU Programs.	Closed NCR and email from Christina Poulos to David Fry concerning container status as it relates to BOK34 Addendum 1.	C380 and NCR-LANL-0343-21
92536	Document M443 provided to CCP from N3B TRU Programs.	Closed NCR and BOK23 Addendum 32 serve as documentation of CCP's approval.	Appropriate pages from M443 and NCR-LANL-0050-22
92773	Document M443 provided to CCP from N3B TRU Programs.	Closed NCR and BOK23 Addendum 32 serve as documentation of CCP's approval.	Appropriate pages from M443 and NCR-LANL-0050-22

TA-55 Information Release Form

This form is to be completed and submitted to the Records Management Coordinator with copies BEFORE you present or submit for release any technical work. AK-TA55-20-111	Package for review must include: 1. Copy of submission 2. Completed **TA-55 Information Release Form** and **Cover sheet** on each submission 3. Completed **Records Submittal Form** for each submission submitted to RMDC.

1. Author(s) name(s)

Last	First	Middle	Z#	Group (or affiliation)
Shelton	Steve			

2. Title of Article (in caps: spell out all symbols):

C380 - Emails RE: Containers with Rad-Release and Wastelock 770 Absorbent

3. Type of Information:

X Acceptable Knowledge (AK) reports, radioisotope data, and/or source documents

☐ Other (**Must be TA-55, specific**):

4. Intended For:

CCP & Public Release

5. Particulars: NONE

6. Z number, Name and Phone of contact for notification of release	**Mail Stop**
224089, Amy Johns, 575-302-8669 (cell)	**J962**

7. Typed/Printed Name of Derivative Classifier	**Signature and Date**
Steve Shelton	Steve S. Shelton 3-20-2020

☒ Unclassified	☐ Unclassified, Limited Explain:

8. TA-55 Public Release Official NPI-6 Authorized Reviewer - See Certified Signature	**Signature and Date:** Steve S. Shelton 3-20-2020
9. Typed/Printed Name of Responsible Author/Requestor **Amy Johns**	**Signature and Date:** Amy Johns Digitally signed by Amy Johns Date: 2020.03.19 12:29:07 -06'00'
10. NPI-6 Group Leader **Rebecca Hollis**	**Signature and Date:** REBECCA HOLLIS (Affiliate) Digitally signed by REBECCA HOLLIS (Affiliate) Date: 2020.03.27 11:48:08 -06'00'

- **From:** Bridget Ams <bridgetams@alumni.nd.edu>
  Sent: Thursday, October 3, 2019 3:25 PM
  To: Shelton, Steven Scott <sshelton@lanl.gov>; Mike Papp <MJ_Papp@msn.com>
  Cc: Hollis, Rebecca Vincent <rhollis@lanl.gov>; Ellen Gammon <ellen.gammon@em-la.doe.gov>
  Subject: Re: LA-MHD01 BoK

  Steven,

  That is very helpful. At that ratio, these containers are compliant with the BoK criteria.

  Thank you,

  Bridget Ams
  Technical Specialists, LLP/Nuclear Waste Partnership LLC
  Contractor for the U.S. Department of Energy

  On Thu, Oct 3, 2019 at 3:08 PM Shelton, Steven Scott <sshelton@lanl.gov> wrote:

  Bridget-

  After many interviews and some more investigation into the 4 containers with this Rad-Release and Wastelock 770 absorbent these are our findings.

  The Rad-Release II step 1 (acid with nitric acid) was sprayed into glovebox and then the Rad-Release II step 2 (base NaOH) was added after it to neutralize the pH at about 7. Then 3 cups of Waste lock 770 would be added to a 1 liter pool in the glovebox absorbing the majority of the spent rad-release solution. Some remaining liquid would be wiped up with Pig wipes (gray polypropylene). The ratio was actually 1.4: 1 to 2:1 solution to absorbent. Since this decon operation would have been run multiple times using the same amounts, we have confidence in this ratio. These GB remediation would have been done in Dome 412, 231 and 375 with a date range of 9-30-13 to 4-2014. Please use this ratio with your BOK calculation of these containers and not the 100:1.

  Thank you and let me know if you have any other questions.

  Steven S Shelton
  Hazardous Materials Management
  Nuclear Process Infrastructure (NPI-7)
  AK Specialists, ALDWP EMS POC and TA55 FOD RWMB POC
  Los Alamos National Laboratory

  From: Bridget Ams <bridgetams@alumni.nd.edu>
  Sent: Thursday, September 26, 2019 1:09 PM
  To: Shelton, Steven Scott <sshelton@lanl.gov>
  Subject: Re: LA-MHD01 BoK

  Accounting for them in what way?

  As far as their contribution to the oxidizing hazard, I have never taken them into account. I just determine the most conservative dominant oxidizing chemical that could form - usually NaNO3 but occasionally KNO3 - and base my calculations on that. For example, for LA-MHD03, nitric

acid was input to the waste, and Na, K, Mg, and Al were all available from neutralization agents. I calculated the concentration of oxidizing chemical in the sorbent (in this case, both the amount of liquid and sorbent were known) for $NaNO_3$, KNO_3, $Mg(NO_3)_2$, and $Al(NO_3)_3$. KNO_3 resulted in the highest concentration (by a very slight margin; they were all similar), so I used that in my calculations as the most conservative option.

As far as whether they're covered by the BoK, most are; Table 4-1 of the BoK includes plutonium nitrate, cesium nitrate, uranyl nitrate, etc.

Bridget Ams
Technical Specialists, LLP/Nuclear Waste Partnership LLC
Contractor for the U.S. Department of Energy

On Thu, Sep 26, 2019 at 7:52 AM Shelton, Steven Scott <sshelton@lanl.gov> wrote:

> Bridget-
>
> How are we accounting for radioisoptes that may be nitrated?
>
> Thanks for the information, I hope to have more specifics to you soon.

Steven S Shelton
Hazardous Materials Management
Nuclear Process Infrastructure (NPI-7)
AK Specialists, ALDWP EMS POC and TA55 FOD RWMB POC
Los Alamos National Laboratory

Attachment 1 – CCP Nonconformance Report (NCR)

CCP NONCONFORMANCE REPORT (NCR)

(Use NCR Continuation, Attachment 3, if necessary)

NCR No. NCR-LANL-0343-21 Revision 0

1. Lot No., Heat No., or Serial No. (if applicable): N/A	2. Process (e.g., NDA, NDE, VE, Other): AK	3. Batch Data Report #(s): N/A
4. Order/Work Order/Job Control Number (if applicable): N/A	5. PO # (if applicable): N/A	Container #(s): 68273 68278
	6. Supplier (if applicable): N/A	

DESCRIPTION OF NONCONFORMANCE

7a. NCR Description: ☐ < 100 nCi/g ☒ Prohibited Item ☐ E-Flag ☐ Receipt Inspection ☐ Transportation ☐ WWIS/WDS ☐ Other

7b. Requirement(s) (Enter Implementing Procedure No., Revision, Section No., & Quoted Text):

DOE/WIPP-17-3589, Revision 1, U.S. Department of Energy Carlsbad Field Office Basis of Knowledge for Evaluating Oxidizing Chemicals in TRU Waste
Section 4.5.1, Engineered Organic Polymer Sorbents with Oxidizing Chemicals, "Table 4-3 lists the wt% of oxidizing chemicals allowed when well mixed in a tested EOPS."

CCP-TP-005, Rev. 32 CCP Acceptable Knowledge Documentation
Section 4.16.12 "Place the containers that fail the BoK criteria and are listed on an Attachment 2 of the BoK on an NCR."

7c. Actual Condition:

Containers in Block 3 are rejected in BoK 34 Addendum 1 for containing EOPS used to absorb potential oxidizing liquid with a calculated weight percent above the maximum concentration allowed by the BoK.

7d. Have the CCP HOLD TAGS associated with this NCR been applied? ☒ YES ☐ NO If no is checked, explain:

For 68273; Container 68278 inaccessible

8. NCR Originator:

Priscilla Patterson (printed name) Priscilla Patterson (signature) 09/27/2021 (date)

9. Does the identified condition have the potential to impact AK? If YES or INDETERMINATE, enter Trend Code L in Block 10. ☒ YES ☐ NO ☐ INDETERMINATE

10. Trend Code: L	11. Responsible Manager: Laura Turner
12. Recurring Condition? ☐ YES ☒ NO (If Yes, list NCRs and WIPP Forms):	13. Significant Condition? ☐ YES ☒ NO (If Yes, enter WIPP Form No.):

14. QA Engineer or QA Designee validation:

Katie Gentry (printed name) Katie Gentry (signature) 9/27/2021 (date)

CCP RECORDS ORIGINAL
DATE REC'D 02/01/22

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0343-21 Revision 0

INTERIM DISPOSITION

15a. Interim Disposition (Check Only One):

☐ N/A (See Final Disposition) ☒ Hold ☐ Conditionally Accept ☐ Conditionally Use

☐ Sort ☐ Reinspect or Retest ☐ Remediate

15b. Instructions for Completion of the Interim Disposition:

The AKE will evaluate host site provided information and along with SPM determine a path forward.

INTERIM DISPOSITION APPROVALS

16a. Responsible Manager or Individual:

Priscilla Patterson	Priscilla A. Patterson	09/27/2021
printed name	signature	date

16b. QA Engineer or QA Designee:

Katie Gentry	Katie Gentry	9/27/2021
printed name	signature	date

COMPLETION OF INTERIM DISPOSITION

17. Interim Disposition Complete – Responsible Manager or Individual:

David Fry	David Fry	1/26/22
printed name	signature	date

18. Interim Disposition Verified – QA Engineer:

Katie Gentry	Katie Gentry	1-26-2022
printed name	signature	date

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0343-21 Revision 0

FINAL DISPOSITION

19. Final Disposition (Check Only One: Use-As-Is, Repair, Reject, Rework, or Scrap):
☒ Use-As-Is ☐ Repair

19a. Technical Justification – Required for Use-As-Is or Repair dispositions. [☐ N/A for Reject, Rework, or Scrap]

The containers identified in Block 3 have been evaluated by the AKE, as demonstrated in BoK34 Addendum 1. Based on the evaluation presented in BoK34 Addendum 1, the containers identified in Block 3 now have sufficient information to demonstrate they are compliant with the BoK criteria

☐ Reject ☐ Rework ☐ Scrap

19b. Instructions for Completion – Required for Reject, Repair, Rework, or Scrap [☒ N/A for Use-As-Is]

19c. Corrective Actions (Actions to Prevent Recurrence – For Repair or Rework, if applicable
[☒ N/A if not applicable, and for Use-As-Is, Reject, and Scrap]

FINAL DISPOSITION APPROVALS

20. Responsible Manager or Individual:

David Fry	David Fry	1/26/2022
printed name	signature	date

21. QA Engineer or QA Designee:

Katie Gentry	Katie Gentry	1-26-2022
printed name	signature	date

CLOSURE

22. Final Disposition Complete - Responsible Manager or Individual:

David Fry	David Fry	1/26/2022
printed name	signature	date

23. Attachments: 1. Reportability Email 2. Hold Tag Applied 3. Closure Evidence 4. Hold Tag Removal

24a. HOLD TAG removal has been verified and reconciled for all nonconforming items on the NCR: ☒
24b. If HOLD TAG is not applicable, check: ☐ and explain:

25. Final Disposition Verified – NCR Closed QA Engineer:

Katie Gentry	Katie Gentry	1-27-2022
printed name	signature	date

Attachment 1 – CCP Nonconformance Report (NCR)

CCP NONCONFORMANCE REPORT (NCR)

(Use NCR Continuation, Attachment 3, if necessary)

NCR No. NCR-LANL-0050-22 **Revision 0**

1. Lot No., Heat No., or Serial No. (if applicable):	2. Process (e.g., NDA, NDE, VE, Other):	3. Batch Data Report #(s):
N/A	Other	N/A
4. Order/Work Order/Job Control Number (if applicable):	5. PO # (if applicable):	Container #(s):
N/A	N/A	92536 (Overpack ID: LASB02173) 92773 (Overpack ID: LASB02149)
	6. Supplier (if applicable): N/A	

DESCRIPTION OF NONCONFORMANCE

7a. NCR Description: ☐ < 100 nCi/g ☐ Prohibited Item ☐ E-Flag ☐ Receipt Inspection ☐ Transportation ☐ WWIS/WDS ☒ Other

7b. Requirement(s) (Enter Implementing Procedure No., Revision, Section No., & Quoted Text):

DOE/WIPP-02-3122 Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plan, Rev. 10, Section 3.5.2 states in part, "Wastes exhibiting the characteristic of ignitability, corrosivity, or reactivity (EPA hazardous waste numbers of D001, D002, or D003) are not acceptable at the WIPP."

7c. Actual Condition:

During the AKA review of the containers in Block 3 it was found that they may contain unknown salts which could be nitrate salts, (D001 waste). Containers in Block 3 were originally addressed in NCR-LANL-0461-19.

7d. Have the CCP HOLD TAGS associated with this NCR been applied? ☐ YES ☒ NO If no is checked, explain:

Use-as-is Disposition

8. NCR Originator:

Priscilla Patterson	PRISCILLA PATTERSON (Affiliate) Digitally signed by PRISCILLA PATTERSON (Affiliate) Date: 2022.07.12 14:30:10 -06'00'	07/12/2022
printed name	signature	date

9. Does the identified condition have the potential to impact AK? If YES or INDETERMINATE, enter Trend Code L in Block 10. ☒ YES ☐ NO ☐ INDETERMINATE

10. Trend Code: L

11. Responsible Manager/Individual: DAVID FRY

12. Recurring Condition? ☐ YES ☒ NO (If Yes, list NCRs and Issue Notices):

13. Significant Condition? ☐ YES ☒ NO
Programmatic Condition? ☐ YES ☒ NO
(If Yes, enter Issue Notice No.):

14. QA Engineer or QA Designee validation:

KATIE GENTRY	KATELYN GENTRY (Affiliate) Digitally signed by KATELYN GENTRY (Affiliate) Date: 2022.07.12 14:43:55 -06'00'	07/12/2022
printed name	signature	date

CCP RECORDS ORIGINAL
DATE REC'D 07/15/22

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0050-22 Revision 0

INTERIM DISPOSITION

15a. Interim Disposition (Check Only One):

☐ N/A (See Final Disposition) ☒ Hold ☐ Conditionally Accept ☐ Conditionally Use

☐ Sort ☐ Reinspect or Retest ☐ Remediate

15b. Instructions for Completion of the Interim Disposition:

AKE to evaluate host site information, and coordinate with SPM on a path forward.

INTERIM DISPOSITION APPROVALS

16a. Responsible Manager/Individual/SPM/VPM:

printed name	signature	date
Priscilla Patterson	PRISCILLA PATTERSON (Affiliate) Digitally signed by PRISCILLA PATTERSON (Affiliate) Date: 2022.07.12 14:45:35 -06'00'	07/12/2022

16b. QA Engineer or QA Designee:

printed name	signature	date
Katie Gentry	KATELYN GENTRY (Affiliate) Digitally signed by KATELYN GENTRY (Affiliate) Date: 2022.07.12 14:48:27 -06'00'	07/12/2022

COMPLETION OF INTERIM DISPOSITION

17. Interim Disposition Complete – Responsible Manager/Individual/SPM/VPM:

printed name	signature	date
Priscilla Patterson	PRISCILLA PATTERSON (Affiliate) Digitally signed by PRISCILLA PATTERSON (Affiliate) Date: 2022.07.12 15:01:22 -06'00'	07/12/2022

18. Interim Disposition Verified – QA Engineer:

printed name	signature	date
KATIE GENTRY	KATELYN GENTRY (Affiliate) Digitally signed by KATELYN GENTRY (Affiliate) Date: 2022.07.12 15:10:26 -06'00'	07/12/2022

Attachment 1 – CCP Nonconformance Report (NCR) (Continued)

NCR No. NCR-LANL-0050-22 Revision 0

FINAL DISPOSITION

19 Final Disposition (Check Only One: Use-As-Is, Repair, Reject, Rework, or Scrap)
☒ Use-As-Is ☐ Repair

19a Technical Justification – Required for Use-As-Is or Repair dispositions. [☐ N/A for Reject, Rework, or Scrap]

As evidenced in AKA01 Addendum 73 for LA-MHD01.001, the containers in Block 3 have been evaluated by the AKE and have been determined to be acceptable as they do not meet the definition of an oxidizer.

☐ Reject ☐ Rework ☐ Scrap

19b Instructions for Completion – Required for Reject, Repair, Rework, or Scrap. [■ N/A for Use-As-Is]

19c Corrective Actions (Actions to Prevent Recurrence – For Repair or Rework, if applicable
[☒ N/A if not applicable, and for Use-As-Is, Reject, and Scrap]

FINAL DISPOSITION APPROVALS

20 Responsible Manager/Individual/SPM/VPM

Priscilla Patterson (printed name) Priscilla Patterson (signature) 07/12/2022 (date)

21 QA Engineer or QA Designee

Katie Gentry (printed name) Katie Gentry (signature) 7-12-2022 (date)

CLOSURE

22 Final Disposition Complete - Responsible Manager/Individual/SPM/VPM

Priscilla Patterson (printed name) Priscilla Patterson (signature) 7/13/22 (date)

23 Attachments 1. Interim and final Closure Documentation
2. Reportability Email

24a HOLD TAG removal has been verified and reconciled for all nonconforming items on the NCR ☐
24b If HOLD TAG is not applicable, check ☒ and explain see Block 7d

25 Final Disposition Verified – NCR Closed QA Engineer

Katie Gentry (printed name) Katie Gentry (signature) 7-13-2022 (date)

CONTAINER PROFILE
92536
T-TTRU-TEMP

WS ID: 13944
C ID: 790026
ACTIVE

GENERAL INFORMATION

Container ID:	790026		
Labeled ID:	92536		
Optional ID:		**Status:**	ACTIVE
Chemical Barcode:		**Decommissioned:**	YES
Physical State:	SOLID	**Container Type:**	DM: Metal drums, barrels, kegs
Waste Stream ID:	13944	**Container Subtype:**	55-gallon steel drum
Work Path:	T-TTRU-TEMP	**Origin Date:**	09-Jan-2013 8:56 am
Quantity (Univ):		**Accum Start Date:**	02-Nov-1981
Compactible:		**Closed Date:**	09-Jan-2013

Discard Matrix:

TID(s):

Gen Contact: JEFFREY COLEMAN (225849)

Insert By: WCATS APPLICATION (000000)

Waste Desc: GENERIC WPF FOR TRU WASTE PROCESSED UNDER THE TRANSURANIC WASTE CERTIFICATION PROGRAM (TWCP). THIS WPF WILL COVER A ...

WEIGHTS AND VOLUMES

Container Volume:	0.21 CM	**Gross Weight:**	202.00 lb
Waste Volume:	NOT SPECIFIED	**Tare Weight:**	69.00 lb
		Net Weight:	133.00 lb

LOCATION

Pickup (Origin): LANL: 50: 000069

Current: LANL: 54-G: 049-PACK

CONTAINER PROFILE
92536
T-TTRU-TEMP

WS ID: 13944
C ID: 790026
ACTIVE

PAYLOAD INFORMATION

Container Procurement

P.O. Number: **Year of Manuf:**

Lot No.: **Serial No:**

Solution Package: 57: SP AG Cement Cans No Issues

TRUCON Code: LA125M: 55-GAL DRUM WITH FIBERBOARD LINER

Shipping Category: 3003400020

CCP AK Report: CCP-AK-LANL-006: LANL TA-55 Mixed Transuranic Waste

WIPP Waste Stream:

Matrix Code: S5400 - DEBRIS WASTE: HETEROGENEOUS DEBRIS

Defense Waste: YES **Equiv. Comb. Matrix:** Non-combustible/Non-dispersible

Adeq. Ventilation: YES **Compliant Metal Cont.:** YES

Overpack (1 to 1): NO **Retrievable:** **BIR WS Code:**

Content Code:

COST CODES

Cost Center	Prog Code	Cost Account	Work Package	Percent Allocation	Cost Center Status	Cost Code Status	Recharge Mode
6F030A	M348	0A12	EP00	100.00	INACTIVE	INACTIVE	*UNCONSTRAINED*

EPA CODES

System Code	Hazardous Waste No.	Waste Description & Treatment Subcategory
D008A	D008	Lead

FILTERS

Manufacturer	Model	Style	Diffusivity*	Serial Number	Torque Ft-lbs	Mfg Date Mon/Year
Not Specified	NA	NA	0	AM-786		0/0

** Diffusivity is specified in moles per second per mole fraction*

LAYERS OF CONFINEMENT

Layer No.	Layer Status	Confinement Type: Subtype
1	Active	rigid drum liner: fiberboard

CONTAINER PROFILE
92536
T-TTRU-TEMP

WS ID: 13944
C ID: 790026
ACTIVE

RADIOLOGICAL SURVEY

Survey Type	Instrument Number	Survey Date	At Contact mrem/hr	At 30 cm mrem/hr	At 1 M mrem/hr	Alpha dpm/100cm2	Beta/Gama dpm/100 cm2
Survey ID: 90904, Status: Active							
B/G Survey			= 6.00	=	=	Not Applicable	
Neutron Survey			= 2.00	=	=	Not Applicable	
Smear Results			Not Applicable			= 1.00	= 5.70

RADIONUCLIDES

Nuclide	Amount	Unit	Uncert	MT Derived (Y/N)	Activated (Y/N)	MDA Result (Y/N)	Normal Form (Y/N)	Measurement Code/Comment
Status: Inactive, Assay Page: 374158, Date: 11/02/1981, Derivation: Generator Entered Results (e.g., Offsite Assay)								
Am-241	3.87E-001	g	5.50E-002	N			Y	
Cs-137	9.68E-006	g	1.38E-006	N			Y	
Pu-238	1.93E-002	g	2.75E-003	N			Y	
Pu-239	1.81E+002	g	2.58E+001	N			Y	
Pu-240	1.16E+001	g	1.65E+000	N			Y	
Pu-241	3.87E-001	g	5.50E-002	N			Y	
Pu-242	3.87E-002	g	5.50E-003	N			Y	
Sr-90	6.17E-006	g	8.78E-007	N			Y	
U-234	3.87E-003	g	5.50E-004	N			Y	
U-235	1.93E-001	g	2.75E-002	N			Y	
Status: Active, Assay Page: 398029, Date: 04/08/2013, Derivation: Non-Destructive Assay (NDA)								
Am-241	4.92E+000	Ci	5.73E-001	N			Y	
Np-237	2.07E-005	Ci	2.54E-006	N			Y	
Pu-238	3.25E-001	Ci	3.79E-002	N			Y	
Pu-239	1.16E+001	Ci	1.35E+000	N			Y	
Pu-240	3.14E+000	Ci	3.66E-001	N			Y	
Pu-241	1.87E+001	Ci	2.18E+000	N			Y	
Pu-242	3.12E-004	Ci	3.64E-005	N			Y	
U-235	0.00E+000	Ci	0.00E+000	N			Y	

CONTAINER PROFILE
92536
T-TTRU-TEMP

WS ID: 13944
C ID: 790026
ACTIVE

RAD CALCULATIONS

	Total Activity (nCi/g):	6.41252E+05		**Decay Heat [U] (W):**	6.89139E-01	
	Alpha (nCi/g):	3.31287E+05		**DOTFissile Mat (g):**	1.87056E+02	
	TRU Alpha (nCi/g):	3.31279E+05		**Transport Index:**		
**	**MDA TRU Alpha (nCi/g)**	3.31279E+05		**NRC Class:**	GTCC	
	Pu-239 FGE:	1.87623E+02		**DOT Type:**	B	
	Pu-239 FGE [2U]:	2.31120E+02		**LSA-I Fraction:**	4.12400E+05	N
	Pu-239 Eq-Ci:	2.04166E+01		**LSA-II Fraction:**	1.24485E+02	N
	Pu-239 Eq-Ci [2U]:	2.34503E+01		**LSA-III Fraction:**	6.22423E+00	N
	TRU Pu-239 Eq-Ci:	2.04166E+01		**Reportable Quantity:**	2.01723E+03	Y
	TRU Pu-239 Eq-Ci [2U]:	2.34503E+01	*	**ALC Ratio:**	1.85427E+08	NE
	Tritium (Ci/m3):	0.00000E+00	*	**ACM Ratio:**	1.23720E+07	NE
	ECW PE-Ci:	5.10415E+00		**Limited Quantity:**	7.50989E+05	N

Weight/Volume Used:

1 Container Net Weight: 6.03278E+01 kg
2 Container Volume: 2.08000E-01 m3

**ALC (Activity Limit for Exempt Consignment)*
**ACM (Activity Concentration for Exempt Material)*
*** Use for LL/TRU Determination*
U = 1 Uncertainty, 2U = 2 Uncertainty

DOT SHIPPING DESC

Status/ Manifest IDs	DOT Shipping Description
ACTIVE 90626	UN3327, WASTE RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE NON-SPECIAL FORM, 7, Solid, ELEMENTAL, AM241, CS137, PU238, PU239, PU240, PU241, PU242, SR90, U234, U235, 2.071E+00 TBq, T.I.=1.0, RADIOACTIVE YELLOW II

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
01/09/2013 8:56 AM	1809527 EXECUTED	LANL:50 - REPACK-TRU	NA
01/09/2013 8:56 AM	1111686 EXECUTED	LANL:50 » 50:000069	NO
01/11/2013 2:43 PM	1120729 EXECUTED	LANL:50 » 54-G:000232 (MANIF ID: 90626) STAGING	NO
01/18/2013 9:43 AM	1120730 EXECUTED	LANL:54-G » 54-G:000545	NO
01/22/2013 9:49 AM	1120731 EXECUTED	LANL:54-G » 54-G:RTR-2	NO
01/24/2013 9:35 AM	1120732 EXECUTED	LANL:54-G » 54-G:000048 DOME 48 STAGING	NO

CONTAINER PROFILE
92536
T-TTRU-TEMP

WS ID: 13944
C ID: 790026
ACTIVE

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
01/24/2013 10:04 AM	1120733 EXECUTED	LANL:54-G » 54-G:000048 COLUMN 033:LAYER 01:ROW 07	NO
02/06/2013 2:28 PM	1120734 EXECUTED	LANL:54-G » 54-G:000048 COLUMN 041:LAYER 02:ROW 03	NO
03/27/2013 2:36 PM	1120735 EXECUTED	LANL:54-G » 54-G:000232 STAGING	NO
03/28/2013 2:40 PM	1120736 EXECUTED	LANL:54-G » 54-G:RTR-2	NO
04/04/2013 4:28 PM	1120737 EXECUTED	LANL:54-G » 54-G:HENC-2	NO
04/08/2013 4:25 PM	1120738 EXECUTED	LANL:54-G » 54-G:000545	NO
04/19/2013 3:19 PM	1120739 EXECUTED	LANL:54-G » 54-G:000049 DOME 49 STAGING	NO
04/19/2013 3:43 PM	1120740 EXECUTED	LANL:54-G » 54-G:000049 COLUMN 047 - HIGH FGE:LAYER 01:ROW 01	NO
08/27/2013 1:28 PM	1816986 EXECUTED	LANL:54-G: » 54-G:000049 COLUMN 031 - HIGH FGE:LAYER 01:ROW 01	NO
08/27/2013 5:45 PM	1816436 PENDING	LANL:54-G - WALL2W - 000049	NO
01/13/2014 9:15 AM	1824543 CANCELLED	LANL:54-G » 54-G:000049	NO
01/21/2014 2:45 PM	1823882 EXECUTED	LANL:54-G: » 54-G:000049 COLUMN 015 - HIGH FGE:LAYER 01:ROW 03	NO
01/22/2014 2:58 PM	1825329 EXECUTED	LANL:54-G - 049-PACK	NO

Note: Highlighted row indicates container was output or receiving container for the indicated task

COMMENTS

Date Time/ User Name	Comment
08/23/2013 10:49 PM WCATS APPLICATION (000000)	[UNIT] HENC 2; [DATE] 04/08/2013; [CONTAINER ID] 92536; [CERT / FAST] Certified; [PASS / FAIL] Pass; [COMMENT] Preliminary >200 Fge;
08/23/2013 10:50 PM WCATS APPLICATION (000000)	[UNIT] RTR 2; [DATE] 04/04/2013; [CONTAINER ID] 92536; [CERT / FAST] Certified; [PASS / FAIL] Pass; [COMMENT] N/A; [BDR#] LA-RTR2-13-0050; [NCR#] N/A;
08/23/2013 9:37 AM WCATS APPLICATION (000000)	PARENT #S813212

EDIT LOG

Date Time/ User Name	Quality Record	Explanation
09/15/2014 10:36 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.MATRIX_CODE [790026] changed from S3150 to S5400
09/15/2014 10:36 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.CCP_WS_ID [790026] changed from LA-CIN01.001 to LA-MHD01.001

EDIT LOG

Date Time/ User Name	Quality Record	Explanation
01/31/2014 6:46 PM WCATS APPLICATION (000000)	YES	RT381813 ¿¿¿ ORIGIN DATE SET TO PKG_HIST.HIST_DATE
01/31/2014 6:46 PM WCATS APPLICATION (000000)	YES	C_MASTER.ORIGIN_DATETIME[790026] CHANGED FROM 11-02-1981 12:00 AM TO 01-09-2013 08:56 AM
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.PKG_VENT TABLE (WASTEDB): [VENT_ID] = 55865, [FILTER_TYPE_CD] = , [INNER_OUTER] = , [PKG_ID] = 92536, [REMOVED] = , [SERIAL_NO] = AM-786, [SOURCE] = , [UPD_WHEN] = 2013-01-09 09:58:35, [UPD_WHO] = 225849, [VENT_CD] = , [VENT_DATE] = 2013-01-09 00:00:00
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.PKG_DOT TABLE (WASTEDB): [PKG_ID] = 92536, [CHEM_STATE] = ELEMENTAL, [DOT_DESC_CD] = , [DOTHAZ_CD] = 7, [DOTSHIP] = WASTE RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE NON-SPECIAL FORM, [DOTUNNA_CD] = UN3327, [ERGNO] = 165, [FISSILE_CLASS] = , [HAZ_SUB] = , [HMTF_NO] = , [LABEL_CAT] = RADIOACTIVE YELLOW II, [LABEL_SEC] = , [OTHERCONID] = , [PLAC_REQ] = , [TRANS_INDEX] = 1.0, [UPD_WHEN] = , [UPD_WHO] = 217156
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.TRUPKG TABLE (WASTEDB): [PKG_ID] = 92536, [ALPHA_CONT] = 1, [APPROVE_BY] = , [APPROVE_DATE] = , [BETA_GAMMA_CONT] = 5.7, [BLDG_CD] = 50-00069, [BX_SERIAL] = , [CERT_STATUS] = , [COLOR_CD] = , [COMMENTS] = PARENT #S813212, [CONTENT_CODE] = , [CONTROL] = , [DATE_CLOSED] = 2013-01-09 00:00:00, [GAMMA_DOSE] = 6, [GROSS_WT] = 202, [GRP] = WDPTWPS, [NEUTRON_DOSE] = 2, [NORMAL] = N, [OLDDRUMNUM] = , [OLDVOL_UNIT] = , [OLDWT_UNIT] = , [ORG_VOL] = , [ORG_WT] = , [PKG_CD] = 01, [PKG_CD_DESC] = STEEL DRUM (55 GAL), [PKG_DATE] = 2013-01-11 00:00:00, [PKG_FISS_GRAMS] = 185, [PKG_LOT] = , [PKG_PE_ACT] = 20.3, [PKG_TARE_WT] = 69, [PKG_VOLUME] = .208, [PROC_BTCH_CD] = , [PROG_CODE] = M348, [ROOM] = , [SAMPLE_ID] = , [THERMAL] = .49398137532574181121028617228914778262 3, [TOTAL_DOSE] = 8, [TOT_ANCG] = 261145.73803766976582618617618333710643 6, [TRUCON_CD] = LA125M, [WASTE_CD] = , [WPRF_CD] = 32358, [YR_MFG] = , [WASTE_TYPE] = S3150, [INSP_DATE] = , [AUA_VUA] = , [PROCESS_ID] = , [WGEN_CD] = 225849, [DOT_TYPE] = , [BIR_ID] = , [RQ] = , [LSA_SCO_CD] = , [LSA] = , [A_START_DATE] = 1981-11-02 00:00:00, [BIR_WS] = , [LA_WS] = , [SWBOP] = , [RETRIEVABLE] = , [OFFSITE] = , [LINER_CD] = 04, [NET_WT] = 133, [SHIP_CD] = 3003400020, [WASTE_STREAM] = LA-CIN01.001, [OVERPACK] = N, [REPACKED] = , [INVENTORY_NO] = , [INVENTORY_DT] = , [CHCD_CC_CD] = 6F030A, [CHCD_CA_CD] = 0A12, [CHCD_WP_CD] = EP00, [DOT_DP] = Y, [WASTE_VERIF] = , [VERIF_COMPLETE] = , [HDL_CD] = S01, [UPD_WHEN] = 2013-01-09 08:56:03, [UPD_WHO] = 241661, [PHY_STATE] = S, [PKG_H3_ACT] = 0, [QTW] = , [AK_REPORT] = CCP-AK-LANL-006, [STP] = 0
08/23/2013 8:50 AM WCATS APPLICATION (000000)	NO	INITWORKPATH (C_ID=790026/PATH_ID=465): SKIPPED (NO WORKPATH UNITS)

Los Alamos NATIONAL LABORATORY EST.1943

TRU WASTE STORAGE RECORD

92536

1. Generator's Pre-Use Visual Inspection

Purchase Order #	Inspected Items		
This container has been visually inspected according to approved procedures and has been found to be free of damage that would make it unsuitable for TRU waste packaging.	☐ Ring, Bolt, and Nut	☐ Chime	☐ Dents
	☐ Lid and Gasket	☐ Gouges	☐ Paint

Printed Name	Signature	Sig. Date	Oper. Date

2. Generator's Package Information

Group	Technical Area	Building	Cost Center	Program Code	Cost Account	Work Package
LTP-WRP	50	000069				

Additional Information

☑ DP ☐ Non-DP If Non-DP waste, attach DOE approval doc.

Container	Liner
☑ Steel Drum (55 gal.)	☐ None
☐ Pipe Overpack Type:	☐ 90 mil liner
☐ Steel Drum (85 gal Overpack)	☐ 125 mil liner
☐ Standard Waste Box	☑ Fiberboard Liner
☐ Standard Waste Box Overpack	**Internal Shielding**
☐ RH Canister	☑ None
☐ Other (Call TWCO)	Type / Thickness

Radionuclide Content

Nuclide	Amount	Uncertainty	C= Curie M = Gram
Am-241	4.920E+000	5.730E-001	C
Np-237	2.070E-005	2.540E-006	C
Pu-238	3.250E-001	3.790E-002	C
Pu-239	1.160E+001	1.350E+000	C
Pu-240	3.140E+000	3.660E-001	C
Pu-241	1.870E+001	2.180E+000	C
Pu-242	3.120E-004	3.640E-005	C
U-235	0.000E+000	0.000E+000	C

Filter Serial No.			
	01 AM-786		
	02		

Hazardous Materials

Name	EPA Code	Qty (g)
Lead	D008	

Waste Profile Number	32358 (WS ID 13944)
Gross Weight (lb.)	2.02E+002
Net Weight (lb.)	1.33E+002
Shipping Category	3003400020
LANL Waste Stream ID	
TRUCON Code	LA125M
Date Closed (MM/DD/YY):	01/09/2013
Accumulation Start Date (MM/DD/YY):	11/02/81

The data in this section were collected, and waste described herein was packaged and labeled according to approved procedures.

Printed Name	Signature	Date:

3. Generator Site Health Physics Information

		Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Gamma Dose Rate (mrem/h) (contact)	6.00E+000				
Neutron Dose Rate (mrem/h) (contact)	2.00E+000	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Total Dose Rate (mrem/h) (contact)	8.00E+000				
Total Dose Rate (mrem/h) (1 meter)					
Alpha Contamination (dpm/100cm2)	1.00E+000				
Beta-Gamma Cont (dpm/100 cm2)	5.70E+000				

The data in this section were collected according to approved procedures.

Printed Name	Date

Signature

Los Alamos NATIONAL LABORATORY EST.1943

TRU WASTE STORAGE RECORD

92536

4. TRU Waste Management Review/Authorization

The data package for this waste has been reviewed. Basedon the information provided, this waste meets the WAC requirements for storage at TA-54.	Printed Name	Date:
	Signature	

5. Preload Visual Inspection

This waste package was visually inspected prior to transport according to approved procedures. It meets WAC packaging and labeling requirements and is free from obvious damage and defects.	Printed Name	Date:

6. Receiving Site Health Physics Information

Gamma Dose Rate (mrem/h) (contact)	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Neutron Dose Rate (mrem/h) (contact)	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Total Dose Rate (mrem/h) (contact)	*The data in this section were collected according to approved procedures.*			
Total Dose Rate (mrem/h) (1 meter)				
Alpha Contamination (dpm/100cm2)	Printed Name			Date
Beta-Gamma Cont (dpm/100 cm2)	Signature			

7. Storage Site Information

Received by (Initials)	Date Received	**Original Storage Data**		
This waste package was visually inspected and found to be properly labeled and in good condition. It was accepted and inspected according to approved procedures.		Building Number	Layer	Row Number
		Column Number	Date Stacked (MM/DD/YY)	
Printed Name	Date:	Printed Name		Date:
Signature		Signature		

8. Waste Acceptance Office

Intials/Date	WE Description

NCR Number	Intials/Date	NCR Description

Los Alamos NATIONAL LABORATORY EST.1943

TRU WASTE STORAGE RECORD

92536

9. Continuation Sheet for Radionuclide Content (from Page 1, Section 2)

Radionuclide Content - Continued			
Nuclide	**Amount**	**Uncertainty**	**C= Curie M = Gram**
No Additional Radionuclides			

10. Continuation Sheet for Hazardous Materials (from Page 1, Section 2)

Hazardous Materials		
Name	**EPA Code**	**Qty (g)**
No Additional Hazardous Materials		

CONTAINER PROFILE
S813212
T-TTRU-TEMP

WS ID: 37017
C ID: 776290
Opt ID: 012497
ACTIVE

GENERAL INFORMATION

Container ID:	776290		
Labeled ID:	S813212		
Optional ID:	012497	**Status:**	ACTIVE
Chemical Barcode:		**Decommissioned:**	YES
Physical State:	SOLID	**Container Type:**	DM: Metal drums, barrels, kegs
Waste Stream ID:	37017	**Container Subtype:**	55-gallon steel drum
Work Path:	T-TTRU-TEMP	**Origin Date:**	02-Nov-1981 12:00 am
Quantity (Univ):		**Accum Start Date:**	02-Nov-1981
Compactible:		**Closed Date:**	

Discard Matrix:

TID(s):

Gen Contact:

Insert By: WCATS APPLICATION (000000)

Waste Desc: GENERATED AT 55-PF4

WEIGHTS AND VOLUMES

Container Volume:	0.21 CM	**Gross Weight:**	133.40 lb
Waste Volume:	NOT SPECIFIED	**Tare Weight:**	60.00 lb
		Net Weight:	73.40 lb

LOCATION

Pickup (Origin): LANL: 55-PF4: 400-AREA: 432

Current: LANL: 50: REPACK-TRU

CONTAINER PROFILE
S813212
T-TTRU-TEMP

WS ID: 37017
C ID: 776290
Opt ID: 012497
ACTIVE

PAYLOAD INFORMATION

Container Procurement

P.O. Number: **Year of Manuf:**

Lot No.: **Serial No:**

Solution Package: 57: SP AG Cement Cans No Issues

TRUCON Code:

Shipping Category:

CCP AK Report: CCP-AK-LANL-006: LANL TA-55 Mixed Transuranic Waste

WIPP Waste Stream: TA-55-38: CEMENTED INORGANICS AND SPENT SAMPLES

Matrix Code: S3150 - HOMOGENEOUS SOLIDS: INORGANIC HOMOGENEOUS SOLIDS: SOLIDIFIED HOMOGENEOUS SOLIDS

Defense Waste: **Equiv. Comb. Matrix:** Non-combustible/Non-dispersible

Adeq. Ventilation: **Compliant Metal Cont.:** YES

Overpack (1 to 1): NO **Retrievable:** **BIR WS Code:** LA-M4

Content Code:

TAGS

Container Tag	List Value	Date	Explanation	Insert By / Date & TIme
3706 M3 INITIAL CONTAINER		04/17/2014		WCATS APPLICATION (000000) 04/17/2014 6:17 PM

COST CODES

Cost Center	Prog Code	Cost Account	Work Package	Percent Allocation	Cost Center Status	Cost Code Status	Recharge Mode
							SELECTION LIST

EPA CODES

System Code	Hazardous Waste No.	Waste Description & Treatment Subcategory
D008A	D008	Lead

CONTAINER PROFILE
S813212
T-TTRU-TEMP

WS ID: 37017
C ID: 776290
Opt ID: 012497
ACTIVE

RADIONUCLIDES

Nuclide	Amount	Unit	Uncert	MT Derived (Y/N)	Activated (Y/N)	MDA Result (Y/N)	Normal Form (Y/N)	Measurement Code/Comment
Status: Active, Assay Page: 342277, Date: 11/02/1981, Derivation: Generator Entered Results (e.g., Offsite Assay)								
52	1.94E+002	g	0.00E+000	N				NONE
Am-241	1.33E+000	Ci	0.00E+000	Y			Y	
Pu-238	3.32E-001	Ci	0.00E+000	Y			Y	
Pu-239	1.13E+001	Ci	0.00E+000	Y			Y	
Pu-240	2.64E+000	Ci	0.00E+000	Y			Y	
Pu-241	4.01E+001	Ci	0.00E+000	Y			Y	
Pu-242	1.53E-004	Ci	0.00E+000	Y			Y	
U-234	2.42E-005	Ci	0.00E+000	Y			Y	
U-235	4.19E-007	Ci	0.00E+000	Y			Y	

RAD CALCULATIONS

Total Activity (nCi/g):	1.67386E+06	**Decay Heat [U] (W):**	4.95526E-01
Alpha (nCi/g):	4.68606E+05	**DOTFissile Mat (g):**	1.82515E+02
TRU Alpha (nCi/g):	4.68575E+05	**Transport Index:**	
** **MDA TRU Alpha (nCi/g)**	4.68575E+05	**NRC Class:**	GTCC
Pu-239 FGE:	1.83203E+02	**DOT Type:**	B
Pu-239 FGE [2U]:	1.83203E+02	**LSA-I Fraction:**	5.92775E+05 N
Pu-239 Eq-Ci:	1.63815E+01	**LSA-II Fraction:**	1.80805E+02 N
Pu-239 Eq-Ci [2U]:	1.63815E+01	**LSA-III Fraction:**	9.04027E+00 N
TRU Pu-239 Eq-Ci:	1.63815E+01	**Reportable Quantity:**	1.60024E+03 Y
TRU Pu-239 Eq-Ci [2U]:	1.63815E+01	* **ALC Ratio:**	1.60580E+08 NE
Tritium (Ci/m3):	0.00000E+00	* **ACM Ratio:**	1.77832E+07 NE
ECW PE-Ci:	1.01565E-01	**Limited Quantity:**	6.01988E+05 N

Weight/Volume Used:

1 Container Net Weight: 3.32948E+01 kg
2 Container Volume: 2.08000E-01 m3

**ALC (Activity Limit for Exempt Consignment)*
**ACM (Activity Concentration for Exempt Material)*
*** Use for LL/TRU Determination*
U = 1 Uncertainty, 2U = 2 Uncertainty

DOT SHIPPING DESC

Status/ Manifest IDs	DOT Shipping Description
ACTIVE 90154	UN3327, WASTE RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE NON-SPECIAL FORM, 7, Solid, ELEMENTAL, AM241, CS137, PU238, PU239, PU240, PU241, PU242, SR90, U234, U235, 2.071E+00 TBq, T.I.=0.6, RADIOACTIVE YELLOW II

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
11/03/1981 12:00 AM	1214694 EXECUTED	LANL:55-PF4 » 54-G:PAD01 POST 23:LAYER 02:POSITION WEST	NO
04/13/1998 12:00 AM	1228553 EXECUTED	LANL:54-G » 54-G:000231	NO
10/14/1998 12:00 AM	1228554 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 057:LAYER 01:ROW 06	NO
09/29/1999 2:00 PM	1228555 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 057:LAYER 01:ROW 02	NO
10/14/2003 12:00 AM	1228556 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 057:LAYER 01:ROW 01	NO
03/25/2004 12:00 AM	1228557 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 010:NOT SPECIFIED:NOT SPECIFIED	NO
08/19/2004 9:49 AM	1228558 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 010:NOT SPECIFIED:NOT SPECIFIED	NO
07/08/2005 2:38 PM	1228559 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 009:LAYER 03:NOT SPECIFIED	NO
03/29/2006 10:32 AM	1229265 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 009:LAYER 01:NOT SPECIFIED	NO
04/09/2006 11:12 AM	1229266 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 103:NOT SPECIFIED:NOT SPECIFIED	NO
04/25/2006 9:01 AM	1229267 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 101:LAYER 01:ROW 01	NO
05/02/2006 1:39 PM	1229268 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 102:LAYER 01:ROW 01	NO
06/29/2006 8:32 AM	1229269 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 006:LAYER 01:ROW 02	NO
06/29/2006 9:18 AM	1229270 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 006:LAYER 01:ROW 04	NO
11/19/2006 11:47 AM	1229271 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 006:LAYER 02:ROW 14	NO
11/27/2006 2:58 PM	1229272 EXECUTED	LANL:54-G » 54-G:000232 B232 NDA QUICKSCAN STAGING	NO
12/05/2006 9:48 AM	1229273 EXECUTED	LANL:54-G » 54-G:000232 STAGING	NO
12/06/2006 10:02 AM	1229274 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 079:LAYER 02:ROW 09	NO

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
12/07/2006 4:40 PM	1229275 EXECUTED	LANL:54-G » 54-G:000231 STAGING	NO
12/21/2006 11:39 AM	1229276 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 015:LAYER 01:ROW 16	NO
02/05/2007 3:30 PM	1229277 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 007:LAYER 02:ROW 08	NO
02/27/2007 1:46 PM	1229278 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 007:LAYER 02:ROW 08	NO
07/09/2007 3:15 PM	1229279 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 015:LAYER 03:ROW 10	NO
08/15/2007 11:02 AM	1229280 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 015:LAYER 02:ROW 10	NO
08/21/2007 2:06 PM	1229281 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 015:LAYER 02:ROW 12	NO
08/29/2007 10:22 AM	1229282 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 014:LAYER 01:ROW 10	NO
09/04/2007 11:09 AM	1229283 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 022:LAYER 03:ROW 04	NO
03/31/2008 11:11 AM	1229284 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 020:LAYER 03:ROW 04	NO
04/24/2008 10:11 AM	1229285 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 022:LAYER 03:ROW 04	NO
09/02/2008 2:47 PM	1229286 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 015:LAYER 01:ROW 08	NO
06/30/2009 2:50 PM	1229287 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 022:LAYER 02:ROW 06	NO
10/07/2009 2:57 PM	1229288 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 022:LAYER 02:ROW 05	NO
12/15/2009 9:25 AM	1229289 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 022:LAYER 02:ROW 06	NO
01/21/2012 3:43 PM	1229290 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 018:LAYER 03:ROW 06	NO
02/04/2012 12:12 PM	1229291 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 019:LAYER 01:ROW 06	NO
04/28/2012 10:22 AM	1229292 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 050:LAYER 03:ROW 08	NO
05/02/2012 4:59 PM	1229293 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 030:LAYER 02:ROW 08	NO
05/29/2012 10:14 AM	1229294 EXECUTED	LANL:54-G » 54-G:RTR-HE	NO
05/29/2012 11:23 AM	1229295 EXECUTED	LANL:54-G » 54-G:000232 STAGING	NO

CONTAINER PROFILE
S813212
T-TTRU-TEMP

WS ID: 37017
C ID: 776290
Opt ID: 012497
ACTIVE

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
06/20/2012 3:40 PM	1229296 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 031:LAYER 02:ROW 07	NO
06/26/2012 3:39 PM	1229297 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 035:LAYER 01:ROW 11	NO
07/03/2012 10:37 AM	1229298 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 035:LAYER 01:ROW 02	NO
09/19/2012 3:13 PM	1229883 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 010:LAYER 01:ROW 02	NO
11/01/2012 10:44 AM	1229884 EXECUTED	LANL:54-G » 54-G:000153-O STAGING ON EAST SIDE OF DOME	NO
11/08/2012 2:41 PM	1229885 EXECUTED	LANL:54-G » 54-G:HGAS	NO
12/11/2012 2:48 PM	1229886 EXECUTED	LANL:54-G » 54-G:000049 DOME 49 STAGING	NO
12/12/2012 12:58 PM	1229887 EXECUTED	LANL:54-G » 54-G:000049 COLUMN 082 - READY TO SHIP:LAYER 01:ROW 08	NO
12/18/2012 9:21 AM	1229888 EXECUTED	LANL:54-G » 50:000069	NO
12/18/2012 11:03 AM	1229889 EXECUTED	LANL:50 » 54-G:000049 DOME 49 STAGING	NO
12/18/2012 11:04 AM	1229890 EXECUTED	LANL:54-G » 54-G:000049 COLUMN 082 - READY TO SHIP:LAYER 01:ROW 08	NO
12/20/2012 8:32 AM	1229891 EXECUTED	LANL:54-G » 50:000069	NO
01/09/2013 8:56 AM	1809527 EXECUTED	LANL:50 - REPACK-TRU	NO

Note: Highlighted row indicates container was output or receiving container for the indicated task

DOCUMENTATION

Doc. Number	Title	Uploaded By
1	S813212-TWSR	WCATS APPLICATION (000000)

COMMENTS

Date Time/ User Name	Comment
08/23/2013 9:37 AM WCATS APPLICATION (000000)	LEACHED SOLIDS
08/23/2013 10:50 PM WCATS APPLICATION (000000)	[UNIT] WCRRF; [DATE] 01/09/2013; [CONTAINER ID] S813212; [DAUGHTER ID] 92536; [SPLIT / VE] PID; [TYPE] Daughter; [COMMENT] -;

EDIT LOG

Date Time/ User Name	Quality Record	Explanation

EDIT LOG

Date Time/ User Name	Quality Record	Explanation
11/05/2014 10:24 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.MATRIX_CODE [776290] changed from null to S3150
11/05/2014 10:24 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.CCP_AK_REPORT_NO [776290] changed from null to CCP-AK-LANL-006
11/05/2014 10:24 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.CCP_WS_ID [776290] changed from null to LA-CIN01.001
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.TW_PKG TABLE (WASTEDB): [PKG_ID] = S813212, [DIS_CD] = , [DIS_DT] = , [DRUM_NO] = 012497, [DVS_BURN] = , [DVS_CONDITION] = , [DVS_DRUM_WT] = , [DVS_EXPECT_HI_H2] = , [DVS_H2] = , [DVS_LID_CONTAM] = , [DVS_OPERATOR] = , [DVS_PSIA] = , [DVS_VENT_DATE] = , [DVS_VENT_STRIP] = , [RETRIEVE_COMMENTS] = inserted from table TW_INIT, 7/27/2000 by z077615, [RETRIEVE_CONDITION] = GOOD, [RETRIEVE_DT] = 1997-04-29 00:00:00, [RETRIEVER_ZNO] = , [SURFACE_DOSE] = .5, [UPD_WHEN] = , [UPD_WHO] =
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.TRUPKG TABLE (WASTEDB): [PKG_ID] = S813212, [ALPHA_CONT] = , [APPROVE_BY] = , [APPROVE_DATE] = , [BETA_GAMMA_CONT] = , [BLDG_CD] = 55-PF4, [BX_SERIAL] = , [CERT_STATUS] = , [COLOR_CD] = , [COMMENTS] = LEACHED SOLIDS , [CONTENT_CODE] = , [CONTROL] = , [DATE_CLOSED] = , [GAMMA_DOSE] = , [GROSS_WT] = 133.4025, [GRP] = CMB11, [NEUTRON_DOSE] = , [NORMAL] = , [OLDDRUMNUM] = 012497, [OLDVOL_UNIT] = M, [OLDWT_UNIT] = K, [ORG_VOL] = , [ORG_WT] = , [PKG_CD] = 01, [PKG_CD_DESC] = STEEL DRUM (55 GAL), [PKG_DATE] = 1981-11-03 00:00:00, [PKG_FISS_GRAMS] = 182.63275164818330255499475365362787357 9, [PKG_LOT] = , [PKG_PE_ACT] = 16.536404341750494813452216001535645834, [PKG_TARE_WT] = 60, [PKG_VOLUME] = .208, [PROC_BTCH_CD] = , [PROG_CODE] = , [ROOM] = 432, [SAMPLE_ID] = , [THERMAL] = .49398653501510004, [TOTAL_DOSE] = 1, [TOT_ANCG] = 473182.05704902975410337784462189852560 3, [TRUCON_CD] = , [WASTE_CD] = 25, [WPRF_CD] = , [YR_MFG] = , [WASTE_TYPE] = , [INSP_DATE] = , [AUA_VUA] = , [PROCESS_ID] = , [WGEN_CD] = , [DOT_TYPE] = , [BIR_ID] = LAM006, [RQ] = , [LSA_SCO_CD] = , [LSA] = , [A_START_DATE] = , [BIR_WS] = LA-M4, [LA_WS] = TA-55-38, [SWBOP] = , [RETRIEVABLE] = , [OFFSITE] = , [LINER_CD] = , [NET_WT] = 73.4025, [SHIP_CD] = , [WASTE_STREAM] = , [OVERPACK] = N, [REPACKED] = X, [INVENTORY_NO] = 3, [INVENTORY_DT] = 1999-09-29 00:00:00, [CHCD_CC_CD] = , [CHCD_CA_CD] = , [CHCD_WP_CD] = , [DOT_DP] = , [WASTE_VERIF] = , [VERIF_COMPLETE] = , [HDL_CD] = S01, [UPD_WHEN] = 2004-06-30 11:55:12, [UPD_WHO] = 114644, [PHY_STATE] = S, [PKG_H3_ACT] = 0, [QTW] = Y, [AK_REPORT] = , [STP] = 2
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.PKG_DOT TABLE (WASTEDB): [PKG_ID] = S813212, [CHEM_STATE] = ELEMENTAL, [DOT_DESC_CD] = , [DOTHAZ_CD] = 7, [DOTSHIP] = WASTE RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE NON-SPECIAL FORM, [DOTUNNA_CD] = UN3327, [ERGNO] = 165, [FISSILE_CLASS] = , [HAZ_SUB] = , [HMTF_NO] = , [LABEL_CAT] = RADIOACTIVE YELLOW II, [LABEL_SEC] = , [OTHERCONID] = , [PLAC_REQ] = , [TRANS_INDEX] = 0.6, [UPD_WHEN] = , [UPD_WHO] = 217156
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.TW_INIT TABLE (WASTEDB): [DRUM_NO] = 012497, [DUP] = , [ENTRY_SEQ] = 4051, [PACKING_CD] = G, [PKG_ID] = S813212, [RETRIEVER] = , [RETRIEVE_COMMENTS] = inserted from table TW_INIT, 7/27/2000 by z077615, [RETRIEVE_CONDITION] = GOOD, [RETRIEVE_DT] = 1997-04-29 00:00:00, [SURFACE_DOSE] = .5, [UPD_WHEN] = , [UPD_WHO] = , [VENT] = , [RANT] = , [ID] = 2217
08/23/2013 12:33 PM WCATS APPLICATION (000000)	NO	TRUP.UPD_HISTORY TABLE: [UPD_ID]= 11966, [AUTH_BY]= 113199 -> CHRISTENSEN DAVIS V , [AUTH_NUM]= SR318, [PKG_ID]= S813212, [UPD_WHEN]= 03-26-1996, [UPD_WHO]= Z111142 -> LONGLEY JOHN M , [WHAT]= tgrams, tcuries, fiss_grams, thermal, pkg_pe_act,pkg_fiss_grams, [WHY]= Correct errors
08/23/2013 8:48 AM WCATS APPLICATION (000000)	NO	INITWORKPATH (C_ID=776290/PATH_ID=465): SKIPPED (NO WORKPATH UNITS)

Los Alamos NATIONAL LABORATORY EST.1943

TRU WASTE STORAGE RECORD

S913212

1. Generator's Pre-Use Visual Inspection

Purchase Order #	Inspecte5 Items		
This container has been visually inspected according to approved procedures and has been found to be free of damage that would make it unsuitable for TRU waste packaging.	☑ Ring, Bolt, and Nut	☑ Chime	☑ Dents
	☑ Lid and Gasket	☑ Gouges	☑ Paint

Printed Name	Signature	Sig. Date	Oper. Date

2. Generator's Pac6ade Information

Group	Technical Area	Building	Cost Center	Program Code	Cost Account	Work Package
IPM	54	000000				

A55itional Information

☑ DP ☑ Non-DP If Non-DP waste, attach DOE approval doc.

Container	(iner
☐ Steel Drum (55 gal.)	☐ None
☑ Pipe Overpack Type:	☑ 90 mil liner
☑ Steel Drum (85 gal Overpack)	☑ 125 mil liner
☑ Standard Waste Box	☑ Fiberboard Liner
☑ Standard Waste Box Overpack	**Internal Shiel5ind**
☑ RH Canister	☐ None
☑ Other (Call TWCO)	Type: Thickness

Ra5ionucli5e Content

Nucli5e	Amount	Uncertainty	Ck Curie g k Gram
Am-241	1.332E+000	0.000E+000	C
Pu-238	3.325E-001	0.000E+000	C
Pu-239	1.129E+001	0.000E+000	C
Pu-240	2.643E+000	0.000E+000	C
Pu-241	4.013E+001	0.000E+000	C
Pu-242	1.529E-004	0.000E+000	C
U-234	2.416E-005	0.000E+000	C
U-235	4.194E-007	0.000E+000	C

Filter Serial No.			
	01		
	02		

Waste Profile Number	53393 (WS ID 37017)
Gross Weight (lb.)	1.33E+002
Net Weight (lb.)	7.34E+001
Shipping Category	
LANL Waste Stream ID	TA-55-38
TRUCON Code	

Ha=ar5ous g aterials

Name	EPA Co5e	Mty zdQ
Lead	D008	

Date Closed (MM/DD/YY):	Accumulation Start Date (MM/DD/YY): 11/02/81

The data in this section were collected, and waste described herein was packaged and labeled according to approved procedures.

Printed Name	Signature	Date:

3. Generator Site Health Physics Information

	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Gamma Dose Rate (mrem/h) (contact)				
Neutron Dose Rate (mrem/h) (contact)				

Total Dose Rate (mrem/h) (contact)	
Total Dose Rate (mrem/h) (1 meter)	*The data in this section were collected according to approved procedures.*
Alpha Contamination (dpm/100cm2)	Printed Name / Date
Beta-Gamma Cont (dpm/100 cm2)	Signature

Los Alamos NATIONAL LABORATORY EST.1943

TRU WASTE STORAGE RECORD

S913212

) . TRU Waste g anadement ReLie4 vAuthori=ation

The data package for this waste has been reviewed. Basedon the information provided, this waste meets the WAC requirements for storage at TA-54.	Printed Name	Date:
	Signature	

w. Preloa5 Visual Inspection

This waste package was visually inspected prior to transport according to approved procedures. It meets WAC packaging and labeling requirements and is free from obvious damage and defects.	Printed Name	Date:

/ . ReceiLind Site Health Physics Information

Gamma Dose Rate (mrem/h) (contact)	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Neutron Dose Rate (mrem/h) (contact)	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Total Dose Rate (mrem/h) (contact)	*The data in this section were collected according to approved procedures.*			
Total Dose Rate (mrem/h) (1 meter)				
Alpha Contamination (dpm/100cm2)	Printed Name			Date
Beta-Gamma Cont (dpm/100 cm2)	Signature			

7. Storade Site Information

Received by (Initials)	Date Received	**Oridinal Storade Data**	
This waste package was visually inspected and found to be properly labeled and in good condition. It was accepted and inspected according to approved procedures.		Building Number / Layer / Row Number	
		Column Number / Date Stacked (MM/DD/YY)	
Printed Name	Date:	Printed Name	Date:
Signature		Signature	

9. Waste Acceptance Office

IntialsvDate	WE Description

NCR Num8er	IntialsvDate	NCR Description

b. Continuation Sheet for Ra5ionucli5e Content zfrom Pade 1, Section 2Q

Ra5ionucli5e Content - Continue5			
Nucli5e	**Amount**	**Uncertainty**	**Ck Curie g k Gram**
No Additional Radionuclides			

10. Continuation Sheet for Ha=ar5ous g aterials zfrom Pade 1, Section 2Q

Ha=ar5ous g aterials		
Name	**EPA Co5e**	**Mty zdQ**
No Additional Hazardous Materials		

CONTAINER PROFILE
92773
T-TTRU-TEMP

WS ID: 13944
C ID: 790066
ACTIVE

GENERAL INFORMATION

Container ID:	790066		
Labeled ID:	92773		
Optional ID:		**Status:**	ACTIVE
Chemical Barcode:		**Decommissioned:**	YES
Physical State:	SOLID	**Container Type:**	DM: Metal drums, barrels, kegs
Waste Stream ID:	13944	**Container Subtype:**	55-gallon steel drum
Work Path:	T-TTRU-TEMP	**Origin Date:**	01-Feb-2013 9:59 am
Quantity (Univ):		**Accum Start Date:**	03-Nov-1981
Compactible:		**Closed Date:**	01-Feb-2013

Discard Matrix:

TID(s):

Gen Contact: JEFFREY COLEMAN (225849)

Insert By: WCATS APPLICATION (000000)

Waste Desc: GENERIC WPF FOR TRU WASTE PROCESSED UNDER THE TRANSURANIC WASTE CERTIFICATION PROGRAM (TWCP). THIS WPF WILL COVER A ...

WEIGHTS AND VOLUMES

Container Volume:	0.21 CM	**Gross Weight:**	203.80 lb
Waste Volume:	NOT SPECIFIED	**Tare Weight:**	69.00 lb
		Net Weight:	134.80 lb

LOCATION

Pickup (Origin): LANL: 50: 000069

Current: LANL: 54-G: 049-PACK

CONTAINER PROFILE
92773
T-TTRU-TEMP

WS ID: 13944
C ID: 790066
ACTIVE

PAYLOAD INFORMATION

Container Procurement

P.O. Number: **Year of Manuf:**

Lot No.: **Serial No:**

Solution Package: 57: SP AG Cement Cans No Issues

TRUCON Code: LA125M: 55-GAL DRUM WITH FIBERBOARD LINER

Shipping Category: 3003400020

CCP AK Report: CCP-AK-LANL-006: LANL TA-55 Mixed Transuranic Waste

WIPP Waste Stream:

Matrix Code: S5400 - DEBRIS WASTE: HETEROGENEOUS DEBRIS

Defense Waste: YES **Equiv. Comb. Matrix:** Non-combustible/Non-dispersible

Adeq. Ventilation: YES **Compliant Metal Cont.:** YES

Overpack (1 to 1): NO **Retrievable:** **BIR WS Code:**

Content Code:

COST CODES

Cost Center	Prog Code	Cost Account	Work Package	Percent Allocation	Cost Center Status	Cost Code Status	Recharge Mode
6F030A	M348	0A12	EP00	100.00	INACTIVE	INACTIVE	*UNCONSTRAINED*

EPA CODES

System Code	Hazardous Waste No.	Waste Description & Treatment Subcategory
D008A	D008	Lead

FILTERS

Manufacturer	Model	Style	Diffusivity*	Serial Number	Torque Ft-lbs	Mfg Date Mon/Year
Not Specified	NA	NA	0	JL-1215		0/0

**Diffusivity is specified in moles per second per mole fraction*

LAYERS OF CONFINEMENT

Layer No.	Layer Status	Confinement Type: Subtype
1	Active	rigid drum liner: fiberboard

CONTAINER PROFILE
92773
T-TTRU-TEMP

WS ID: 13944
C ID: 790066
ACTIVE

RADIOLOGICAL SURVEY

Survey Type	Instrument Number	Survey Date	At Contact mrem/hr	At 30 cm mrem/hr	At 1 M mrem/hr	Alpha dpm/100cm2	Beta/Gama dpm/100 cm2
Survey ID: 90942, Status: Active							
B/G Survey			= 19.00	=	=	Not Applicable	
Neutron Survey			= 4.00	=	=	Not Applicable	
Smear Results			Not Applicable			= 2.20	= 5.70

RADIONUCLIDES

Nuclide	Amount	Unit	Uncert	MT Derived (Y/N)	Activated (Y/N)	MDA Result (Y/N)	Normal Form (Y/N)	Measurement Code/Comment
Status: Inactive, Assay Page: 374198, Date: 11/03/1981, Derivation: Generator Entered Results (e.g., Offsite Assay)								
Am-241	3.338-771	0	4.E48-772	5			g	
NY-13E	C.338-77s	0	1.1C8-77s	5			g	
96-23C	1.ss8-772	0	2.3E8-773	5			g	
96-23P	1.us8+772	0	2.228+771	5			g	
96-247	P.PP8+777	0	1.428+777	5			g	
96-241	3.338-771	0	4.E48-772	5			g	
96-242	3.338-772	0	4.E48-773	5			g	
Sr-P7	u.318-77s	0	E.us8-77E	5			g	
U-234	3.338-773	0	4.E48-774	5			g	
U-23u	1.ss8-771	0	2.3E8-772	5			g	
Status: Active, Assay Page: 384962, Date: 06/11/2013, Derivation: Non-Destructive Assay (NDA)								
Am-241	4.u38+777	Ni	s.u28-771	5			g	
5p-23E	2.s48-77u	Ni	3.318-77s	5			g	
96-23C	4.1C8-771	Ni	s.728-772	5			g	
96-23P	1.1C8+771	Ni	1.sP8+777	5			g	
96-247	3.718+777	Ni	4.328-771	5			g	
96-241	1.EE8+771	Ni	2.uu8+777	5			g	
96-242	2.CP8-774	Ni	4.1s8-77u	5			g	
U-23u	7.778+777	Ni	7.778+777	5			g	

CONTAINER PROFILE
92773
T-TTRU-TEMP

WS ID: 13944
C ID: 790066
ACTIVE

RAD CALCULATIONS

	Total Activity (nCi/g):	s.12s228+7u		**Decay Heat [U] (W):**	s.P22CC8-71	
	Alpha (nCi/g):	3.231u78+7u		**DOTFissile Mat (g):**	1.P72sC8+72	
	TRU Alpha (nCi/g):	3.231438+7u		**Transport Index:**		
**	**MDA TRU Alpha (nCi/g)**	3.231438+7u		**NRC Class:**	GTNN	
	Pu-239 FGE:	1.P7C7P8+72		**DOT Type:**	B	
	Pu-239 FGE [2U]:	2.4u2s78+72		**LSA-I Fraction:**	4.721138+7u	5
	Pu-239 Eq-Ci:	2.71u328+71		**LSA-II Fraction:**	1.2134C8+72	5
	Pu-239 Eq-Ci [2U]:	2.3CCPs8+71		**LSA-III Fraction:**	s.7sE3P8+77	5
	TRU Pu-239 Eq-Ci:	2.71u328+71		**Reportable Quantity:**	1.PP3u38+73	g
	TRU Pu-239 Eq-Ci [2U]:	2.3CCPs8+71	*	**ALC Ratio:**	1.EPCCP8+7C	58
	Tritium (Ci/m3):	7.777778+77	*	**ACM Ratio:**	1.27s348+7E	58
	ECW PE-Ci:	u.73C378+77		**Limited Quantity:**	E.41PE28+7u	5

Weight/Volume Used:

1 Container Net Weight: 6.11443E+01 kg
2 Container Volume: 2.08000E-01 m3

**3 AC8L3 ctivity8Aimit8for8(Eempt8Consixnmentg*
**3 CM8L3 ctivity8Concentration8for8(Eempt8Materialg*
***8) se8for8AA/UT) 8Determination*
) 8R8I8) ncertainty=86) 8R868) ncertainty

DOT SHIPPING DESC

Status/ Manifest IDs	DOT Shipping Description
ACTIVE 95847	UN3327, WASTE RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE NON-SPECIAL FORM, 7, Solid, ELEMENTAL, AM241, CS137, PU238, PU239, PU240, PU241, PU242, SR90, U234, U235, 1.783E+00 TBq, T.I.=1.9, RADIOACTIVE YELLOW III

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
02/01/2013 9:59 AM	1805121 EXECUTED	LANL:50 - REPACK-TRU	NA
02/01/2013 9:59 AM	1097677 EXECUTED	LANL:50 » 50:000069	NO
02/04/2013 12:00 PM	1110324 EXECUTED	LANL:50 » 54-G:000232 (MANIF ID: 95847) STAGING	NO
02/07/2013 8:35 AM	1110325 EXECUTED	LANL:54-G » 54-G:000545	NO
02/08/2013 9:21 AM	1110326 EXECUTED	LANL:54-G » 54-G:RTR-2	NO
02/12/2013 3:19 PM	1110327 EXECUTED	LANL:54-G » 54-G:000048 DOME 48 STAGING	NO

CONTAINER PROFILE
92773
T-TTRU-TEMP

WS ID: 13944
C ID: 790066
ACTIVE

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
03/14/2013 12:53 PM	1110328 EXECUTED	LANL:54-G » 54-G:000048 COLUMN 051:LAYER 02:ROW 01	NO
06/06/2013 9:19 AM	1110329 EXECUTED	LANL:54-G » 54-G:RTR-2	NO
06/10/2013 9:31 AM	1110330 EXECUTED	LANL:54-G » 54-G:HENC-1	NO
06/11/2013 4:08 PM	1110331 EXECUTED	LANL:54-G » 54-G:000545	NO
06/21/2013 12:29 PM	1110332 EXECUTED	LANL:54-G » 54-G:000049 DOME 49 STAGING	NO
06/21/2013 12:50 PM	1110333 EXECUTED	LANL:54-G » 54-G:000049 COLUMN 037 - HIGH FGE:LAYER 01:ROW 07	NO
08/27/2013 2:01 PM	1816987 EXECUTED	LANL:54-G: » 54-G:000049 COLUMN 021 - HIGH FGE:LAYER 01:ROW 07	NO
08/27/2013 5:45 PM	1816436 PENDING	LANL:54-G - WALL2W - 000049	NO
01/15/2014 10:18 AM	1824741 CANCELLED	LANL:54-G » 54-G:000049	NO
01/22/2014 3:13 PM	1825340 EXECUTED	LANL:54-G - 049-PACK	NO

, ote48NixHixHed8oh 8ndicates&ontainer8h as&utput8or8eceivinx&ontainer8or8He8ndicated8asw

COMMENTS

Date Time/ User Name	Comment
08/23/2013 10:50 PM WCATS APPLICATION (000000)	[UNIT] RTR 2; [DATE] 02/08/2013; [CONTAINER ID] 92773; [CERT / FAST] Certified; [PASS / FAIL] Fail; [COMMENT] >50% Debris; [BDR#] LA-RTR2-13-0022; [NCR#] NCR-LANL-0413-13;
08/23/2013 10:50 PM WCATS APPLICATION (000000)	[UNIT] RTR 2; [DATE] 06/07/2013; [CONTAINER ID] 92773; [CERT / FAST] Certified; [PASS / FAIL] Pass; [COMMENT] 55 gal drum - Currently has NCR-LANL-0413-13 (>50% Debris); Operator recommends disposition of NCR.; [BDR#] LA-RTR2-13-0080; [NCR#] N/A;
08/23/2013 9:37 AM WCATS APPLICATION (000000)	PARENT #S816861
08/23/2013 10:51 PM WCATS APPLICATION (000000)	[UNIT] HENC 1; [DATE] 06/11/2013; [CONTAINER ID] 92773; [CERT / FAST] Certified; [PASS / FAIL] Pass; [COMMENT] Preliminarily >200 FGE;
02/15/2014 10:00 PM WCATS APPLICATION (000000)	[UNIT] RANT; [DATE] 02/06/2014; [CONTAINER ID] 92773; [DRUM / SWB] Drum; [COMMENT] -;

EDIT LOG

Date Time/ User Name	Quality Record	Explanation
09/15/2014 10:36 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.MATRIX_CODE [790066] changed from S3150 to S5400
09/15/2014 10:36 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.CCP_WS_ID [790066] changed from LA-CIN01.001 to LA-MHD01.001

CONTAINER PROFILE
92773
T-TTRU-TEMP

WS ID: 13944
C ID: 790066
ACTIVE

EDIT LOG

Date Time/ User Name	Quality Record	Explanation
01/31/2014 6:46 PM WCATS APPLICATION (000000)	YES	RT381813 ¿¿¿ ORIGIN DATE SET TO PKG_HIST.HIST_DATE
01/31/2014 6:46 PM WCATS APPLICATION (000000)	YES	C_MASTER.ORIGIN_DATETIME[790066] CHANGED FROM 11-03-1981 12:00 AM TO 02-01-2013 09:59 AM
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.PKG_VENT TABLE (WASTEDB): [VENT_ID] = 56186, [FILTER_TYPE_CD] = , [INNER_OUTER] = , [PKG_ID] = 92773, [REMOVED] = , [SERIAL_NO] = JL-1215, [SOURCE] = , [UPD_WHEN] = 2013-02-01 12:25:14, [UPD_WHO] = 225849, [VENT_CD] = , [VENT_DATE] = 2013-02-01 00:00:00
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.PKG_DOT TABLE (WASTEDB): [PKG_ID] = 92773, [CHEM_STATE] = ELEMENTAL, [DOT_DESC_CD] = , [DOTHAZ_CD] = 7, [DOTSHIP] = WASTE RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE NON-SPECIAL FORM, [DOTUNNA_CD] = UN3327, [ERGNO] = 165, [FISSILE_CLASS] = , [HAZ_SUB] = , [HMTF_NO] = , [LABEL_CAT] = RADIOACTIVE YELLOW III, [LABEL_SEC] = , [OTHERCONID] = , [PLAC_REQ] = , [TRANS_INDEX] = 1.9, [UPD_WHEN] = , [UPD_WHO] = 120261
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.TRUPKG TABLE (WASTEDB): [PKG_ID] = 92773, [ALPHA_CONT] = 2.2, [APPROVE_BY] = , [APPROVE_DATE] = , [BETA_GAMMA_CONT] = 5.7, [BLDG_CD] = 50-00069, [BX_SERIAL] = , [CERT_STATUS] = , [COLOR_CD] = , [COMMENTS] = PARENT #S816861, [CONTENT_CODE] = , [CONTROL] = , [DATE_CLOSED] = 2013-02-01 00:00:00, [GAMMA_DOSE] = 19, [GROSS_WT] = 203.8, [GRP] = WDPTWPS, [NEUTRON_DOSE] = 4, [NORMAL] = N, [OLDDRUMNUM] = , [OLDVOL_UNIT] = , [OLDWT_UNIT] = , [ORG_VOL] = , [ORG_WT] = , [PKG_CD] = 01, [PKG_CD_DESC] = STEEL DRUM (55 GAL), [PKG_DATE] = 2013-02-04 00:00:00, [PKG_FISS_GRAMS] = 189, [PKG_LOT] = , [PKG_PE_ACT] = 20, [PKG_TARE_WT] = 69, [PKG_VOLUME] = .208, [PROC_BTCH_CD] = , [PROG_CODE] = M348, [ROOM] = , [SAMPLE_ID] = , [THERMAL] = .42523139009999423954699892150663752421 6, [TOTAL_DOSE] = 23, [TOT_ANCG] = 221798.92270927082385379719321515266875 1, [TRUCON_CD] = LA125M, [WASTE_CD] = , [WPRF_CD] = 32358, [YR_MFG] = , [WASTE_TYPE] = S3150, [INSP_DATE] = , [AUA_VUA] = , [PROCESS_ID] = , [WGEN_CD] = 225849, [DOT_TYPE] = , [BIR_ID] = , [RQ] = , [LSA_SCO_CD] = , [LSA] = , [A_START_DATE] = 1981-11-03 00:00:00, [BIR_WS] = , [LA_WS] = , [SWBOP] = , [RETRIEVABLE] = , [OFFSITE] = , [LINER_CD] = 04, [NET_WT] = 134.8, [SHIP_CD] = 3003400020, [WASTE_STREAM] = LA-CIN01.001, [OVERPACK] = N, [REPACKED] = , [INVENTORY_NO] = , [INVENTORY_DT] = , [CHCD_CC_CD] = 6F030A, [CHCD_CA_CD] = 0A12, [CHCD_WP_CD] = EP00, [DOT_DP] = Y, [WASTE_VERIF] = , [VERIF_COMPLETE] = , [HDL_CD] = S01, [UPD_WHEN] = 2013-02-01 09:59:09, [UPD_WHO] = 241661, [PHY_STATE] = S, [PKG_H3_ACT] = 0, [QTW] = , [AK_REPORT] = CCP-AK-LANL-006, [STP] = 0
08/23/2013 8:50 AM WCATS APPLICATION (000000)	NO	INITWORKPATH (C_ID=790066/PATH_ID=465): SKIPPED (NO WORKPATH UNITS)

TRU WASTE STORAGE RECORD

92553

1. Generator's Pre-Use Visual Inspection

Purchase Order #	Inspecte6 Items		
This container has been visually inspected according to approved procedures and has been found to be free of damage that would make it unsuitable for TRU waste packaging.	☐ Ring, Bolt, and Nut	☐ Chime	☐ Dents
	☐ Lid and Gasket	☐ Gouges	☐ Paint

Printed Name	Signature	Sig. Date	Oper. Date

2. Generator's Pacdake Information

Group	Technical Area	Building	Cost Center	Program Code	Cost Account	Work Package
LTP-WRP	50	000069				

A66itional Information

☑ DP ☐ Non-DP If Non-DP waste, attach DOE approval doc.

Container	) iner
☑ Steel Drum (55 gal.)	☐ None
☐ Pipe Overpack Type:	☐ 90 mil liner
☐ Steel Drum (85 gal Overpack)	☐ 125 mil liner
☐ Standard Waste Box	☑ Fiberboard Liner
☐ Standard Waste Box Overpack	**Internal Shiel6ink**
☐ RH Canister	☑ None
☐ Other (Call TWCO)	Type / Thickness

Ra6ionucli6e Content

Nucli6e	Amount	Uncertainty	Cg Curie = g Gram
Am-241	E.M 0+L000	).M20+-005	C
Np-237	2.)E0+-00M	. 50+-00)	C
Pu-238	E.570+-005	).020+-002	C
Pu-239	5.570+L005	5.)(0+L000	C
Pu-240	.050+L000	E. 20+-005	C
Pu-241	5.330+L005	2.MM0+L000	C
Pu-242	2.7(0+-00E	E.5)0+-00M	C
U-235	0.000+L000	0.000+L000	C

Filter Serial No.			
	01 JL-1215		
	02		

Waste Profile Number	2 M76WSI6D965 (EE4
Gross Weight (lb.)	2.0E+L002
Net Weight (lb.)	5. M+L002
Shipping Category	00 E00020
LANL Waste Stream ID	
TRUCON Code	A152M/

HaMar6ous = aterials

Name	EPA Co6e	z ty Q(
Lead	D008	

Date Closed (MM/DD/YY): 028058205

Accumulation Start Date (MM/DD/YY): 5580 875

The data in this section were collected, and waste described herein was packaged and labeled according to approved procedures.

Printed Name	Signature	Date:

3. Generator Site Health Physics Information

		Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Gamma Dose Rate (mrem/h) (contact)	5.(0+L005				
Neutron Dose Rate (mrem/h) (contact)	E.00+L000	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Total Dose Rate (mrem/h) (contact)	2. 0+L005				
Total Dose Rate (mrem/h) (1 meter)					
Alpha Contamination (dpm/100cm2)	2.20+L000				
Beta-Gamma Cont (dpm/100 cm2)	M.30+L000				

The data in this section were collected according to approved procedures.

Printed Name	Date

Signature

Los Alamos NATIONAL LABORATORY EST.1943

TRU WASTE STORAGE RECORD

92553

L. TRU Waste = anakement Re4iev w Authori Mation

The data package for this waste has been reviewed. Basedon the information provided, this waste meets the WAC requirements for storage at TA-54.	Printed Name	Date:
	Signature	

/ . Preloa6 Visual Inspection

This waste package was visually inspected prior to transport according to approved procedures. It meets WAC packaging and labeling requirements and is free from obvious damage and defects.	Printed Name	Date:

7. Recei4ink Site Health Physics Information

Gamma Dose Rate (mrem/h) (contact)	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Neutron Dose Rate (mrem/h) (contact)	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Total Dose Rate (mrem/h) (contact)	*The data in this section were collected according to approved procedures.*			
Total Dose Rate (mrem/h) (1 meter)				
Alpha Contamination (dpm/100cm2)	Printed Name			Date
Beta-Gamma Cont (dpm/100 cm2)	Signature			

5. Storake Site Information

Received by (Initials)	Date Received	**Orikinal Storake Data**		
This waste package was visually inspected and found to be properly labeled and in good condition. It was accepted and inspected according to approved procedures.		Building Number	Layer	Row Number
		Column Number	Date Stacked (MM/DD/YY)	
Printed Name	Date:	Printed Name		Date:
Signature		Signature		

8. Waste Acceptance Office

Intials Date	WE Description

NCR Number	Intials Date	NCR Description

TRU WASTE STORAGE RECORD

92553

9. Continuation Sheet for Ra6ionucli6e Content Cfrom Pake 1, Section 2(

Ra6ionucli6e Content - Continue6			
Nucli6e	**Amount**	**Uncertainty**	**Cg Curie = g Gram**
No Additional Radionuclides			

10. Continuation Sheet for HaMar6ous = aterials Cfrom Pake 1, Section 2(

HaMar6ous = aterials		
Name	**EPA Co6e**	**z ty Qx(**
No Additional Hazardous Materials		

CONTAINER PROFILE
S816861
T-TTRU-TEMP

WS ID: 37017
C ID: 772841
Opt ID: 011407
ACTIVE

GENERAL INFORMATION

Container ID:	772841		
Labeled ID:	S816861		
Optional ID:	011407	**Status:**	ACTIVE
Chemical Barcode:		**Decommissioned:**	YES
Physical State:	SOLID	**Container Type:**	DM: Metal drums, barrels, kegs
Waste Stream ID:	37017	**Container Subtype:**	55-gallon steel drum
Work Path:	T-TTRU-TEMP	**Origin Date:**	03-Nov-1981 12:00 am
Quantity (Univ):		**Accum Start Date:**	03-Nov-1981
Compactible:		**Closed Date:**	

Discard Matrix:

TID(s):

Gen Contact:

Insert By: WCATS APPLICATION (000000)

Waste Desc: GENERATED AT 55-PF4

WEIGHTS AND VOLUMES

Container Volume:	0.21 CM	**Gross Weight:**	168.02 lb
Waste Volume:	NOT SPECIFIED	**Tare Weight:**	60.00 lb
		Net Weight:	108.02 lb

LOCATION

Pickup (Origin): LANL: 55-PF4: 400-AREA: 432

Current: LANL: 50: REPACK-TRU

CONTAINER PROFILE
S816861
T-TTRU-TEMP

WS ID: 37017
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ACTIVE

PAYLOAD INFORMATION

Container Procurement

P.O. Number: **Year of Manuf:**

Lot No.: **Serial No:**

Solution Package: 57: SP AG Cement Cans No Issues

TRUCON Code:

Shipping Category:

CCP AK Report: CCP-AK-LANL-006: LANL TA-55 Mixed Transuranic Waste

WIPP Waste Stream: TA-55-38: CEMENTED INORGANICS AND SPENT SAMPLES

Matrix Code: S3150 - HOMOGENEOUS SOLIDS: INORGANIC HOMOGENEOUS SOLIDS: SOLIDIFIED HOMOGENEOUS SOLIDS

Defense Waste: **Equiv. Comb. Matrix:** Non-combustible/Non-dispersible

Adeq. Ventilation: **Compliant Metal Cont.:** YES

Overpack (1 to 1): NO **Retrievable:** **BIR WS Code:** LA-M4

Content Code:

TAGS

Container Tag	List Value	Date	Explanation	Insert By / Date & TIme
3706 M3 INITIAL CONTAINER		04/17/2014		WCATS APPLICATION (000000) 04/17/2014 6:17 PM

COST CODES

Cost Center	Prog Code	Cost Account	Work Package	Percent Allocation	Cost Center Status	Cost Code Status	Recharge Mode
							SELECTION LIST

EPA CODES

System Code	Hazardous Waste No.	Waste Description & Treatment Subcategory
D008A	D008	Lead

CONTAINER PROFILE
S816861
T-TTRU-TEMP

WS ID: 37017
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ACTIVE

RADIONUCLIDES

Nuclide	Amount	Unit	Uncert	MT Derived (Y/N)	Activated (Y/N)	MDA Result (Y/N)	Normal Form (Y/N)	Measurement Code/Comment
Status: Active, Assay Page: 349452, Date: 11/03/1981, Derivation: Generator Entered Results (e.g., Offsite Assay)								
52	1.94E+002	g	0.00E+000	N				NONE
Am-231	1.15E+000	Ci	0.00E+000	Y			Y	
Pu-286	2.69E-001	Ci	0.00E+000	Y			Y	
Pu-28U	U.42E+000	Ci	0.00E+000	Y			Y	
Pu-230	2.26E+000	Ci	0.00E+000	Y			Y	
Pu-231	8.35E+001	Ci	0.00E+000	Y			Y	
Pu-232	1.82E-003	Ci	0.00E+000	Y			Y	
7-283	2.06E-005	Ci	0.00E+000	Y			Y	
7-285	8.91E-004	Ci	0.00E+000	Y			Y	

RAD CALCULATIONS

Total Activity (nCi/g):	U.4U120E+05	**Decay Heat [U] (W):**	3.29591E-01	
Alpha (nCi/g):	2.43110E+05	**DOTFissile Mat (g):**	1.54113E+02	
TRU Alpha (nCi/g):	2.430U2E+05	**Transport Index:**		
** **MDA TRU Alpha (nCi/g)**	2.430U2E+05	**NRC Class:**	GTCC	
Pu-239 FGE:	1.54405E+02	**DOT Type:**	B	
Pu-239 FGE [2U]:	1.54405E+02	**LSA-I Fraction:**	8.39432E+05	N
Pu-239 Eq-Ci:	1.31019E+01	**LSA-II Fraction:**	1.05492E+02	N
Pu-239 Eq-Ci [2U]:	1.31019E+01	**LSA-III Fraction:**	5.2660UE+00	N
TRU Pu-239 Eq-Ci:	1.31019E+01	**Reportable Quantity:**	1.84458E+08	Y
TRU Pu-239 Eq-Ci [2U]:	1.31019E+01	* **ALC Ratio:**	1.86281E+06	NE
Tritium (Ci/m3):	0.00000E+00	* **ACM Ratio:**	1.03028E+04	NE
ECW PE-Ci:	6.43800E-02	**Limited Quantity:**	5.16204E+05	N

Weight/Volume Used:

1 Container Net Weight: 4.89975E+01 kg
2 Container Volume: 2.08000E-01 m3

*3*AM8L*(nxcav8Acy an8nCe8f Eiy . n8MCoxasoy iorg*
*3*MP 8L*(nxcav8MCo(ioret naCo8nCe8f Eiy . n8P tniea)g*
338l xi8nCe8AA/UTl 8Riniey aotnaCo
l 8D8l8l o(ient aonv=8l 8D868l o(ient aonv

CONTAINER PROFILE
S816861
T-TTRU-TEMP

WS ID: 37017
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ACTIVE

DOT SHIPPING DESC

Status/ Manifest IDs	DOT Shipping Description
ACTIVE 94411	UN3327, WASTE RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE NON-SPECIAL FORM, 7, Solid, ELEMENTAL, AM241, CS137, PU238, PU239, PU240, PU241, PU242, SR90, U234, U235, 1.783E+00 TBq, T.I.=0.9, RADIOACTIVE YELLOW II

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
11/04/1981 12:00 AM	1277609 EXECUTED	LANL:55-PF4 » 54-G:PAD01 POST 24:LAYER 03:POSITION WEST	NO
04/13/1998 12:00 AM	1289230 EXECUTED	LANL:54-G » 54-G:000231	NO
10/14/1998 12:00 AM	1289231 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 059:LAYER 02:ROW 03	NO
12/14/1999 12:00 AM	1289232 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 055:LAYER 03:ROW 10	NO
03/25/2004 12:00 AM	1289233 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 014:NOT SPECIFIED:NOT SPECIFIED	NO
08/19/2004 9:21 AM	1289234 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 014:NOT SPECIFIED:NOT SPECIFIED	NO
07/08/2005 2:43 PM	1289235 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 013:LAYER 03:NOT SPECIFIED	NO
03/29/2006 9:57 AM	1289236 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 013:NOT SPECIFIED:NOT SPECIFIED	NO
04/09/2006 10:33 AM	1289237 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 104:NOT SPECIFIED:NOT SPECIFIED	NO
04/11/2006 4:11 PM	1289238 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 105:LAYER 01:ROW 01	NO
04/24/2006 10:15 AM	1289239 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 101:LAYER 01:ROW 01	NO
05/02/2006 1:45 PM	1289240 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 102:LAYER 01:ROW 01	NO
06/29/2006 8:36 AM	1289241 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 001:LAYER 01:ROW 10	NO
06/29/2006 9:19 AM	1289242 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 006:LAYER 02:ROW 08	NO
11/18/2006 2:37 PM	1289243 EXECUTED	LANL:54-G » 54-G:000232 STAGING	NO
12/06/2006 10:01 AM	1289244 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 079:LAYER 01:ROW 01	NO
12/08/2006 4:44 PM	1289245 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 010:LAYER 01:ROW 14	NO
01/10/2007 11:31 AM	1289246 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 018:LAYER 03:ROW 16	NO

CONTAINER PROFILE
S816861
T-TTRU-TEMP

WS ID: 37017
C ID: 772841
Opt ID: 011407
ACTIVE

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
04/02/2007 12:00 AM	1289821 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 020:LAYER 03:ROW 16	NO
06/02/2007 9:51 AM	1289822 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 008:LAYER 01:ROW 12	NO
07/10/2007 10:58 AM	1289823 EXECUTED	LANL:54-G » 54-G:000229 COLUMN 014:LAYER 01:ROW 06	NO
08/16/2007 1:15 PM	1289824 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 014:LAYER 03:ROW 04	NO
08/20/2007 2:04 PM	1289825 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 014:LAYER 02:ROW 04	NO
08/22/2007 9:15 AM	1289826 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 014:LAYER 01:ROW 04	NO
09/04/2007 11:10 AM	1289827 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 022:LAYER 03:ROW 16	NO
09/25/2007 4:01 PM	1289828 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 023:LAYER 01:ROW 12	NO
02/14/2008 10:42 AM	1289829 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 035:LAYER 01:ROW 06	NO
07/09/2008 9:26 AM	1289830 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 031:LAYER 03:ROW 08	NO
09/02/2008 9:33 AM	1289831 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 035:LAYER 01:ROW 06	NO
09/29/2008 3:26 PM	1289832 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 011:LAYER 01:ROW 10	NO
03/02/2009 12:00 AM	1289833 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 014:LAYER 03:ROW 14	NO
03/18/2009 3:20 PM	1289834 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 027:LAYER 02:ROW 14	NO
05/01/2009 9:51 AM	1289835 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 014:LAYER 02:ROW 10	NO
05/05/2009 9:30 AM	1289836 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 011:LAYER 03:ROW 10	NO
06/03/2009 2:42 PM	1289837 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 015:LAYER 02:ROW 08	NO
06/30/2009 2:49 PM	1289838 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 022:LAYER 01:ROW 06	NO
01/21/2012 3:41 PM	1289839 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 018:LAYER 02:ROW 08	NO
02/04/2012 12:13 PM	1289840 EXECUTED	LANL:54-G » 54-G:000231 COLUMN 019:LAYER 03:ROW 04	NO
04/28/2012 10:21 AM	1289841 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 050:LAYER 03:ROW 06	NO

CONTAINER PROFILE
S816861
T-TTRU-TEMP

WS ID: 37017
C ID: 772841
Opt ID: 011407
ACTIVE

TASK HISTORY

Date/ Time	Task ID/ Status	Task Name/ Storage or Disposal Grid Location	Reject
05/02/2012 4:59 PM	1289842 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 030:LAYER 02:ROW 10	NO
05/25/2012 9:21 AM	1289843 EXECUTED	LANL:54-G » 54-G:000232 STAGING	NO
06/01/2012 9:02 AM	1289844 EXECUTED	LANL:54-G » 54-G:RTR-HE	NO
06/01/2012 11:28 AM	1289845 EXECUTED	LANL:54-G » 54-G:000232 STAGING	NO
06/20/2012 3:48 PM	1289846 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 029:LAYER 02:ROW 04	NO
07/11/2012 3:25 PM	1289847 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 023:LAYER 02:ROW 02	NO
09/18/2012 11:56 AM	1289848 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 039:LAYER 01:ROW 12	NO
09/19/2012 3:13 PM	1289849 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 010:LAYER 01:ROW 10	NO
09/27/2012 1:18 PM	1289850 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 014:LAYER 01:ROW 14	NO
10/16/2012 2:35 PM	1289851 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 018:LAYER 01:ROW 04	NO
11/01/2012 9:21 AM	1289852 EXECUTED	LANL:54-G » 54-G:000232 COLUMN 020:LAYER 01:ROW 04	NO
11/07/2012 1:05 PM	1290481 EXECUTED	LANL:54-G » 54-G:000153-O STAGING ON EAST SIDE OF DOME	NO
01/17/2013 3:31 PM	1290482 EXECUTED	LANL:54-G » 54-G:HGAS	NO
01/22/2013 3:30 PM	1290483 EXECUTED	LANL:54-G » 54-G:000153-O STAGING ON EAST SIDE OF DOME	NO
01/29/2013 8:19 AM	1290484 EXECUTED	LANL:54-G » 50:000069	NO
02/01/2013 9:59 AM	1805121 EXECUTED	LANL:50 - REPACK-TRU	NO

NCi 48Hash)as hni d8eCwa8oda(t ni x8(Cont aoi e8wt x8Cun un8Ce8ei (i ac as 8(Cont aoi e8Ke8hi 8oda(t ni d8t xk

DOCUMENTATION

Doc. Number	Title	Uploaded By
1	S816861-TWSR	WCATS APPLICATION (000000)

CONTAINER PROFILE
S816861
T-TTRU-TEMP

WS ID: 37017
C ID: 772841
Opt ID: 011407
ACTIVE

COMMENTS

Date Time/ User Name	Comment
08/23/2013 9:37 AM WCATS APPLICATION (000000)	LEACHED SOLIDS
08/23/2013 10:50 PM WCATS APPLICATION (000000)	[UNIT] WCRRF; [DATE] 02/01/2013; [CONTAINER ID] S816861; [DAUGHTER ID] 92773; [SPLIT / VE] PID; [TYPE] Daughter; [COMMENT] -;
08/23/2013 10:53 PM WCATS APPLICATION (000000)	[UNIT] HE RTR PS; [DATE] 06/01/2012; [CONTAINER ID] S816861; [CERT / FAST] Fast Scan; [PASS / FAIL] Fail; [COMMENT] >4L Sealed Cont. (Sliptop and Paint Cans) Appears to be s5000; [BDR#] LA-HERTR-12-0044 (open); [NCR#] -;

EDIT LOG

Date Time/ User Name	Quality Record	Explanation
11/05/2014 10:25 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.MATRIX_CODE [772841] changed from null to S3150
11/05/2014 10:25 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.CCP_AK_REPORT_NO [772841] changed from null to CCP-AK-LANL-006
11/05/2014 10:25 AM WCATS APPLICATION (000000)	YES	C_MASTER_TRU.CCP_WS_ID [772841] changed from null to LA-CIN01.001
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.TW_PKG TABLE (WASTEDB): [PKG_ID] = S816861, [DIS_CD] = , [DIS_DT] = , [DRUM_NO] = 011407, [DVS_BURN] = , [DVS_CONDITION] = , [DVS_DRUM_WT] = , [DVS_EXPECT_HI_H2] = , [DVS_H2] = , [DVS_LID_CONTAM] = , [DVS_OPERATOR] = , [DVS_PSIA] = , [DVS_VENT_DATE] = , [DVS_VENT_STRIP] = , [RETRIEVE_COMMENTS] = inserted from table TW_INIT, 7/27/2000 by z077615, [RETRIEVE_CONDITION] = , [RETRIEVE_DT] = 1997-04-17 00:00:00, [RETRIEVER_ZNO] = , [SURFACE_DOSE] = 6, [UPD_WHEN] = 1997-10-22 00:00:00, [UPD_WHO] = Z111491
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.TRUPKG TABLE (WASTEDB): [PKG_ID] = S816861, [ALPHA_CONT] = , [APPROVE_BY] = , [APPROVE_DATE] = , [BETA_GAMMA_CONT] = , [BLDG_CD] = 55-PF4, [BX_SERIAL] = , [CERT_STATUS] = , [COLOR_CD] = , [COMMENTS] = LEACHED SOLIDS , [CONTENT_CODE] = , [CONTROL] = , [DATE_CLOSED] = , [GAMMA_DOSE] = , [GROSS_WT] = 168.021, [GRP] = CMB11, [NEUTRON_DOSE] = , [NORMAL] = , [OLDDRUMNUM] = 011407, [OLDVOL_UNIT] = M, [OLDWT_UNIT] = K, [ORG_VOL] = , [ORG_WT] = , [PKG_CD] = 01, [PKG_CD_DESC] = STEEL DRUM (55 GAL), [PKG_DATE] = 1981-11-04 00:00:00, [PKG_FISS_GRAMS] = 157.21479136725057487981507144410234478 1, [PKG_LOT] = , [PKG_PE_ACT] = 14.234632744882645687549752614565181883 6, [PKG_TARE_WT] = 60, [PKG_VOLUME] = .208, [PROC_BTCH_CD] = , [PROG_CODE] = , [ROOM] = 432, [SAMPLE_ID] = , [THERMAL] = .42523583168825622, [TOTAL_DOSE] = 5, [TOT_ANCG] = 276786.98655122208910746941932236149 7186, [TRUCON_CD] = , [WASTE_CD] = 25, [WPRF_CD] = , [YR_MFG] = , [WASTE_TYPE] = , [INSP_DATE] = , [AUA_VUA] = , [PROCESS_ID] = , [WGEN_CD] = , [DOT_TYPE] = , [BIR_ID] = LAM006, [RQ] = , [LSA_SCO_CD] = , [LSA] = , [A_START_DATE] = , [BIR_WS] = LA-M4, [LA_WS] = TA-55-38, [SWBOP] = , [RETRIEVABLE] = , [OFFSITE] = , [LINER_CD] = , [NET_WT] = 108.021, [SHIP_CD] = , [WASTE_STREAM] = , [OVERPACK] = N, [REPACKED] = X, [INVENTORY_NO] = 2, [INVENTORY_DT] = 1999-04-07 00:00:00, [CHCD_CC_CD] = , [CHCD_CA_CD] = , [CHCD_WP_CD] = , [DOT_DP] = , [WASTE_VERIF] = , [VERIF_COMPLETE] = , [HDL_CD] = S01, [UPD_WHEN] = 2004-06-30 11:56:18, [UPD_WHO] = 114644, [PHY_STATE] = S, [PKG_H3_ACT] = 0, [QTW] = N, [AK_REPORT] = , [STP] = 2
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.PKG_DOT TABLE (WASTEDB): [PKG_ID] = S816861, [CHEM_STATE] = ELEMENTAL, [DOT_DESC_CD] = , [DOTHAZ_CD] = 7, [DOTSHIP] = WASTE RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE NON-SPECIAL FORM, [DOTUNNA_CD] = UN3327, [ERGNO] = 165, [FISSILE_CLASS] = , [HAZ_SUB] = , [HMTF_NO] = , [LABEL_CAT] = RADIOACTIVE YELLOW II, [LABEL_SEC] = , [OTHERCONID] = , [PLAC_REQ] = , [TRANS_INDEX] = 0.9, [UPD_WHEN] = , [UPD_WHO] = 120424

CONTAINER PROFILE
S816861
T-TTRU-TEMP

WS ID: 37017
C ID: 772841
Opt ID: 011407
ACTIVE

EDIT LOG

Date Time/ User Name	Quality Record	Explanation
08/23/2013 9:44 PM WCATS APPLICATION (000000)	NO	TRUP.TW_INIT TABLE (WASTEDB): [DRUM_NO] = 011407, [DUP] = , [ENTRY_SEQ] = 1951, [PACKING_CD] = G, [PKG_ID] = S816861, [RETRIEVER] = , [RETRIEVE_COMMENTS] = inserted from table TW_INIT, 7/27/2000 by z077615, [RETRIEVE_CONDITION] = , [RETRIEVE_DT] = 1997-04-17 00:00:00, [SURFACE_DOSE] = 6, [UPD_WHEN] = 1997-10-22 00:00:00, [UPD_WHO] = Z111491, [VENT] = , [RANT] = , [ID] = 157
08/23/2013 12:33 PM WCATS APPLICATION (000000)	NO	TRUP.UPD_HISTORY TABLE: [UPD_ID]= 29620, [AUTH_BY]= 113199 -> CHRISTENSEN DAVIS V , [AUTH_NUM]= SR318, [PKG_ID]= S816861, [UPD_WHEN]= 03-27-1996, [UPD_WHO]= Z111142 -> LONGLEY JOHN M , [WHAT]= tgrams, tcuries, fiss_grams, thermal, pkg_pe_act,pkg_fiss_grams, [WHY]= Correct errors
08/23/2013 8:48 AM WCATS APPLICATION (000000)	NO	INITWORKPATH (C_ID=772841/PATH_ID=465): SKIPPED (NO WORKPATH UNITS)

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TRU WASTE STORAGE RECORD

S912921

1. Generator's Pre-Use Visual Inspection

Purchase Order #	Inspecte5 Items		
This container has been visually inspected according to approved procedures and has been found to be free of damage that would make it unsuitable for TRU waste packaging.	☑ Ring, Bolt, and Nut	☑ Chime	☑ Dents
	☑ Lid and Gasket	☑ Gouges	☑ Paint

Printed Name	Signature	Sig. Date	Oper. Date

6. Generator's Pacdake Information

Group	Technical Area	Building	Cost Center	Program Code	Cost Account	Work Package
IPM	54	000000				

A55itional Information

☑ DP ☑ Non-DP If Non-DP waste, attach DOE approval doc.

Ra5ionucli5e Content

Nucli5e	Amount	Uncertainty	Cg Curie = g Gram
Am-241	1.16)+0222	2.222+0222	C
Pu-238	/.E3/+-221	2.222+0222	C
Pu-239	(.)//+0222	2.222+0222	C
Pu-240	/./)9+0222	2.222+0222	C
Pu-241	.696+0221	2.222+0222	C
Pu-242	1. 13+-226	2.222+0222	C
U-234	/.2E2+-229	2.222+0222	C
U-235	.311+-22)	2.222+0222	C

Container	**) iner**	
☐ Steel Drum (55 gal.)	☐ None	
☑ Pipe Overpack Type:	☑ 90 mil liner	
☑ Steel Drum (85 gal Overpack)	☑ 125 mil liner	
☑ Standard Waste Box	☑ Fiberboard Liner	
☑ Standard Waste Box Overpack	**Internal Shiel5ink**	
☑ RH Canister	☐ None	
☑ Other (Call TWCO)	Type	Thickness

Filter Serial No.	01		
	02		

HaMar5ous = aterials

Name	EPA Co5e	z ty Q(
Lead	D008	

Waste Profile Number	9 (5WSI5D75)21)4
Gross Weight (lb.)	1.3E+022/
Net Weight (lb.)	1.2E+022/
Shipping Category	
LANL Waste Stream ID	TA-99- E
TRUCON Code	

Date Closed (MM/DD/YY):	Accumulation Start Date (MM/DD/YY): 1182 8E1

The data in this section were collected, and waste described herein was packaged and labeled according to approved procedures.

Printed Name	Signature	Date:

3. Generator Site Health Physics Information

	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Gamma Dose Rate (mrem/h) (contact)				
Neutron Dose Rate (mrem/h) (contact)				

Total Dose Rate (mrem/h) (contact)	
Total Dose Rate (mrem/h) (1 meter)	*The data in this section were collected according to approved procedures.*
Alpha Contamination (dpm/100cm2)	Printed Name / Date
Beta-Gamma Cont (dpm/100 cm2)	Signature

Los Alamos NATIONAL LABORATORY EST. 1943

TRU WASTE STORAGE RECORD

S912921

L. TRU Waste = anakement Re4iev w Authori Mation

The data package for this waste has been reviewed. Basedon the information provided, this waste meets the WAC requirements for storage at TA-54.	Printed Name	Date:
	Signature	

/ . Preloa5 Visual Inspection

This waste package was visually inspected prior to transport according to approved procedures. It meets WAC packaging and labeling requirements and is free from obvious damage and defects.	Printed Name	Date:

2. Recei4ink Site Health Physics Information

Gamma Dose Rate (mrem/h) (contact)	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Neutron Dose Rate (mrem/h) (contact)	Survey Date	Survey Meter Model	Property Number	Calibration Void Date
Total Dose Rate (mrem/h) (contact)				
Total Dose Rate (mrem/h) (1 meter)	*The data in this section were collected according to approved procedures.*			
Alpha Contamination (dpm/100cm2)	Printed Name			Date
Beta-Gamma Cont (dpm/100 cm2)	Signature			

7. Storake Site Information

Received by (Initials)	Date Received	**Orikinal Storake Data**		
This waste package was visually inspected and found to be properly labeled and in good condition. It was accepted and inspected according to approved procedures.		Building Number	Layer	Row Number
		Column Number	Date Stacked (MM/DD/YY)	
Printed Name	Date:	Printed Name		Date:
Signature		Signature		

9. Waste Acceptance Office

Intials Date	WE Description

NCR Num8er	Intials Date	NCR Description

b. Continuation Sheet for Ra5ionucli5e Content Cfrom Pake 1, Section 6(

Ra5ionucli5e Content - Continue5			
Nucli5e	**Amount**	**Uncertainty**	**Cg Curie = g Gram**
No Additional Radionuclides			

10. Continuation Sheet for HaMar5ous = aterials Cfrom Pake 1, Section 6(

HaMar5ous = aterials		
Name	**EPA Co5e**	**z ty Cx(**
No Additional Hazardous Materials		