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Date: DEC 18 2015
Symbol: ENV-DO-15-0344
LA-UR: 15-29287
Locates Action No.: Not Applicable

Mr. John E. Kieling
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505

Dear Mr. Kieling:

Subject: **Request to Withdraw and Resubmit Los Alamos National Laboratory Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 4 for Review and Approval**

The purpose of this letter is to request to withdraw and resubmit a Los Alamos National Laboratory (LANL) document for review and approval by the New Mexico Environment Department (NMED). The *LANL Nitrate Salt–Bearing Waste Container Isolation Plan, Revision 4* (Isolation Plan) is being resubmitted as discussed with NMED Hazardous Waste Bureau (NMED-HWB) personnel on November 10, 2015. The Los Alamos National Security, LLC (LANS) and the U.S. Department of Energy (DOE), collectively the Permittees, submitted the original draft of the Isolation Plan as required by the May 19, 2014, *Administrative Order,* which was then modified by letters on July 10, 2014; April 27, 2015; May 8, 2015; and August 12, 2015.

The enclosures to this letter represent changes to the LANL Isolation Plan that are necessary to incorporate NMED-required changes to the plan, update the plan, and revise monitoring requirements for remediated nitrate salt-bearing waste containers based on new information. This revision incorporates major changes within the LANL Isolation Plan that include:

- Removal of informational attachments that were not necessary to be transmitted with each revision (e.g. correspondence between the Permittees and the Carlsbad Field Office and Waste Control Specialists LLC);
- Removal of the term "suspect" when referring to the four waste containers discovered in February and March 2015;
- Modification to the procedure/plan that will be utilized in the event of abnormal conditions for nitrate salt-bearing waste containers located at Technical Area (TA) 54, Area G, Dome 375;

- Updates to the procedure that is used for monitoring remediated nitrate salt-bearing waste containers,
- Updates to the description of the monitoring utilized to ensure that the containers are in a safe configuration;
- Updates to reflect flexibility in temperature measurement equipment;
- Modification to text to reflect the discontinuation of solid phase micro-extraction analysis of headspace gas samples;
- Modification to text to more accurately describe the use of occupational continuous air monitors and provide flexibility in the notification from the monitors that are located within the TA-54, Area G, Dome 375 Perma-Con®;
- Modification to the frequency of written submittals from the Permittees to monthly rather than daily submittals as directed by the NMED by letter on August 12, 2015;
- Correction of inconsistencies within the document; and
- Modifications to the visual inspection frequency from hourly to daily as approved by the NMED on November 20, 2015.

Enclosure 1 contains a crosswalk table of changes to the LANL Isolation Plan and a copy of the plan with editing marks. Enclosure 2 includes a clean copy of the *LANL Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 4* and all attachments to the plan. If you have comments/questions or would like to meet regarding this submittal, please contact Mark P. Haagenstad at (505) 665-2014 or Gene Turner at (505) 667-5794.

Sincerely,

Alison M. Dorries
Division Leader
Environmental Protection Division
Los Alamos National Security, LLC

Sincerely,

Kimberly Davis Lebak
Manager
National Security Missions
Los Alamos Field Office
U.S. Department of Energy

AMD:KDL:MPH:LRVH/lm

Enclosures: (1) Revision Crosswalk and Isolation Plan, Revision 4 with Editing Marks
(2) LANL Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 4

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Kathryn Roberts, NMED, Santa Fe, NM, (E-File)
Steve Pullen, NMED/HWB, Santa Fe, NM, (E-File)
Dave Cobrain, NMED/HWB, Santa Fe, NM, (E-File)
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David J. Nickless, EM-WM, (E-File)
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The enclosures to this letter represent changes to the LANL Isolation Plan that are necessary to incorporate NMED-required changes to the plan, update the plan, and revise monitoring requirements for remediated nitrate salt-bearing waste containers based on new information. This revision incorporates major changes within the LANL Isolation Plan that include:

- Removal of informational attachments that were not necessary to be transmitted with each revision (e.g. correspondence between the Permittees and the Carlsbad Field Office and Waste Control Specialists LLC);
- Removal of the term "suspect" when referring to the four waste containers discovered in February and March 2015;
- Modification to the procedure/plan that will be utilized in the event of abnormal conditions for nitrate salt-bearing waste containers located at Technical Area (TA) 54, Area G, Dome 375;

ENCLOSURE 1

Crosswalk of Changes and Isolation Plan, Revision 4 with Editing Marks

ENV-DO-15-0344

LA-UR-15-29287

Date: DEC 1 8 2015

Revisions for Los Alamos National Laboratory Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 4

Location	Activity Supported	Description of Changes from Revisions 3 and 4
Throughout Plan	General update.	Change to the revision number of the isolation plan and move present and future words to past tense where appropriate.
Table of Contents and List of Attachments	General update.	Changes that reflect the change to titles of sections discussed later, and the removal/change of attachments where appropriate.
I. Introduction	General update and removal of the term "suspect".	Changes reflect the intent of Revision 4, changes the text for Revision 3 to past tense, and removes the term "suspect". Editorial changes also made for consistency with the rest of the document.
II.2 Background	General update.	Sentence deleted because the initiator for the breached waste container is no longer unknown.
II.6 Background	General update.	Editorial changes made for consistency with the rest of the document.
II.7 Background	General update.	Clarification added to statement and typographical error corrected.
II.8 Background	General update.	Editorial changes made for consistency and clarification added to the statement.
II.9 Background	Removal of large attachment.	Change to indicate analytical data was included with Revisions 2 and 3.
II.10 Background	General update.	Editorial change made for consistency with the rest of the document.
II.11 Background	Removal of large attachment and clarification of submittals to the New Mexico Environment Department – Hazardous Waste Bureau (NMED-HWB).	Changes to reflect correspondence submitted to NMED-HWB.
II.12, 14, & 16 Background	General update.	Changes reflect that the Pipe Overpack Containers (POCs) were placed in storage within the Technical Area (TA) 54, Area G, Dome 375 Perma-Con® and were later overpacked into 85 gallon containers.
II.15 Background	General update.	Addition of bullet to reflect that unremediated nitrate salt waste containers were removed from isolation under the isolation plan.

Location	Activity Supported	Description of Changes from Revisions 3 and 4
III. Waste Container Categories	General update and incorporation of cemented waste stream reevaluation.	Changes to the section reflect movement of relevant information to the front of the section and editorial changes to reflect the current changes to the nitrate salt-bearing waste container inventory. Other changes to this section communicate the recent reevaluation of the cemented waste stream recently conducted by the Permittees.
IV. Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update and removal of the term “suspect”.	Modifications to this section reflect change in the section title and typographical errors corrections, clarification of the current inventory, and removal of “treating” from the paragraph because it is likely that treatment of the waste will be described by a document other than the Isolation Plan (i.e. the LANL Hazardous Waste Facility Permit).
IV.1 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Editorial changes made for consistency with the rest of the document.
IV.4 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Editorial changes made for consistency with the rest of the document. Text was also removed because Dome 231 is not expected to be used for storage of remediated nitrate salt-bearing waste containers under the Isolation Plan and is no longer included within the procedure that will be utilized in the event of abnormal conditions for nitrate salt-bearing waste containers located at TA-54, Area G, Dome 375.
IV.5 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update and removal of the term “suspect”.	Editorial changes made for consistency with the rest of the document and text added to reflect the overpackaging of POCs.
IV.6 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update and removal of the term “suspect”.	Editorial changes made for consistency with the rest of the document, text was removed because Dome 231 is not expected to be used for storage of remediated nitrate salt-bearing waste containers under the Isolation Plan. Additionally, the procedure that will be utilized in the event of abnormal conditions for nitrate salt-bearing waste containers located at TA-54, Area G, Dome 375 has been changed.

Location	Activity Supported	Description of Changes from Revisions 3 and 4
IV.7 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update, addition of flexibility for use of temperature measurement equipment, change from hourly to daily visual inspection, provide for flexibility in notification from continuous air monitors, and removal of the term "suspect".	Editorial changes throughout the section were made for consistency with the rest of the document. The section was also updated to include additional temperature measurement equipment for the daily required temperature measurement, the approval for daily visual inspection (rather than hourly), and flexibility for notification from the continuous air monitors. Additionally, text was removed because Dome 231 is not expected to be used for storage of remediated nitrate salt-bearing waste containers under the Isolation Plan.
IV.8 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update and removal of the term "suspect".	Editorial changes made for consistency with the rest of the document and text added to reflect the overpackaging of POCs.
IV.11 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update and removal of the term "suspect".	Editorial changes made for consistency with the rest of the document, text added to reflect the overpackaging of POCs, and information included regarding the presence of liquids within three additional containers.
IV.12 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update, removal of a large attachment, and removal of the term "suspect".	Editorial changes were made for consistency with the rest of the document. A large attachment that included old HSG data and graphs was changed to an attachment of current graphic presentations for seven containers that are currently sampled regularly. Lastly, text was added to reflect the overpackaging of POCs.
IV.13 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Editorial change was made.

Location	Activity Supported	Description of Changes from Revisions 3 and 4
IV.14 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Changes have been made to incorporate the indicators used as a basis to determine the need for action associated with nitrate salt-bearing waste containers. New information reflects what the Permittees have learned about the reactions occurring within the waste containers.
IV.15-16 Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Editorial changes made for consistency with the rest of the document and text added to reflect the overpackaging of POCs.
V. Immediate and Current Actions for Unremediated Nitrate Salt–Bearing Waste Containers	General update throughout section.	Section title changed, editorial changes made for consistency with the rest of the document, and an option added for storage of unremediated nitrate salt waste containers.
VI. Remediation Planning	General update.	Editorial changes made for consistency with the rest of the document and text added to reflect the overpackaging of POCs.
VII. Cemented Legacy and Newly Generated Cemented Nitrate Salt-Bearing Waste	Incorporation of cemented waste stream reevaluation.	Discussion has been added to the section to include the recent reevaluation of the cemented waste stream and conclusions and references to correspondence associated with that reevaluation.
VIII. Immediate Action Implementation Schedule	Updated to incorporate changes in monitoring.	Editorial changes made for consistency with the rest of the document and text added to reflect the removal of the unremediated nitrate salt waste containers from isolation.
IX. Updates/ Submissions	Incorporation of newest reporting requirements.	Changes to the frequency of submittals and approval notifications.

LANL Nitrate Salt-Bearing Waste Container Isolation Plan
Revision ~~43~~ 43

~~April~~ December 2015

LA-UR-15-~~2047~~29287

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LIST OF ATTACHMENTS

~~Attachment 1 Final Analytical Reports for EPA Hazardous Waste Number D001 Analyses~~

~~Attachment 2 Correspondence with Other Agencies Related to Assignment of EPA Hazardous Waste Number D001~~

~~Attachment 3~~Attachment 1 Summary of Evaluation and Identification of LANL Nitrate Salt Containers

~~Attachment 4~~Attachment 2 Photographs

~~Attachment 5~~Attachment 3 TID User Manual

~~Attachment 6~~Attachment 4 EP-AREAG-RM-AOP-1299, R.1: 375 Permacon Nitrate-Salt Waste Container Abnormal Conditions~~EWMO-AREAG-PLAN-1248, R.1: TA-54 Area G Nitrate Salt Waste Container Response Instructions~~

~~Attachment 7~~Attachment 5 EWMO-AREAG-FO-DOP-1246, R.~~6~~8: Nitrate Salt-Bearing TRU Waste Container Monitoring

~~Attachment 8~~Attachment 6 EP-DIV-BEP-20048, R.1, EWMO Division Building Emergency Plan (BEP)

Attachment ~~9~~7 EP-DIV-RM-ERP-20200, R.0, EWMO Area Emergency Response

Attachment ~~8~~10 EP-DIV-RM-AOP-20201, R.0, Discovery of an Airborne, Liquid, and/or Solid Material Release or Spill

Attachment ~~9~~11 EP-DIV-RM-AOP-20204, R.0, Waste Container Questionable Integrity

~~Attachment 12~~Attachment 10 EWMO-AREAG-S~~0~~O-1247, R.2: TA-54 Area G Domes TA-54-231 and TA-54-375 PermaCon Access Restrictions

~~Attachment 13~~Attachment 11 Headspace Gas Data Graphs

~~Attachment 14 Solid Phase Micro-Extraction Data~~

~~Attachment 15 Flammable Gas Data~~

~~Attachment 16~~Attachment 12 Interpretation of Headspace Gas Observations In Remediated Nitrate Salt Waste Containers Stored at Los Alamos National Laboratory

Attachment 13 Memorandum: Hazards Associated with Legacy Nitrate Salt Waste Drums Managed under the Container Isolation Plan

I. Introduction

On May 19, 2014, the Department of Energy (DOE) and the Los Alamos National Security, LLC (LANS) ("Permittees") received Administrative Order No. 5-19001 ("Order") issued by the New Mexico Environment Department (NMED). The Order, at paragraph 18, required the Permittees to submit a *LANL Nitrate Salt-Bearing Waste Container Isolation Plan* ("Isolation Plan"). The Isolation Plan was submitted by 2:00 PM on May 21, 2014.

On May 23, 2014, NMED approved the Isolation Plan contingent on the submittal of a revised Isolation Plan that incorporated additional requirements ("Revised Isolation Plan"). NMED required the Permittees to address all of the items enumerated in their May 23, 2014 letter, incorporate those changes and resubmit the Revised Isolation Plan by May 29, 2014. The Revised Isolation Plan was submitted on May 29, 2014.

On August 29, 2014, NMED approved the Revised Isolation Plan with modifications. NMED required the Permittees to address all of the items enumerated in their August 29, 2014 letter, incorporate changes and resubmit the Plan ("Isolation Plan, Revision 2") to NMED no later than September 19, 2014 for final review and approval.

The Isolation Plan, Revision 2 incorporated the modifications enumerated by NMED and was submitted to the NMED on September 19, 2014. It included description of how the Permittees isolated and secured all nitrate salt-bearing waste containers currently stored at Los Alamos National Laboratory (LANL) and information on characterization assessments conducted by the Permittees.

~~This revision of the Isolation Plan,~~ Isolation Plan, Revision 3, ~~describes the activities and assessments that have been conducted to date associated with all nitrate salt-bearing waste containers and~~ includes~~d~~ the addition of 4four ~~suspect~~ remediated nitrate salt-bearing waste containers into isolation in the ~~Permacon within~~ Technical Area 54, Dome 375 (TA-54-375) Perma-Con®.

This Isolation Plan, Revision 4, modifies and updates the plan to include the following: changes to the procedure that will be utilized in the event of abnormal conditions for nitrate-salt-bearing waste containers located at the TA-54-375 Perma-Con®; updates the procedure used for monitoring waste containers; removal of the term "suspect" when referring to four waste containers discovered in February and March 2015; updates status information for containers located at LANL; introduces additional flexibility in temperature measurement equipment, changes the visual inspection frequency from hourly to daily, and incorporates NMED-directed changes to the frequency of written submittals to NMED from daily to monthly. Lastly, this revision removes attachments that are not necessary to describe the present practices for nitrate

salt-bearing waste containers on-site at LANL and includes updated language for monitoring and potential response triggers/actions.

The plan ~~It~~ describes how the Permittees continue to secure and isolate remediated ~~and newly suspect~~ nitrate salt-bearing waste containers, so that a potential release from them at LANL does not pose a threat to human health or the environment. This plan also includes information on other nitrate salt-bearing waste streams that are currently being managed or reevaluated at LANL, and general information concerning remediation planning for unremediated and remediated nitrate salt ~~and a schedule of immediate actions undertaken to implement isolating, securing and/or treating nitrate salt-bearing~~ waste containers currently stored at LANL.

Additional measures ~~above~~ to those described in ~~this~~ Isolation Plan, Revision 4~~3~~ may also be taken and will be identified to NMED during the technical calls established in Section IX ~~below~~.

II. Background and General Implementation Updates

1) On May 1, 2014, the Waste Isolation Pilot Plant (WIPP) declared a potentially inadequate safety analysis (PISA) on the possibility of unremediated nitrate salt-bearing waste contained in waste packages at WIPP. On May 2, 2014, LANS convened a critique to perform an extent of condition on the PISA issued by WIPP. As a result of the critique, the Permittees implemented several corrective and precautionary actions immediately to ensure protection of human health and the environment. The Permittees identified the current storage locations of all remediated and unremediated nitrate salt-bearing waste containers. The Permittees moved all remediated nitrate salt-bearing waste containers into TA-54, Area G, Dome 230 (because Dome 230 has an active fire suppression system) and daily temperature measurements of each container commenced. Additionally, continuous radiological air monitoring was initiated in Dome 230. Finally, any further processing of nitrated salt waste streams was suspended and all transuranic (TRU) waste shipments from LANL were paused.

2) On May 15, 2014, WIPP released photographs showing a LANL drum containing remediated nitrate salt-bearing waste that appeared to be breached in Panel 7, Room 7~~. The initiator of this breach and other potentially impacted drums is currently unknown, but is being actively investigated by multiple parties~~.

3) On May 16, 2014, the Permittees convened a critique to review the new information. A PISA was declared (ORPS NA-LASO-LANL-WASTEMGT-2014-0004) on the possibility of inadequate safety basis controls specified for the remediated nitrate salt-

bearing waste. As a result of the critique, the Permittees implemented several corrective and precautionary actions immediately to ensure protection of human health and the environment.

4) On May 18, 2014, the Permittees completed the overpacking of all originally identified remediated nitrate salt-bearing waste containers at LANL into Standard Waste Boxes (SWBs). There ~~are~~ were 57 remediated nitrate salt-bearing waste containers at LANL, and these were overpacked into 55 SWBs. (As part of the original packing configuration, 2 SWBs each have 2 remediated nitrate salt-bearing waste containers.)

5) On May 20, 2014, the Permittees held the initial meeting of their Remediation Team. (See Section VI below for additional information.)

6) On June 3, 2014, the Permittees completed the move of all unremediated nitrate salt-bearing waste containers to the ~~Permacon~~Perma-Con® in Dome 231 located at TA-54, Area G, and all remediated nitrate salt-bearing waste containers were moved to the ~~Permacon in Dome 375 located at TA-54, Area G~~TA-54-375 Perma-Con®.

7) On June 5, 2014, the Permittees conservatively applied Environmental Protection Agency (EPA) Hazardous Waste Number D002 to 26 unremediated nitrate salt-bearing waste containers that contain free liquids. The following describes the Permittees' regulatory basis, reasoning and analysis for assigning this EPA Hazardous Waste Number. (*See* also, Permittees' letter to NMED dated September 5, 2014, ADESH-14-088~~.~~).

During a review of operating records associated with the remediation of nitrate salt-bearing TRU wastes, the Permittees determined that a few of the parent containers were noted as having liquids with a pH of 2 or less. (~~*s*~~*See* ES Nitrate Salt Waste Containers at WCS, WIPP Panel 7, and LANL Data Summary, May 17, 2014, http://www.nmenv.state.nm.us/NMED/Issues/documents/ESNSWasteContatWCS-WIPP-LANL5.17.14.pdf). Based on this information, LANL evaluated the remaining unremediated nitrate salt-bearing waste containers to identify those with free liquids using real-time radiography (RTR) and high-energy RTR (HERTR) analysis. ~~The testing~~ RTR analysis identified that 26 of the 29 containers contained free liquids. As a conservative measure, based on this information, LANL applied the D002 EPA Hazardous Waste Number to these remaining unremediated nitrate salt-bearing waste containers identified with free liquids.

Videos of 27 RTR fast scans were provided to NMED on September 5, 2014. (ADESH-14-088). As explained in the Permittees' September 5, 2014 letter, RTR video recordings

are not available for 2 of the 29 unremediated nitrate salt-bearing waste containers as historically RTR video recordings were not created.

8) On June 18, 2014, the Permittees began headspace gas (HSG) sampling on all ~~additional~~ SWBs containing remediated nitrate salt-bearing waste containers. The Permittees' intent was to conduct HSG sampling on each of the 55 SWBs stored in the TA-54-375 Perma-Con®. This HSG monitoring was an additional measure above those described in the original May 19, 2014 Isolation Plan and the May 29, 2014 Revised Isolation Plan. When all 55 SWBs were sampled the Permittees transitioned to sampling a subset of the 55 SWBs on a regular basis.

9) On July 25, 2014, the Permittees conservatively applied EPA Hazardous Waste Number D001 to the remediated and unremediated nitrate-salt bearing wastes stored at LANL. The following describes the Permittees' regulatory basis, reasoning and analysis for assigning this EPA Hazardous Waste Number. (See also, Permittees' letter to NMED dated September 5, 2014, ADESH-14-088.)

Unremediated Nitrate-Salt Bearing Waste. On May 22, 2014, LANL received analytical results from two samples taken from an unremediated nitrate salt-bearing waste drum stored at Area G, Dome 231. (These results were provided as Attachment A to the Permittees' letter to NMED dated September 5, 2014, ADESH-14-088). The results showed the presence of nitrate compounds listed on the US Department of Transportation (DOT) Division 5.1 Oxidizers table under the DOT rules at 49 CFR §173.127. EPA/NMED require hazardous wastes that qualify as a 5.1 DOT oxidizer to be managed as a RCRA waste (D001) under 40 CFR §261.21(a)(4). Although the analytical results apply to one (1) unremediated drum, the Permittees determined to conservatively label the remaining drums with the D001 Hazardous Waste Number.

Remediated Nitrate-Salt Bearing Waste. As described in CCP's *Acceptable Knowledge Summary Report for Los Alamos National Laboratory TA-55 Mixed Transuranic Waste* (CCP–AK-LANL-006, Rev. 13, which includes waste stream LA-MIN02-V-001), on page 142, LANL previously determined that these nitrate salts did not meet the definition of a DOT oxidizer. However, to further support managing these specific nitrate salt wastes as non-ignitable, LANL determined to remediate and repackage this waste with an inert material (e.g., zeolite/kitty litter) with a minimum absorbent material to nitrate salts mixture ratio of 1.5 to 1. This ratio was based on results of oxidizing solids testing performed by the Energetic Materials Research and Testing Center (EMRTC) and a white paper authored by the LANL-Carlsbad Office Difficult Waste Team (DWT), *Amount of Zeolite Required to Meet the Constraints Established by the EMRTC Report RF 10-13: Application to LANL Evaporator Nitrate Salts* (See, Attachment B to Permittees' letter to NMED dated September 5, 2014,

ADESH-14-088). The EMRTC testing established the concentration at which the most reactive mixture of sodium and potassium nitrate becomes a non-oxidizer when mixed with either zeolite or grout. Based on the EMRTC testing, the LANL DWT concluded that the results can apply to LANL's non-cemented nitrate salts.

As previously reported, LANL remediated and repackaged certain nitrate-salt bearing waste containers using an organic kitty litter, and not a zeolite-based kitty litter (see Letter from Permittees to NMED Secretary Flynn dated July 1, 2014, *Addendum to the Los Alamos National Laboratory Hazardous Waste Facility Permit Reporting on Instances of Noncompliance and Releases for Fiscal Years 2012 and 2013*). This type of absorbent did not comport with the EMRTC testing or the LANL DWT recommendation.

To date, the Permittees have not sampled a remediated nitrate salt-bearing waste drum. Between July 22 and 29, 2014, LANL had surrogate samples of the waste tested by Southwest Research Institute of San Antonio, Texas. The surrogates were formulated using materials to approximate the remediated nitrate salt waste including *Swheat*™ kitty litter and a mixture of nitrate salts in both wet and dry samples. The samples were analyzed using US Environmental Protection Agency's *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) Method 1040 (which is based on a test method adapted from the United Nations regulations and classification procedures for the international transportation of dangerous goods) to determine whether the D001 designation code could apply.

On July 25, 2014, the Permittees received preliminary, un-validated results from this testing that indicated that the surrogates sampled could be classified as oxidizers. Based on these results, LANL determined that it could not exclude the application of D001 to the remediated nitrate salt-bearing wastes. Based on this information and consultation with the Carlsbad Field Office, LANL determined to conservatively apply D001 to the remaining remediated nitrate salt-waste containers stored at LANL.

The final analytical reports for this test and all of the other testing that ~~has been~~ was conducted ~~is~~ was included as ~~Attachment 1~~an attachment to Isolation Plan, Revisions 2 and 3.

10) On September 3-5, 2014, the Permittees had additional surrogate samples representative of the remediated waste tested by Southwest Research Institute of San Antonio, Texas to determine if the surrogate samples meet the DOT oxidizer criteria when tested in accordance with the UN Manual of Tests and Criteria under DOT rules at 49 CFR ~~§~~173.127 (a) in addition to SW-846, Method 1040. The surrogates for the remediated nitrate salt waste were comprised of a mixture of *Swheat*™ kitty litter and sodium nitrate in a ratio of 3:1. This mixture represents the main components of interest in the

remediated waste, i.e., the organic kitty litter and the principal nitrate salt as indicated by the May 22, 2014 analysis. The additional testing determined that the surrogate mixture was a DOT Oxidizer, Packing Group II by the DOT test and a Category II oxidizer by Method 1040. Additional analytical tests for ignitability have also been conducted on various surrogates related the investigation of nitrate-salt bearing wastes.

11) ~~Attachment 2 contains correspondence between t~~ The Permittees have finalized correspondence with ~~,~~ Waste Control Specialists (WCS), the Waste Isolation Pilot Plant (WIPP), and any other agencies related to the assignment of EPA Hazardous Waste Number D001 to containers that were shipped to WCS and/or WIPP. The Permittees have not yet received copies of corrected manifests. However, upon receipt of the corrected manifests, the Permittees will provide them to NMED within 15 business days. ~~Additionally, the Permittees are working to resolve manifest discrepancies with WIPP and WCS.~~ The Permittees have ~~will~~ provided NMED with all~~any~~ of the Permittees' ~~additional~~ correspondence on this issue within ~~-~~Isolation Plan Revisions 2 and 3 by letter dated October 22, 2015 (ENV-DO-15-0293).

12) In late February 2015, the Permittees identified an additional 3 parent containers designated as within waste stream LA-MIN04 to be suspect nitrate salt-bearing waste containers. The 3 parent containers produced 10 daughter waste containers: 3 daughters are designated as LA-MDH01 (i.e., debris) and 7 daughters are designated as LA-MIN04. The 10 daughter waste containers are located at Waste Control Specialists (WCS) (2 containers), WIPP (4 containers), and LANL (4 containers). All 4 containers located at LANL ~~are~~ were in Pipe Overpack Containers (POCs). As a result of this reevaluation, the Permittees determined that the 10 daughter waste containers are suspected to hold nitrate salt-bearing waste.

13) On March 12, 2015, the Permittees identified an additional 2 parent waste containers designated as LA-MDH01 (i.e., debris) to be suspect nitrate salt-bearing waste containers. The parent waste containers produced 3 daughter waste containers also designated as LA-MDH01. The Permittees and CCP reviewed generator AK documentation, RTR videos, and conducted interviews with SMEs to determine if these 3 daughter waste containers held any nitrate-salt bearing wastes. As a result of this reevaluation, the Permittees determined that the 3 daughter waste containers, located at WIPP, were suspected to hold nitrate salt-bearing waste.

14) On March 27, 2015, the Permittees placed the POCs in the TA-54-375 Perma-Con®.

15) After the approval of LANL Isolation Plan, Revision 3 on April 27, 2015, the Permittees discontinued visual and temperature monitoring of unremediated nitrate salt waste

containers and removed them from isolation and into compliant storage within another permitted unit.

~~13)~~16) On August 13, 2015, the Permittees overpacked the POCs into 85 gallon overpack containers within the TA-54-375 and placed them back in storage within the TA-54-375 Perma-Con®.

III. Waste Container Categories

The current inventory of nitrate salt-bearing waste containers covered by this plan and stored at LANL can be divided into two categories: 1) remediated nitrate salt-bearing wastes; and 2) unremediated nitrate salt-bearing wastes. ~~Additionally, there is a~~ A third category of containers ~~that are cemented legacy and newly generated wastes~~ that originated from the nitrate evaporator and cementation operations within TA-55 are cemented legacy and newly generated wastes and are not covered under this plan but are currently undergoing reevaluation as described in Section VII.

This plan addresses isolation, securing and/or treatment of the remediated nitrate salt-bearing wastes. In this plan, "remediated" containers are defined as LANL unconsolidated nitrate salts that were remediated with kitty litter absorbent and were repackaged into new drums. "Unremediated" containers are defined as LANL unconsolidated nitrate salts drums to which absorbent material has not been added. Isolation Plan, Revision 3, removed~~s~~ unremediated nitrate salt-bearing waste containers from secured isolation and allows for the storage of these waste containers in other compliant permitted storage at Technical Area (TA)-54, Area G.

To identify all of the nitrate salts-bearing waste containers generated, a focused review of the generator records was conducted. Unconsolidated nitrate salts were only generated at TA-55 in a specific room and glove box from 1979 through 1991. It is important to note that after 1991, all nitrate wastes were cemented.

Following the original review of generator records, it was determined that all of the nitrate salt parents exist as subsets in both a debris (LA-MHD01.001) and cemented (LA-CIN01.001-Cans) waste stream. The LA-MHD01.001 waste stream includes over a thousand containers, but only 164 original parent drums were determined to contain~~ed~~ nitrate salts in the original assessment. LA-CIN01.001-Cans waste stream also includes over a thousand containers, but only 103 original parent drums were determined to contain~~ed~~ nitrate salts in the original assessment.

In total, there were 267 original nitrate salt parent containers identified during the initial query. A large portion of these 267 parent containers ~~have~~ had been remediated into nitrate salt daughter containers. As a result, the original inventory ~~there are currently 707~~ of nitrate salt-bearing waste containers was 707. After remediation, all of the remediated nitrate daughters were assigned to two homogeneous absorption waste streams; LA-MIN02-V.001 and LA-MIN04-S.001. However, after Real-time Radiography (RTR), daughter containers may have been re-assigned to a final waste stream based on the volume percentages of the final waste content.

~~Of the 707 identified nitrate salt-bearing containers, a total of 86 remain at LANL, 57 are remediated daughter containers and 29 are unremediated parent containers.~~

The above-referenced waste streams, LA-MHD01.001, LA-CIN01.001, LA-MIN02-V.001 and LA-MIN04-S.001 are not solely dedicated to nitrate salts. All ~~other~~ containers in waste streams LA-MHD01.001, LA-CIN01.001, LA-MIN02-V.001 and LA-MIN04-S.001 do not contain nitrate salts and therefore, not all ~~do not~~ require isolation or management as nitrate salts.

The Permittees' approach to the focused review~~ed~~ discussed above was conservative. The original list of 707 includes containers that contain nitrate salt-bearing waste or are suspected of containing nitrate salt-bearing waste.

Additional information on the Permittees' evaluation and identification of LANL nitrate salt drums is provided in the *Summary of Evaluation and Identification of LANL Nitrate Salt Containers*. (~~Attachment 3~~Attachment 1)

The inventory of LANL nitrate salt-bearing waste containers changed upon discovery of the newly-identified nitrate salt-bearing waste containers in February and March 2015. This brought the total inventory of nitrate salt-bearing waste containers to 720 containers. The total parent containers was raised to 272 containers. Changes to the inventory were proposed in March 2015 when the Permittees presented NMED with a proposed inventory recommending the removal of 97 waste containers from the inventory. The NMED concurred with the removal of 10 of those containers from the inventory on March 20, 2015. Three of the containers removed from the inventory were original parent containers that were shipped off-site for direct disposal because they did not require remediation. One of the containers removed from the inventory is located within the TA-54-375 Perma-Con®.

As a result of inventory changes, the current total inventory of LANL nitrate-salt bearing waste containers can be summarized as follows:

- 269 parent nitrate salt waste containers either remain parent containers or were remediated for a total inventory of 710 nitrate salt-bearing waste containers.
    - 29 of the 710 waste containers are parent nitrate salt waste containers that remain in storage at LANL.
    - Three of the 710 waste containers were shipped off-site for direct disposal because they did not require remediation.
    - 678 of the 710 waste containers are remediated nitrate salt-bearing waste containers.

Of the 710 identified nitrate salt-bearing containers, a total of 89 remain at LANL, 60 are remediated daughter containers and 29 are unremediated parent containers.

~~Ongoing internal reviews have produced new information as described in II.12 and II.13.~~ If any additional nitrate salt-bearing waste containers are identified based on new information, these containers will be managed in the same manner as the currently identified nitrate salt-bearing

waste containers. The Permittees will notify NMED during the technical calls as established in Section IX ~~below~~.

~~This plan addresses isolation, securing and/or treatment of the remediated nitrate salt-bearing wastes. In this plan, "remediated" containers are defined as LANL unconsolidated nitrate salts that were remediated with kitty litter absorbent and were repackaged into new drums. "Unremediated" containers are defined as LANL unconsolidated nitrate salts drums to which absorbent material has not been added. Isolation Plan, Revision 3, removes unremediated nitrate salt-bearing waste containers from secured isolation and allows for the storage of these waste containers in other compliant permitted storage at Technical Area (TA)-54, Area G.~~

Characterization for ~~The~~ the third category, cemented legacy and newly generated cemented wastes from the nitrate processing line at TA-55, has recently undergone reevaluation~~is not addressed in this Isolation Plan, Revision 3 because~~, as discussed in Section VII.~~, per the definitions of ignitable and reactive in 40 CFR §264.21 and §264.23,~~ These wastes do not require isolation, however, legacy cemented nitrate waste containers generated since 1991~~, as well as newly generated cemented nitrate waste generated at TA-55, is not~~ that contain free liquids have been conservatively recharacterized as ignitable ~~or reactive~~and corrosive.

IV. Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers

There are currently 6061 remediated ~~and suspect~~ nitrate salt-bearing waste containers at LANL. The Permittees validated this number through review of data from the Waste Compliance ~~haracterization~~ and ~~Action~~ Tracking System (WCATS) database and a field walk-down verification. Below is a description of the activities the Permittees have ~~already~~ taken and currently conduct to address isolating and ~~,~~ securing~~, and/or treating~~ the remediated nitrate salt-bearing waste containers.

1) On May 16, 2014, LANS applied five LANL tamper indicating devices (TIDs) to drum number 68685 as shown in the attached photo (~~Attachment 4~~Attachment 2, photo 1). This TRU waste drum is the sister drum related to the ~~suspect~~ breached drum at WIPP (drum 68660 was confirmed as the damaged drum during the May 22, 2014 WIPP entry, and drum 68685 is its sibling). Additionally, a member of the DOE Los Alamos Field Office observed the application of the TIDs.

   On May 16, 2014, drum number 68685 was placed inside an SWB along with three empty dunnage drums (~~Attachment 4~~Attachment 2, photo 2) and was sealed. LANS applied two additional TIDs to either end of the SWB as shown in the attached photo (~~Attachment 4~~Attachment 2, photo 3).

On May 16, 2014, the empty parent containers for the two drums of initial interest (68660 and 68533) in the WIPP underground repository were identified onsite at LANL. As a result, LANS applied TIDs to both empty parent containers (69120 and 68359) during the early afternoon of May 16, 2014. This evolution was observed by DOE Los Alamos Field Office. Since that time S855793 was determined to be the parent container of drums 68685 and 68660.

These TIDs, and all subsequent TIDs, were installed in accordance with the LANL TID User Manual, NMCA-TID-FWI-002 R.1 (~~Attachment 5~~Attachment 3) by trained and qualified LANL TID users.

No additional TIDs have been applied to date, nor do the Permittees intend to install any additional TIDs at this time. However, additional TIDs will be applied as necessary to ensure that valuable information is not lost or as otherwise needed.

If directed to open the containers, the TIDs must be removed by qualified TID personnel in accordance with the TID User Manual (Section 3.21). In this instance, a two-person rule must be followed to verify chain of custody has been maintained and to verify that the TID has been properly destroyed once removed. Additionally, to ensure the TIDs are not removed without approval from the Facility Operations Director (FOD), they also have postings that clearly address that the TIDs cannot be removed without FOD approval.

2) On May 18, 2014, the Permittees completed overpacking the 57 remediated nitrate salt-bearing waste containers at LANL into SWBs. These containers were first placed into isolated storage in Dome 230 at TA-54, Area G, which has an active fire protection system. This dry-pipe fire protection system is not included within the LANL Hazardous Waste Facility Permit ("Permit"), Attachment D ("Contingency Plan") as it was inoperable during the re-application process for the Permit. This system became operable in November 2011, and currently the Permittees have chosen not to credit this system as fire control equipment in the Contingency Plan.

3) Additionally, as described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including Dome 230. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

4) The Permittees moved all remediated nitrate salt-bearing waste SWBs originally identified at LANL to the ~~Permacon in Dome~~ TA-54-375 Perma-Con® located at TA-54, Area G. This move was completed on June 3, 2014. ~~In the future, for operational~~

~~efficiency, the Permittees may also utilize the Permacon in Dome 231 for storage of these containers.~~

5) The 4 newly identified ~~suspect~~ remediated nitrate salt-bearing waste containers located at LANL were moved from Domes 232 and 153 into the ~~Permacon in Dome~~ TA-54-375 Perma-Con® on March 27, 2015. These containers were overpacked into 85 gallon waste containers on August 13, 2015.

6) As described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including ~~Domes 231 and~~ TA-54-375. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

   The Los Alamos Fire Department (LAFD) is manned and available 24-hours a day. ~~-~~They are able to utilize fire hydrants in the event of a fire or reaction. Additionally, the LANL emergency management organization is also on call 24-hours a day, and will respond promptly.

   The ~~Permacon in Dome~~ TA-54-375 Perma-Con® ~~and the Permacon in Dome 231~~, as ~~part of~~ a permitted unit~~s~~, ~~are~~ is authorized under the LANL Permit for storage of mixed TRU wastes. ~~-~~The dry-pipe fire protection systems within the ~~Permacon~~Perma-Con®~~s~~ ~~in the Domes are~~ is not included within the Permit Contingency Plan as the ~~Permacon~~Perma-Con®~~s~~ ~~have been~~ has generally been used for processing waste containers, a process that requires added safety ~~/ -~~emergency controls more prescriptive than those of normal waste storage. Therefore, currently the Permittees have chosen not to credit these systems as fire control equipment in the Contingency Plan.

   A ~~P~~pre-action fire suppression system~~s~~ (FSS~~s~~) ~~were~~ was installed in the ~~Permacon within Dome 231 in November 2012, and in the Permacon within Dome~~ TA-54-375 Perma-Con® in February 2013. The FSS~~s are~~ is designed as an ordinary group 2 pre-action sprinkler system to protect the moderate hazard operations in the ~~Permacon~~Perma-Con®. A d~~D~~rawing~~s~~ of the~~se~~ FSS~~s~~ in Dome 375 is ~~are~~ found in *375 Permacon Nitrate-Salt Waste Container Abnormal Conditions,* EP-AREAG-RM-AOP-1299, R.1 ~~*TA-54 Area G Nitrate Salt Waste Container Response Instructions,* EWMO-AREAG-PLAN-1248, R.1~~ (~~Attachment 6~~Attachment 4). This system uses water for fire suppression, which is compatible with the nitrate salt waste. Should the fire suppression system activate, ~~Pad 9 has a fire water collection system that would contain water from the 231 Permacon FSS. Dome~~ TA-54-375 has curbing that provides approximately 49,000 gallons of retention capacity.

The sprinkler system pre-action valve is automatically activated by a combination of any 2 of 3 types of electronic initiating devices located in the Dome or the ~~Permacon~~Perma-Con®: smoke detection, heat detection, or fire alarm pull stations. During an event, fire alarm pull stations can be accessed and manually activated by staff. Pull stations are located in accordance with National Fire Protection Association (NFPA) standards~~, and are~~ in ~~both~~the ~~-~~Dome~~s~~ and the ~~both Permacon~~Perma-Con®~~s~~. Also, access is facilitated by maintaining emergency egress aisles with a minimum aisle space of two feet in the Dome~~s~~ and the ~~Permacon~~Perma-Con®~~s~~. Further, in compliance with Permit Section 3.5.1(1), the Permittees will maintain adequate aisle space to allow for the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within ~~the 231 and~~ TA-54-375 Dome~~s~~ and ~~Permacon~~Perma-Con®~~s~~. Finally, in the event of an abnormal condition, staff will evacuate quickly and will promptly report to 911, the operations center or the shift manager. ~~—~~Should an abnormal condition be observed, the Permittees will implement their emergency response plan and provide notice to NMED within 24 hours.

The ~~Permacon~~Perma-Con®~~s are~~ is constructed of stainless steel frame and sheeting. ~~They are~~ It is a contamination-control structure~~s~~ that ~~are~~ is temperature-controlled and equipped with a High Efficiency Particulate Air (HEPA) filtration and fire suppression system~~s~~. ~~-~~The ~~Permacon~~Perma-Con®~~s are~~ is also maintained at negative pressure. Additionally, the remediated drums were overpacked into new SWBs and ~~suspect~~ newly identified nitrate salt-bearing ~~waste are packaged in~~ POCs were overpacked into 85 gallon waste containers. ~~Since~~ SWBs ~~and POCs~~ are considered robust enough to prevent lid loss due to deflagration or fire based on information in DOE-STD-5506-2007, they would act as a barrier to provide a significant measure of worker protection. ~~While the energy of the WIPP event in Panel 7, Room 7 has not been determined at this time,~~ ~~s~~Should an event occur, the ~~231 and~~ TA-54-375 ~~Permacon~~Perma-Con®~~s~~ ~~are~~ is designed to contain a radiological release.

7) The Permittees are monitoring, on a daily basis, the temperature of the SWBs and ~~POCs~~ 85 gallon containers that contain remediated ~~or suspect~~ nitrate salt-bearing waste drums. As discussed above, all remediated nitrate salt-bearing containers are overpacked in SWBs or ~~are within POCs~~85 gallon containers. ~~Daily t~~Temperature measurements are taken of the ~~external surface of the SWB using a calibrated infrared thermometer~~top surface of the overpack container using a thermocouple, infrared thermometer, or Infrared Imaging Camera. The target temperature at which the nitrate salt-bearing waste containers are maintained in ~~both~~ the TA-54-375 ~~and 231 Permacon~~Perma-Con®~~s~~ is less than 90 °F.

The Permittees ~~will~~ maintain records of all ~~such~~ temperature monitoring. These activities will be performed in accordance with LANL's Procedure on *Nitrate Salt-bearing TRU*

Waste Container Monitoring, EWMO-AREAG-FO-DOP-1246, R.6 (~~Attachment 7~~Attachment 5). These records will be updated on a daily basis. The temperature data (both daily, and if conducted as an additional measure ~~under Section I~~, hourly) that the Permittees have collected since the Isolation Plan was implemented was included with the Isolation Plan, Revision 2 as two attachments. The attachments were discs containing documentation of daily and hourly temperature measurements obtained by the Permittees up to the time the Permittees began including temperature data in the ~~daily~~ written submissions provided to NMED, as established in Section IX ~~below~~. ~~-~~Between the data included with the Isolation Plan, Revision 2 in ~~Attachments 8 and 9 of~~ an attachment to that document and the data that the Permittees provide in the ~~daily~~ written submissions, the Permittees have provided a current set of information to NMED. Additionally, these records and all temperature data (both daily, and if conducted as an additional measure under ~~Section I~~, hourly) will be available to NMED for inspection.

The Permittees ~~are also performing~~ performed visual inspections of these containers on an hourly basis, 24 hours per day, until the approval of the Permittees request to change the frequency of visual inspections from hourly to daily received on November 20, 2015 (ESHID-601027). On November 30, 2015, the Permittees began conducting daily visual inspections to identify abnormal conditions (e.g., signs of smoking and fire, evidence of deterioration, bulging). These activities ~~will be~~ are performed in accordance with LANL's Procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246, R.6. The Permittees ~~will~~ maintain records of all ~~such~~ visual monitoring. (See, ~~Attachment 7~~Attachment 5) These records ~~will be~~are updated on a daily basis and ~~be~~ are available to NMED for inspection.

Recent studies, analysis, and a head space gas data report (Attachment 12) provides additional understanding of the safety of remediated nitrate salt-bearing waste containers onsite in the TA-54, Area G, Dome 375 Perma-Con®. The HSG data report demonstrated the correlation of HSG concentrations with environmental temperature, and showed that temperature influences the rate of chemical reaction. The HSG results provided a measure of chemical reactivity of the remediated nitrate salt waste stream that has greater fidelity than either temperature or visual monitoring. In fact, the HSG analysis can be used as an indicator of increased chemical reactivity and as an input to initiate a facility response for abnormal operating conditions. Visual inspection of the drums, while providing confirmation of an abnormal environment, is not a leading indicator of an abnormality. It is expected that any visual indication of an abnormality will be accompanied by a hot gas release, which would be detectable through continuous remote temperature monitoring of the overpack container lid. For these reasons, a change from hourly visual inspections to daily visual inspections was requested by the Permittees and approved by the NMED.

Additionally, the Permittees are using continuous air monitors (CAMs) with alarm capability, and will continue their use until further notice. There are CAMs in place in the TA-54-375 ~~Permacon~~Perma-Con®~~, two of which have remote alarm notification capability. These two remotely monitored CAMs~~ that can provide remote ~~notification~~ data if there is a significant airborne release. ~~(the 375 Permacon currently contains the LANL remediated nitrate salt-bearing waste). Additionally, there are CAMs in place in the 231 Permacon.~~ Lastly, the Emergency Response/Hazardous Materials organization has been briefed on the storage configuration.

Action levels have been established and response instructions prepared. These are contained in the LANL~~'s P~~procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246, R.6 (~~Attachment 7~~Attachment 5). Should an abnormal condition be observed, the Permittees will implement their emergency response plan and provide notice to NMED within 24 hours. Area G's building emergency plan is found in ~~at Attachment 8~~Attachment 6, and associated procedures are found at Attachments 7, 8, and 9~~9, 10 and 11~~.

8) The overpacks containing r~~R~~emediated ~~and suspect~~ nitrate salt-bearing waste containers are spaced an adequate distance apart to limit any potential interactions between ~~SWBs and POCs~~the containers. This distance has been determined to be a minimum of ~~2~~1 (one) f~~ee~~oot between containers. ~~-~~This distance is based on the Permittees' review of evidence from the event at WIPP, a calculation on the heat transfer from ~~an SWB or POC~~ a container undergoing a similar reaction, and a review of fire protection and Permit requirements. The containers are currently stored with a minimum of 2 feet between containers and will not be moved.

The Permittees have reviewed photographs of the impacted drum in WIPP Room 7, Panel 7 and the adjacent containers. From the photographs, the adjacent drum and the adjacent SWB appear to have minimal damage and no release. The adjacent drums are in contact with the impacted drum and the adjacent SWBs are within inches of the impacted drum.

The Permittees have performed a preliminary calculation on the minimum separation distance between ~~SWBs and POCs~~ containers to ensure that an incident in one container will not impact an adjacent container. Assuming the offending container reaches a maximum temperature of approximately 1100°F and that the adjacent container does not to exceed 200°F, the heat generated from the offending container drops off to below 200°F within 1 inch. The 2 foot spacing in use provides additional assurance that the adjacent containers will not be impacted by the heat generated during an exothermic event in a single container. Drawings that include the locations of the containers are included in ~~TA-54 Area G Nitrate Salt Waste Container Response Instructions, EWMO-AREAG-PLAN-1248, R.1~~*375 Permacon Nitrate-Salt Waste Container Abnormal*

Conditions, EP-AREAG-RM-AOP-1299, R.1 (~~Attachment 6~~Attachment 4). The use of fire curtains in between containers will not provide a measurable reduction in the thermal conductivity across the 24 inches but does provide protection from flame impingement.

~~SWBs and POCs~~Containers in the TA-54-375 Perma-Con® are placed in rows that allow for emergency egress and that have Permit compliant spacing between each row. If used, the fire curtains will be placed within a row (that is, between the adjacent containers in that row) to mitigate the potential for interaction between adjacent containers. ~~While the temperatures of the event in Panel 7 have not been determined at this time, t~~The Permittees have procured fire curtains ~~that~~ are rated to a continuous temperature of 1800°F and intermittent temperatures of 2500°F.

The NFPA consensus standards were also reviewed and NFPA 211 provided the most similar type of control. NFPA 211 covers the installation of chimney pipes and stoves and the distance recommended between the pipe and unprotected combustibles is 18 inches. There are no unprotected combustibles in the ~~Permacon~~Perma-Con®s in Domes 231 and 375.

This 2 foot distance also meets the requirements in Permit Section 3.5.1(1). This section requires the Permittees to maintain adequate aisle space to allow for the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within the ~~231 and~~ TA-54-375 Dome~~s~~ and ~~Permacon~~Perma-Con®~~s~~.

The Permittees have purchased ~~may also use~~ fire resistant curtains that are not in use, but may be used in lieu of spacing. Containers will be placed in rows that allow for safe egress and that have Permit compliant spacing between each row. If used, the curtains will be placed within a row (that is, between the adjacent containers in that row) to mitigate the potential for interaction between adjacent containers. ~~While the temperatures of the event in Panel 7, Room 7 have not been determined at this time, the Permittees have procured~~ The fire curtains ~~that~~ are rated to a continuous temperature of 1800°F and intermittent temperatures of 2500°F. This temperature well covers the temperature at which a breached container is estimated to reach. Prior to using fire resistant curtains, the Permittees will discuss the details of their use with NMED during the technical calls established in Section IX ~~below~~.

The Permittees will protect workers by restricting access to the remediated nitrate salt-bearing waste containers. Only those personnel performing the ongoing container monitoring activities (e.g., daily ~~temperature~~ monitoring), other sampling/data collection work (e.g., periodic head space gas sampling), necessary maintenance activities (e.g., corrective or preventative maintenance), and other required inspections (e.g., Permit

required inspections) will be allowed into the storage areas. This is documented in Standing Order ~~EP~~EWMO-AREAG-SO-1247, R.2 (~~Attachment 12~~Attachment 10). Also, there will be warning signs posted at the entrance to the ~~Permacon in Dome~~ TA-54-375 Perma-Con® that will inform personnel of access restrictions.

Additionally, all originally identified remediated nitrate salt-bearing waste (in May 2014) were packed in new drums and overpacked into new SWBs, and suspect nitrate salt-bearing waste is located in 85 gallon overpacked POCs. Since SWBs and 85 gallon overpacked POCs are considered robust enough to prevent lid loss due to deflagration or fire, based on information in DOE-STD-5506-2007, they would act as a barrier to provide a significant measure of worker protection. No other protective shields or barriers are deemed necessary for the protection of workers at this time.

Furthermore, the ongoing data collection activities provide continuing information on the physical condition of the waste so that appropriate additional worker safety measures can be taken, if required.

9) Prior to moving nitrate salt-bearing containers, the Permittees will notify the LANL Emergency Operations Center (EOC). ~~-~~The EOC will notify the Los Alamos Fire Department and other responders, if needed. The Permittees will notify the EOC at the completion of the move. The Permittees do not anticipate that responders will be present during the movement of these containers, or that responders will be present~~-~~/~~-~~alerted during other actions.

10) The Permittees have updated all procedures and safety basis documents to convert the processing facilities into storage facilities.

11) SWBs and 85 gallon containers ~~will~~ display the required labels for all inner containers or ~~will be~~ are reclassified as a new container in WCATS. This means that the container either displays the container identification number for the 55-gallon nitrate salt-bearing waste container within the overpack or displays a new container number. The 6~~1~~0 subject containers (including the sister drum to the ~~suspect~~ breached drum in WIPP) have been clearly labeled with the appropriate warning labels and any other required labeling. Specifically, the containers have the hazardous waste labels required by Permit Section 3.6(1) and~~. Additionally,~~ the remediated nitrate salt-bearing waste containers are also marked as "Radioactive", as required by Permit Section 3.6(1). ~~In addition, t~~The 4four ~~POCs~~ 85 gallon containers have been labeled as containing "Free Liquids" and have been placed on adequate secondary containment within the ~~Permacon in Dome~~ TA-54-375 Perma-Con®. Additionally, three of the remediated nitrate salt-bearing waste containers that are overpacked in SWBs within the TA-54-375 Perma-Con® have been identified as containing free liquids. The SWBs were not placed on secondary containment when this

discovery was made because movement of the SWBs is prohibited. Additionally, there are visual inspections conducted daily that would identify leaked liquid and the facility has procedures that will be followed in the event of a spill or leak within the TA-54-375 Perma-Con®.

12) The Permittees have conducted ~~headspace gas (~~HSG~~)~~ sampling on all 5~~4~~4 SWBs and four 85 gallon containers that contain nitrate salt-bearing waste containers. Each SWB has been sampled for at least ~~7~~seven days.

Gas chromatography with thermal conductivity detection is used for the analysis of He_2, H_2, O_2, N_2, CH_4, CO, CO_2, and NO_4 in HSG samples. The HSG sample data (H_2, CO_2, CO, and N_2O) that the Permittees ~~have~~ collected from the time the Isolation Plan was implemented through September 11, 2014 was included as an attachment to Isolation Plan Revisions 2 and 3~~is attached to this Isolation Plan, Revision 3 at Attachment 13~~. ~~Between~~ In conjunction with the data in ~~Attachment 13~~ those revisions and the data that the Permittees have ~~already begun to~~ provided in the ~~daily~~ written submissions, the Permittees have provided a current set of information to NMED. ~~Attachment 13~~Attachment 11 ~~also~~ graphically presents the H_2, CO_2, CO, and N_2O data collected for seven~~each~~ SWBs that are currently daily or twice weekly sampled~~, and the range of H_2 and CO_2 concentrations from the HSG for each~~. The CO_2 values are adjusted by the quantity of CO_2 in the field blank (i.e., the amount of CO_2 in the air at the time the sample is taken is subtracted from the CO_2 reading from the container). No other adjustments are made to the data.

~~Additionally,~~ He_2 and CH_4 have not been detected in ~~these~~ HSG samples, and O_2 and N_2 are observed at atmospheric concentrations. More detailed information on these compounds is available to the NMED at their request. If there is any change to this status, the Permittees will inform the NMED during the technical calls established in Section IX ~~below~~.

The Permittees began this HSG sampling on May 19, 2014, when they began daily HSG sampling of SWB 68685. This SWB contains TRU waste drum 68685 which is the sister drum related to the ~~suspect~~ breached drum at WIPP.

On June 18, 2014, the Permittees began HSG sampling on the additional SWBs containing nitrate salt-bearing waste containers, in order to better be able to compare and evaluate results against SWB 68685. On July 24, 2014, the Permittees began daily HSG sampling of SWB SB50522. On August 13, 2014, LANL had conducted HSG sampling of all 55 SWBs that contain remediated nitrate salt-bearing waste. The Permittees transitioned to sampling a subset of the 55 SWBs on a regular basis (this subset may change over time). All of this headspace gas monitoring was an additional measure above

those described in the original May 19, 2014 Isolation Plan and the May 29, 2014 Revised Isolation Plan.

On September 3, 2014, upon receipt (email) of the NMED's letter dated August 29, 2014, the Permittees immediately resumed daily HSG sampling of SWBs 68685 and SB50522. (The Permittees had been sampling both of these containers on a daily basis until August 28, 2014, when they shifted sampling to twice per week. The Permittees had also conducted HSG sampling of both SWBs on September 2, 2014.)

The Permittees ~~will~~ continue to conduct HSG sampling~~. This HSG sampling will~~ to measure concentrations of H_2, CO_2, CO and N_2O. The Permittees ~~will~~:

1. Conduct daily HSG sampling of SWB SB50522 and the SWB that contains 68685.

2. Periodically sample HSG of ~~all other~~ 52 other SWBs and four 85 gallon containers within the TA-54-375 Perma-Con®~~that contain nitrate salt-bearing waste containers~~. ~~This~~ HSG sampling occurs on a schedule that ensures that each of ~~these SWBs and POCs~~ the containers are sampled for HSG at least once per calendar month. The Permittees began implementation of this monthly HSG sampling in September, 2014. The monthly schedule is supported by the graphical presentations of the H_2, CO_2, CO and N_2O data in Attachment 13 which indicate stability in the analyzed gas constituents and is protective of human health and the environment.

HSG sampling was conducted for at least ~~7~~ seven days on the four~~4~~ newly identified POCs (prior to overpacking). After the seven~~7~~ day sampling was completed, the POCs (now 85 gallon containers) were added to the monthly schedule described above. Additionally, the SWB that was removed from the inventory of nitrate salt-bearing waste containers was removed from this schedule in September 2015. The Permittees ~~will~~ include ~~this~~ HSG data (H_2, CO_2, CO and N_2O) in the ~~daily~~ written submissions provided to NMED, as established in Section IX ~~below~~. Between the data included with the Isolation Plan, Revisions 2 and 3 and the data that the Permittees provide in the written submissions, the Permittees have provided a current set of information to NMED. Additionally, these records and all temperature data will be available to NMED for inspection.

Additionally, as part of initial investigations, the Permittees ~~have~~ performed solid phase micro-extraction (SPME) analyses. This work was ~~is being~~ performed as part of the Permittees additional measures ~~under Section I~~. SPME monitors for trace levels of organic compounds (< 1ppm). The detection limits for organic compounds without SPME is sufficient to establish that concentrations of organic vapors do not approach

flammability limits. SPME was performed for the purpose of detecting organic molecules which could be an ignition initiator at very low concentrations. No noteworthy detections of compounds ~~have been~~ were observed. A summary of this data with graphical presentation of the data (prior to September 2014) ~~is available as Attachment 14~~was included as an attachment to Isolation Plan Revisions 2 and 3. SPME analyses was discontinued in September 2015, because~~.~~ no detections for organic compounds were observed during the time the analyses was conducted and the Permittees deemed that there was no value added to continuing SPME analyses.

- The Permittees evaluated the HSG data (H_2, CO_2, CO, and N_2O) collected from SWB SB50522 ~~collected~~ from July 24, 2014 through September 11, 2014. SB50522 contains 4four drums, with the following container identification numbers and waste stream identification numbers:
- Container 69490 (LA-MIN02-V.001)
- Container 69271 (LA-MIN03-NC.001)
- Container 68799 (LA-MIN03-NC.001)
- Container 57653 (LA-CIN01.001)

The range (high to low) of H_2 levels the Permittees observed in HSG data during that time frame was 28,020 parts per million (ppm) to 6,986 ppm. On July 30, 2014, the Permittees installed additional filters in the SWB to decrease concentrations. This approach was successful and concentrations of H_2 are present at a lower level. Form August 18, 2014 through September 11, 2014, H_2 levels remained below 10,000 ppm. The range (high to low) of CO_2 levels the Permittees observed in HSG data was 76,858 ppm to 39,338 ppm during that time frame.

The range of temperature measurements the Permittees observed during hourly temperature measurements through ~~September 11, 2014~~ November 17, 2015 were:

SB50522 Temperature	Degrees Fahrenheit
High	~~83.7~~84.1
Low	~~55.5~~31.8

For comparison the ambient temperature range in Dome 375 Cell 1 where SB50522 is located during the same time period is:

Dome 375 Cell 1 Temperature	Degrees Fahrenheit
High	~~85.1~~90.6
Low	~~54.9~~29.3

Prior to packaging the four containers into SB50522, the Permittees conducted flammable gas analysis on three of the containers (57653, 69271 and 69490). (Note: although flammable gas analysis is not required for the LA-MIN03-NC.001 waste stream it was conducted for 69271.) The Quantitation Reports for flammable gas analysis for ~~these~~ the three containers were~~are~~ provided ~~at Attachment 15~~as an attachment to Isolation Plan Revisions 2 and 3.

~~The HSG data for SB50522 is presented in Attachment 13. This Attachment also graphically presents the H_2, CO_2, CO and N_2O data collected.~~

13) The Permittees also evaluated the HSG data (H_2, CO_2, CO, and N_2O) collected from all of the SWBs with remediated nitrate salt-bearing waste through September 11, 2014 and the discussion below describes this evaluation. The Permittees continue to evaluate HSG data and the results of that evaluation are described in the modeling report included as Attachment 12.

As background information, radiolytic processes produce simple gas molecules from the interaction of radiation with organic and inorganic material in TRU waste. Hydrogen is typically the principal gas produced from the interaction of radiation with organic material. During headspace analysis for hydrogen, levels of other gases including CO, CO_2, and N_2O are also measured. Gaseous CO_2 can also be formed from radiolysis, and its concentration depends on the specific composition of the waste. From studying the radiolysis of selected simulated TRU waste, the relative amount of CO_2 and H_2 that is produced has been established under a range of conditions. From these investigations, the ratio of the amount of CO_2 to H_2 produced was greatest for poly vinyl chloride, with a maximum ratio for this material to be 6.5 CO_2/H_2. Other waste types did not produce as much CO_2 and therefore this ratio would be less than 6.5.

The conducted HSG analysis initially selected revealed that some drums had CO_2 to H_2 ratios of >100. This suggests that gas generation in some cases cannot be attributed solely to radiolysis of the waste. This supposition is reinforced by the observation of nitrous oxide > 1,000 ppm, which would likely be indicative of nitrate salt chemistry. Atmospheric concentrations for these gases are approximately 450 ppm and 350 parts per billion (ppb) respectively.

LANL began characterizing the headspace gas of 55 SWBs containing remediated nitrate salt-bearing waste for Volatile Organic Compounds (VOCs) by Gas Chromatography/ Mass Spectrometry (GC-MS) and for permanent gases using GC with a Thermal

Conductivity Detector (GC-TCD). Permanent gases are those that remain gaseous at standard temperature and pressure. Daily monitoring of a subset of these 55 SWBs was initiated on May 19, 2014. All 55 SWBs have now been characterized. Elevated concentrations of HSG compounds have been observed at concentrations well above normal atmospheric concentrations in some of these 55 SWBs (Attachment 13). These concentrations cannot be explained based on radiolysis of waste drum content and suggest that the gases are being produced from other processes. Specifically, N_2O is believed to result from the oxidation of material contained within the nitrate salt containing waste. The N_2O concentrations observed, ranging from (100 – 9000 ppm), are above the normal atmospheric concentration of ~ 350 ppb. The Permittees have ongoing work that may provide insight into this chemistry.

While high CO_2 concentrations (and potentially the ratio of CO_2 and H_2) are expected to be proportional to the magnitude of potential changes taking place in any given drum, they are not, on their own an indicator of significant changes to the waste within the container. To date, LANL has collected over 700 HSG samples. The graphical representation of this HSG data indicates stability in the analyzed gas constituents and supports the monthly sampling schedule set out in Section IV.10 above.

The Permittees initially suspected the CO_2 to H_2 ratio might be an indicator of radiolytic decomposition, and tracked that ratio. However, analysis of the HSG data (H_2, CO_2, CO, and N_2O) gathered to date indicates there are potentially other gas generating mechanisms occurring within some containers. The concentrations of oxidation products (e.g.,~~:~~ CO_2 and N_2O) is ancillary to the H_2 concentration measurement. While it provides additional insight into the nitrate salt-bearing waste, the Permittees no longer consider tracking the CO_2 to H_2 ratio to be a useful indicator. The Permittees have focused ongoing analyses on the monitoring of H_2 concentrations and temperature measurements rather than ratio of CO_2 and H_2 because: the lower flammability limit (LFL) for H_2 is established; both H_2 gas concentrations and temperature are readily measured; and actionable levels can be established. The H_2 and temperature measurements are a more direct way to monitor potential changes in the waste.

14) The Permittees ~~conclude that~~ currently utilize a combination of temperature measurement and regularly collected HSG data as ~~the concentration of H_2 is an appropriate~~ indicators to track chemical reactivity and ~~to use~~ as a basis for validating container safety~~action levels to trigger specific actions~~. Modeling has been conducted and an interpretation of HSG observations has been drafted in support of this approach (Attachment 12). If the HSG concentrations were to depart from the expected trends based on the storage temperature and previous concentrations (e.g., higher CO_2 concentrations than expected based on the model) the Permittees could infer increasing chemical reactivity and potentially, increased hazard. For example, in 2015, the temperature dependent

concentrations have been significantly lower in the summer when compared to those measured in the summer of 2014. If concentrations were to exceed the most recent values and approach those of 2014, there would be a strong indication that chemical reactivity has increased and therefore concern for safety would be increased.

15) If the Permittees observe an H_2 concentration at or above 20,000 ppm (~50% of the lower explosive limit [LEL]), they will conduct daily HSG (H_2, CO_2, CO, and N_2O) for that SWB.

If the Permittees observe an H_2 concentration at or above 30,000 ppm (~75% of the LEL), they will install additional filters in the SWB, if the SWB is configured to accept additional filters. (This approach was successfully implemented by the Permittees with SB50522. Concentrations of H_2 were reduced after the installation of additional filters in that SWB, and have since been maintained at a lower level.)

If additional filters cannot be added to the SWB or if concentrations are not reduced to below 30,000 ppm at the next daily HSG sample, then the Permittees will apply a 15 foot stand-off exclusion zone. (The stand-off exclusion zone is a 15 foot area that is used at LANL to surround a container that is or has become unvented, thereby unable to vent contents adequately. This area is segregated from normal operations except those operations specific to disposition or inspection of the container of concern. Surrounding containers may exist in the exclusion zone. Entry into the exclusion zone is controlled by the Facility Operations Director (FOD) who will determine what actions can be taken – including entry for sampling, temperature measurements or visual monitoring.) This approach is consistent with the hazard analysis that has been performed for an unvented drum discovery. The Permittees will notify LANL Emergency Management to assume responsibility for the container if the container poses a threat, e.g., bulging.

The Permittees ~~will~~ include ~~this~~ HSG data (H_2, CO_2, CO, and N_2O) in the ~~daily~~ written submissions provided to NMED, as established in Section IX ~~below~~.

16) The isolation configuration described in this ~~S~~section ~~IV~~ continues to be protective of human health and the environment in light of the observed concentrations of H_2 and CO_2 in SWBs and 85 gallon containers, and in light of the conservative assignment of EPA Hazardous Waste Number D001. The facility being used for isolation is compliant with the LANL Hazardous Waste Facility Permit. The fire suppression systems, climate control and filtration systems, and other mechanisms described above are designed to protect human health and the environment in the event of a reaction within a container, a release, a fire, or an explosion. The Permittees continue to evaluate the effectiveness of the isolation configuration and will make changes to this configuration as appropriate.

V. Immediate and Current Actions for Unremediated Nitrate Salt–Bearing Waste Containers

There are currently 29 unremediated nitrate salt-bearing waste containers at LANL. The Permittees validated this number through review of data from the WCATS database and a field walk-down verification conducted prior to May 29, 2014. Below is a description of the activities DOE/LANS implemented isolating, securing, and then removing from isolation the unremediated nitrate salt-bearing waste containers.

1) The 29 unremediated containers were first placed into isolated storage in Dome 230 at TA-54, Area G, which has an active fire protection system. This dry-pipe fire protection system is not included within the Permit Contingency Plan as it was inoperable during the re-application process for the Permit. This system became operable in November 2011, and currently the Permittees have chosen not to credit this system as fire control equipment in the Contingency Plan.

   Additionally, as described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including Dome 230. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

2) The Permittees moved all unremediated nitrate salt-bearing waste ~~SWBs~~ containers at LANL to the ~~Permacon~~Perma-Con® in Dome 231 located at TA-54, Area G. This move was completed on June 3, 2014~~-~~.

3) The Permittees monitored the temperature daily of the 85-gallon overpacks that contain unremediated nitrate salt-bearing waste drums from the time the Isolation Plan was implemented until the approval of the Isolation Plan, Revision 3 on April 27, 2015. Daily temperature measurements were taken of the external surface of the 85-gallon overpack using a calibrated infrared thermometer. The target temperature at which the nitrate salt-bearing waste containers were maintained while in isolation was less than 90°F.

   The Permittees ~~will~~ maintain records of all ~~such~~ temperature monitoring. These activities were performed in accordance with LANL's Procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246~~, R.6 (Attachment 7)~~. ~~These records will be updated on a daily basis.~~ The temperature data (both daily, and if conducted as an additional measure ~~under Section I~~, hourly) that the Permittees collected since the Isolation Plan was implemented was included with the Isolation Plan, Revision 2 as two attachments. The attachments were discs containing documentation of daily and hourly temperature measurements obtained by the Permittees up to the time the Permittees began including temperature data to NMED in the daily written submissions

provided to NMED, as established in Section IX ~~below~~. Between the data included with the Isolation Plan, Revision 2 in Attachments 8 and 9 of that plan and the data that the Permittees ~~have~~ provided in the ~~daily submissions~~written submittals, the Permittees ~~have~~ provided a ~~current~~complete set of information to NMED. Additionally, these records and all temperature data (both daily, and if conducted as an additional measure ~~under Section I~~, hourly) ~~will be~~ are available to NMED for inspection.

The Permittees also performed visual inspections of these containers on an hourly basis, 24 hours per day, to identify abnormal conditions (e.g., signs of smoking and fire, evidence of deterioration, bulging) from the time the Isolation Plan was implemented until the approval of the Isolation Plan, Revision 3. These activities were performed in accordance with LANL's Procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246~~, R.6~~. The Permittees will maintain records of all such visual monitoring ~~(see Attachment 7)~~. These records ~~will be updated on a daily basis and be~~ are available to NMED for inspection.

Additionally, the Permittees used continuous air monitors ~~(~~CAMs~~)~~ with alarm capability. There were CAMs in place in the TA-54-231 Perma-Con®~~Permacon~~ for the entire time unremediated nitrate salt-bearing waste containers were stored within the Perma-Con®~~Permacon~~. Lastly, the Emergency Response/Hazardous Materials organization were briefed on the storage configuration while the containers were isolated.

4) During isolation, unremediated nitrate salt-bearing containers were spaced an adequate distance apart to limit any potential interactions with other containers. This distance has been determined to be 2 feet between containers. This distance was based on the Permittees' review of evidence from the event at WIPP, a calculation on the heat transfer from an SWB undergoing a similar reaction, and a review of fire protection and Permit requirements.

5) During isolation, the Permittees protected workers by restricting access to the unremediated nitrate salt-bearing waste containers. Only those personnel performing the ongoing container monitoring activities (e.g., daily temperature monitoring), other sampling/data collection work (e.g., periodic head space gas sampling), and other required inspections (e.g., Permit required inspections) were allowed into the storage areas. This is documented in Standing Order EP-AREAG-SO-1247~~, R.2 (Attachment 12)~~. Also, there were warning signs posted at the entrance to the Perma-Con® ~~Permacon~~ in Dome 231 informing personnel of access restrictions.

6) Additionally, all unremediated nitrate salt-bearing waste is in 55-gallon drums that have been overpacked into 85-gallon containers of good integrity.

7) This waste has been stored above-ground for many years and the Permittees- continued data collection activities to provide information on the physical condition of the waste so that appropriate additional worker safety measures could be taken, if required.

8) Further evaluation of unremediated nitrate salt waste ~~has~~ led to the conclusion that the 29 unremediated nitrate salt-bearing waste containers do not require specific isolation from other waste containers stored at permitted units at TA-54 Area G. Unremediated salts are determined to not present the potential hazard of spontaneous combustion or enhanced combustion in their current configuration; therefore, they can be stored in any area in which combustible material is minimized and separated from the nitrate salt waste containers, without fear of a release. ~~Attachment 16~~Attachment 13 for this Isolation Plan details the assessment conducted to reach this conclusion.

9) As a result of this evaluation, the Permittees ~~will remove~~ received NMED approval to move the 29 unremediated nitrate salt-bearing waste containers located within the Dome 231 ~~Permacon~~Perma-Con® from isolation and into a compliant permitted storage unit at TA-54, Area G, Pad 9 within Dome 230. Storage of the waste containers within Dome 230 will continue to be protective of human health and the environment. In light of the conservative assignment of EPA Hazardous Waste Number D001 and D002 (D002 conservatively assigned to some containers as described above), storage of the containers will meet all applicable conditions in Permit Section 2.8 and all other applicable sections of the LANL Hazardous Waste Facility Permit.

   Dome 230 at TA-54, Area G, is equipped with an active dry-pipe fire protection system. Additionally, as described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including Dome 230. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

   Additional precautions that will be maintained for these containers of ignitable waste include:

   - CAMs with alarm capability are located within TA-54, Area G, Dome 230.
   - Waste will be stored with adequate aisle space (at least 2 feet) and separate from other wastes within the permitted unit.
   - The waste will be protected from sources of ignition by facility procedure.
   - Sources of open flames will not be allowed in, on, or around the containers and smoking is not permitted within the boundaries of TA-54, Area G.
   - Dome 230 has appropriate lightning protection for storage of ignitable waste.

- Non-sparking tools will be used when managing ignitable waste containers (e.g., opening waste container or sampling waste).
- Movement of the containers will be achieved using a drum grappler or a forklift ~~with the container strapped to the mast~~.
- ~~Although~~ Dome 230 is designed for secondary containment, but the 26 unremediated nitrate salt-bearing waste containers that have free liquids ~~will be~~ are stored on secondary containment pallets or the containers will be separated or segregated to prevent any contact with accumulated liquids as required by Permit Section 3.7. The remaining 3 containers will be stored elevated.
- Waste containers ~~will~~ are not ~~be~~ stacked.

VI. Remediation Planning

1) The Permittees have established a "Remediation Team" to identify a path forward for remediation of these containers as necessary and appropriate. The Remediation Team has met regularly. The Permittees have met with NMED on multiple occasions to discuss the Team's progress, and will continue these communications.

   As discussed in Paragraphs IV.2 and IV.3 above, the Permittees have overpacked the ~~57~~ 56 remediated nitrate salt-bearing waste containers at LANL into ~~55~~54 SWBs. These ~~55~~54 SWBs are currently located in the ~~Permacon in Dome~~ TA-54-375 Perma-Con®. As discussed in IV.4 above, an additional four 85 gallon ~~4 POCs~~ containers are also located in the ~~Permacon in Dome~~ TA-54-375 Perma-Con®.

   NMED and the Permittees have had initial discussions on these potential remediation actions and the Permittees will continue their contact with NMED to ~~set~~ coordinate meeting(s) to discuss these potential actions in more detail. The Permittees will use these meetings to help develop a proposal for ~~submission~~ submittals to NMED.

2) Any treatment plans or proposals that are developed by the Remediation Team shall be discussed with NMED. These plans or proposals shall include, but not be limited to, the neutralization steps, the reagents used, the location of the process for treating wastes, and any other key specific information related to all potential treatment options. Any treatment plans that are developed shall detail which characteristic (toxicity, reactivity, ignitability, corrosivity) mixed TRU wastes the ~~Permacon~~Perma-Con®s (or other locations such as the glovebox at the Waste Characterization Reduction and Repackaging Facility [WCRRF]) are authorized to treat – including, as appropriate, the removal of the characteristics of ignitability (D001) and/or corrosivity (D002).

Permittees shall discuss with NMED any permit modifications or authorizations that may be necessary for treatment of the nitrate salt-bearing wastes.

3) The key events, actions and activities to be documented as specified in the treatment plan. The Permittees will maintain records of all key events, actions and activities related to the disposition of the unremediated nitrate salt-bearing waste as documented in the treatment plan (e.g., safe storage configuration, the neutralization steps, the reagents used, the location of the process for treating drums). These records will be updated ~~on a daily basis~~ and be available to NMED for inspection.

VII. Cemented Legacy and Newly Generated Cemented Nitrate Salt-Bearing Waste

Since 1991, the nitrate salt waste stream generated from the evaporator process at TA-55 has been sent to cement fixation immediately upon generation. Remediated and unremediated nitrate salt-bearing waste containers generated at TA-55 prior to 1991 are discussed above. Additional information about the review that the Permittees conducted to identify containers with nitrate salt-bearing waste is included in Enclosure 2 of the Permittees' letter to NMED dated September 19, 2014 (DIR-14-149). This enclosure also includes a discussion on how the evaluation was conducted for a specific subset of waste containers (all of which were pre-1991 containers). The discussions below include information about the Permittees' characterization of both legacy and newly generated cemented nitrate salt-bearing waste that has been generated since 1991.

Some containers from the subset of the TA-55 cemented waste stream (CIN01) include small quantities of dewatered liquids with the potential for containing nitrate compounds. The liquid is believed to have originated from dewatering of the cemented waste over time. The Permittees continued evaluation of the contents of these containers. Free liquid in one unremediated cemented waste container (No. S811785, LA-CIN01.001) was analyzed and found to contain oxidizing compounds, specifically nitrate in the ~34% wt. range. The Permittees identified 448 waste containers stored at LANL that were either verified to contain free liquids or were awaiting RTR review for presence of free liquids.

The Permittees decided to conservatively label and manage these waste containers in the interim as ignitable (D001) and corrosive (D002) waste pending completion of multiple concurrent actions. This is described in *Self-Disclosure of Non-Compliances Resulting From the Extent of Condition Review Los Alamos National Laboratory Hazardous Waste Facility Permit No NM0890010515* (DIR-15-127 or ESHID-600898). The Permittees then implemented a sampling and analysis effort to analyze LA-CIN01 waste containers to confirm or deny the applicability of the ignitability characteristic (D001). In addition to the one container discussed above, additional waste containers were sampled and analyzed to confirm the chemical composition of the contents. Analytical results provided to the NMED-HWB (ENV-DO-15-0313 or ESHID-

601010) were used to determine that D001 and D002 were applicable for the subset of the LA-CIN01 waste stream that contain liquids (ADESH-15-162 or ESHID-601002). Management of these containers continues to be consistent with these types of wastes and do not require special isolation under this plan. Concurrently, the Permittees have reviewed existing RTR data (available for most of the LA-CIN01 waste containers), and will schedule RTR analysis for the remaining containers without RTR data, or pre-screen data, as soon as practicable. ~~There are approximately 378 containers of post-1991 cemented nitrate salt containers within the LANL Area G inventory.~~

The cementation process that is utilized for newly generated cemented waste at TA-55 ~~removes~~ would remove any characteristics of ignitability and reactivity from the nitrate salt waste stream, if applicable. The ~~N~~nitrate salt waste in containers generated at TA-55 after 1991 ~~have~~has been cemented. The cemented waste is ~~and are~~ therefore not ignitable per the definition in 40 CFR ~~§~~264.21 (Characteristic of Ignitability) or reactive per the definition in ~~§~~264.23 (Characteristic of Reactivity).

The waste characterization by Acceptable Knowledge used at TA-55 to demonstrate that the cement from the stabilization process for newly generated waste meets the waste acceptance criteria at WIPP was centered around two primary elements (1) no free liquids greater than 1% were present in the cemented waste and 2) the Portland cement created an inert solid monolith. These elements support the determination that the waste does not exhibit the characteristics of ignitability and reactivity.

The ignitability characteristic is not a concern for the following reasons: (1) the cement from the stabilization process is a solid and does not meet the definition of a liquid per 40 CFR 261.21(a)(1); (2) the cement has never exhibited the characteristic of an ignitable solid that is capable "under standard temperature and pressure of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard" per 40 CFR 261.21(a)(2); and (3) the cement has never exhibited oxidizing behavior per 40 CFR 261.21(a)(4).

The reactivity characteristic has never been observed regarding cement, and further, review of AK documentation processes involved with this waste stream do not indicate the potential for reactivity. The cement has never exhibited the following properties per 40 CFR 261.23: (1) it is normally unstable and readily undergoes violent change without detonating; (2) it reacts violently with water; (3) it forms potentially explosive mixtures with water; (4) when mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment; (5) it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement; and (6) it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

The basis for this determination has been established by direct personnel observations, the facility operating record, and the chemical nature of the Portland cement used in the LANL stabilization process. LANL staff has never observed any ignitable or reactive behavior associated with the cemented waste from the stabilization process. Facility records also confirm that no ignitable or reactive behavior was ever observed from the cemented waste. Lastly, Portland cement by its chemical nature will not react with oxidizers and has no available hydrogen, oxygen, and carbon molecules to help sustain a reaction. In addition, the stabilization process produces a solid monolith, which is an absorber of heat, further reducing any potential for reactive behavior within the cement matrix.

Characterization and stabilization (cementation) treatment of newly generated evaporator bottom waste at TA-55 is conducted in accordance with the Permit as approved. The waste treated at the TA-55 Mixed Waste Stabilization Unit is characterized using the procedure outlined in Permit Attachment C (Waste Analysis Plan), Section C.3.2.4.

Based on the above facts, the Permittees recommend that no further controls be implemented at this time for the ~~cemented~~ legacy ~~and newly generated~~ cemented nitrate salt-bearing waste generated since 1991 or the newly generated cemented nitrate salt-bearing waste. However, it should be noted that the legacy cemented waste is continuing reevaluation as described above and the Permittees will communicate the outcomes of the evaluation with the NMED.

VIII. Immediate Action Implementation Schedule

All actions within the schedule have been completed and implementation of the LANL Isolation Plan is conducted and communicated with NMED in the meetings and written submissions established in Section IX.

Activity	Due Date
Remediated Nitrate Salt-Bearing Waste Containers	
Overpacking (into SWBs) of all nitrate salt-bearing wastes at LANL	Completed 5/18/14
Movement of SWBs to designated areas (e.g., Domes 230, 231 and 375) – (Remediated nitrate salt-bearing drums were in Dome 230, but have been moved to the 375 ~~Permacon~~Perma-Con®)	Move to Dome 230 completed on 5/1/14. All remaining moves completed on 6/3/14
Daily/Hourly monitoring of containers	Daily monitoring began on 5/1/14. ~~———~~Hourly monitoring began on 5/17/14. Daily visual (rather than hourly) began on 11/30/2015.
Appropriate spacing of SWBs	Completed in Dome 230 on 5/1/14. Completed in Dome

Activity	Due Date
	375 & 231 ~~Permacon~~Perma-Con®s on 6/3/14
Updating procedures/safety basis documents as appropriate	Completed on 5/30/14 Procedures are updated as necessary to incorporate changes.
Labels for SWBs (display inner container label)	Completed 5/18/14
Remediation Team kick off	Completed 5/20/14
Unremediated Nitrate Salt-Bearing Containers	
Movement of 85-gallon drums to designated areas (e.g., Domes 230, 231 and 375)	Began in Dome 230 on 5/1/14. ~~————~~All remaining moves completed on 6/3/14.
Daily/Hourly monitoring of containers	Daily/Hourly; began on 5/20/14 Daily/Hourly monitoring of containers was discontinued after the approval of Isolation Plan Revision 3 on 04/27/2015.
Appropriate spacing of containers	Completed in Dome 230 on 5/1/14. Completed in Domes 375 and 231 ~~Permacon~~Perma-Con®s on 6/3/14
~~——~~Updating procedures/safety basis documents for immediate implementation actions as appropriate	Completed 5/30/14
Remediation Team kick off	Completed 5/20/14

~~VIII.~~IX. Updates/Submissions

The Permittees shall provide updates to NMED during the ~~twice weekly~~monthly pre-scheduled technical calls. The Permittees shall also provide updates to NMED in the form of a monthly~~daily~~ written submissions that will be sent to NMED via electronic mail (email) by close of business (COB) on ~~a daily basis~~ the 3rd Wednesday of each month until NMED indicates otherwise. For purposes of this Plan, daily refers to business days, and excludes state and federal holidays.

All submissions related to of the May 19, 2014, *Administrative Order*; the July 10, 2014, April 27, 2015, May 8, 2015, and August 12, 2015 letters from NMED regarding *Modification to May 19, 2014*, Administrative Order ~~this Order~~ shall be placed in both the electronic and hard-copy Information Repositories within five (5) working days of submission to NMED.

All procedures and plans attached to this Revised Isolation Plan may be revised by the Permittees as required. Revisions will be submitted to NMED and placed in Information Repositories as required in this Section IX.

All submissions required by NMED's Order (and modifications to that Order) will be sent to the following addresses:

Bureau Chief
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87508-6303

Division Director
~~Environmental Health~~Resource ~~Division~~Protection Division
Harold Runnels Building
1190 Saint Francis Drive, PO Box 5469
Santa Fe, New Mexico 87502-5469

ENCLOSURE 2

LANL Nitrate Salt-Bearing Waste Container Isolation Plan
Revision 4

ENV-DO-15-0344

LA-UR-15-29287

DEC 1 8 2015

Date: _____

LANL Nitrate Salt-Bearing Waste Container Isolation Plan
Revision 4

December 2015

LA-UR-15-29287

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Attachment 4 EP-AREAG-RM-AOP-1299, R.1: 375 Permacon Nitrate-Salt Waste Container Abnormal Conditions
Attachment 5 EWMO-AREAG-FO-DOP-1246, R.8: Nitrate Salt-Bearing TRU Waste Container Monitoring
Attachment 6 EP-DIV-BEP-20048, R.1, EWMO Division Building Emergency Plan (BEP)
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LA-UR-15-29287
December 2015

I. Introduction

On May 19, 2014, the Department of Energy (DOE) and the Los Alamos National Security, LLC (LANS) ("Permittees") received Administrative Order No. 5-19001 ("Order") issued by the New Mexico Environment Department (NMED). The Order, at paragraph 18, required the Permittees to submit a *LANL Nitrate Salt-Bearing Waste Container Isolation Plan* ("Isolation Plan"). The Isolation Plan was submitted by 2:00 PM on May 21, 2014.

On May 23, 2014, NMED approved the Isolation Plan contingent on the submittal of a revised Isolation Plan that incorporated additional requirements ("Revised Isolation Plan"). NMED required the Permittees to address all of the items enumerated in their May 23, 2014 letter, incorporate those changes and resubmit the Revised Isolation Plan by May 29, 2014. The Revised Isolation Plan was submitted on May 29, 2014.

On August 29, 2014, NMED approved the Revised Isolation Plan with modifications. NMED required the Permittees to address all of the items enumerated in their August 29, 2014 letter, incorporate changes and resubmit the Plan ("Isolation Plan, Revision 2") to NMED no later than September 19, 2014 for final review and approval.

The Isolation Plan, Revision 2 incorporated the modifications enumerated by NMED and was submitted to the NMED on September 19, 2014. It included description of how the Permittees isolated and secured all nitrate salt-bearing waste containers currently stored at Los Alamos National Laboratory (LANL) and information on characterization assessments conducted by the Permittees. Isolation Plan, Revision 3, included the addition of four remediated nitrate salt-bearing waste containers into isolation in the Technical Area 54, Dome 375 (TA-54-375) Perma-Con®.

This Isolation Plan, Revision 4, modifies and updates the plan to include the following: changes to the procedure that will be utilized in the event of abnormal conditions for nitrate-salt-bearing waste containers located at the TA-54-375 Perma-Con®; updates the procedure used for monitoring waste containers; removal of the term "suspect" when referring to four waste containers discovered in February and March 2015; updates status information for containers located at LANL; introduces additional flexibility in temperature measurement equipment, changes the visual inspection frequency from hourly to daily, and incorporates NMED-directed changes to the frequency of written submittals to NMED from daily to monthly. Lastly, this revision removes attachments that are not necessary to describe the present practices for nitrate salt-bearing waste containers on-site at LANL and includes updated language for monitoring and potential response triggers/actions.

The plan describes how the Permittees continue to secure and isolate remediated nitrate salt-bearing waste containers, so that a potential release from them at LANL does not pose a threat to human health or the environment. This plan also includes information on other nitrate salt-bearing waste streams that are currently being managed or reevaluated at LANL, and general information concerning remediation planning for unremediated and remediated nitrate salt waste containers currently stored at LANL.

Additional measures to those described in Isolation Plan, Revision 4 may also be taken and will be identified to NMED during the technical calls established in Section IX.

II. Background and General Implementation Updates

1) On May 1, 2014, the Waste Isolation Pilot Plant (WIPP) declared a potentially inadequate safety analysis (PISA) on the possibility of unremediated nitrate salt-bearing waste contained in waste packages at WIPP. On May 2, 2014, LANS convened a critique to perform an extent of condition on the PISA issued by WIPP. As a result of the critique, the Permittees implemented several corrective and precautionary actions immediately to ensure protection of human health and the environment. The Permittees identified the current storage locations of all remediated and unremediated nitrate salt-bearing waste containers. The Permittees moved all remediated nitrate salt-bearing waste containers into TA-54, Area G, Dome 230 (because Dome 230 has an active fire suppression system) and daily temperature measurements of each container commenced. Additionally, continuous radiological air monitoring was initiated in Dome 230. Finally, any further processing of nitrated salt waste streams was suspended and all transuranic (TRU) waste shipments from LANL were paused.

2) On May 15, 2014, WIPP released photographs showing a LANL drum containing remediated nitrate salt-bearing waste that appeared to be breached in Panel 7, Room 7.

3) On May 16, 2014, the Permittees convened a critique to review the new information. A PISA was declared (ORPS NA-LASO-LANL-WASTEMGT-2014-0004) on the possibility of inadequate safety basis controls specified for the remediated nitrate salt-bearing waste. As a result of the critique, the Permittees implemented several corrective and precautionary actions immediately to ensure protection of human health and the environment.

4) On May 18, 2014, the Permittees completed the overpacking of all originally identified remediated nitrate salt-bearing waste containers at LANL into Standard Waste Boxes

(SWBs). There were 57 remediated nitrate salt-bearing waste containers at LANL, and these were overpacked into 55 SWBs. (As part of the original packing configuration, 2 SWBs each have 2 remediated nitrate salt-bearing waste containers.)

5) On May 20, 2014, the Permittees held the initial meeting of their Remediation Team. (See Section VI below for additional information.)

6) On June 3, 2014, the Permittees completed the move of all unremediated nitrate salt-bearing waste containers to the Perma-Con® in Dome 231 located at TA-54, Area G, and all remediated nitrate salt-bearing waste containers were moved to the TA-54-375 Perma-Con®.

7) On June 5, 2014, the Permittees conservatively applied Environmental Protection Agency (EPA) Hazardous Waste Number D002 to 26 unremediated nitrate salt-bearing waste containers that contain free liquids. The following describes the Permittees' regulatory basis, reasoning and analysis for assigning this EPA Hazardous Waste Number. (*See* also, Permittees' letter to NMED dated September 5, 2014, ADESH-14-088).

   During a review of operating records associated with the remediation of nitrate salt-bearing TRU wastes, the Permittees determined that a few of the parent containers were noted as having liquids with a pH of 2 or less. (*See* ES Nitrate Salt Waste Containers at WCS, WIPP Panel 7, and LANL Data Summary, May 17, 2014, http://www.nmenv.state.nm.us/NMED/Issues/documents/ESNSWasteContatWCS-WIPP-LANL5.17.14.pdf). Based on this information, LANL evaluated the remaining unremediated nitrate salt-bearing waste containers to identify those with free liquids using real-time radiography (RTR) and high-energy RTR (HERTR) analysis. RTR analysis identified that 26 of the 29 containers contained free liquids. As a conservative measure, based on this information, LANL applied the D002 EPA Hazardous Waste Number to these remaining unremediated nitrate salt-bearing waste containers identified with free liquids.

   Videos of 27 RTR fast scans were provided to NMED on September 5, 2014. (ADESH-14-088). As explained in the Permittees' September 5, 2014 letter, RTR video recordings are not available for 2 of the 29 unremediated nitrate salt-bearing waste containers as historically RTR video recordings were not created.

8) On June 18, 2014, the Permittees began headspace gas (HSG) sampling on all SWBs containing remediated nitrate salt-bearing waste containers. The Permittees' intent was to conduct HSG sampling on each of the 55 SWBs stored in the TA-54-375 Perma-Con®. This HSG monitoring was an additional measure above those described in the original May 19, 2014 Isolation Plan and the May 29, 2014 Revised Isolation Plan. When all 55

SWBs were sampled the Permittees transitioned to sampling a subset of the 55 SWBs on a regular basis.

9) On July 25, 2014, the Permittees conservatively applied EPA Hazardous Waste Number D001 to the remediated and unremediated nitrate-salt bearing wastes stored at LANL. The following describes the Permittees' regulatory basis, reasoning and analysis for assigning this EPA Hazardous Waste Number. (See also, Permittees' letter to NMED dated September 5, 2014, ADESH-14-088.)

Unremediated Nitrate-Salt Bearing Waste. On May 22, 2014, LANL received analytical results from two samples taken from an unremediated nitrate salt-bearing waste drum stored at Area G, Dome 231. (These results were provided as Attachment A to the Permittees' letter to NMED dated September 5, 2014, ADESH-14-088). The results showed the presence of nitrate compounds listed on the US Department of Transportation (DOT) Division 5.1 Oxidizers table under the DOT rules at 49 CFR §173.127. EPA/NMED require hazardous wastes that qualify as a 5.1 DOT oxidizer to be managed as a RCRA waste (D001) under 40 CFR §261.21(a)(4). Although the analytical results apply to one (1) unremediated drum, the Permittees determined to conservatively label the remaining drums with the D001 Hazardous Waste Number.

Remediated Nitrate-Salt Bearing Waste. As described in CCP's *Acceptable Knowledge Summary Report for Los Alamos National Laboratory TA-55 Mixed Transuranic Waste* (CCP–AK-LANL-006, Rev. 13, which includes waste stream LA-MIN02-V-001), on page 142, LANL previously determined that these nitrate salts did not meet the definition of a DOT oxidizer. However, to further support managing these specific nitrate salt wastes as non-ignitable, LANL determined to remediate and repackage this waste with an inert material (e.g., zeolite/kitty litter) with a minimum absorbent material to nitrate salts mixture ratio of 1.5 to 1. This ratio was based on results of oxidizing solids testing performed by the Energetic Materials Research and Testing Center (EMRTC) and a white paper authored by the LANL-Carlsbad Office Difficult Waste Team (DWT), *Amount of Zeolite Required to Meet the Constraints Established by the EMRTC Report RF 10-13: Application to LANL Evaporator Nitrate Salts* (See, Attachment B to Permittees' letter to NMED dated September 5, 2014, ADESH-14-088). The EMRTC testing established the concentration at which the most reactive mixture of sodium and potassium nitrate becomes a non-oxidizer when mixed with either zeolite or grout. Based on the EMRTC testing, the LANL DWT concluded that the results can apply to LANL's non-cemented nitrate salts.

As previously reported, LANL remediated and repackaged certain nitrate-salt bearing waste containers using an organic kitty litter, and not a zeolite-based kitty litter (see Letter from Permittees to NMED Secretary Flynn dated July 1, 2014, *Addendum to the*

Los Alamos National Laboratory Hazardous Waste Facility Permit Reporting on Instances of Noncompliance and Releases for Fiscal Years 2012 and 2013). This type of absorbent did not comport with the EMRTC testing or the LANL DWT recommendation.

To date, the Permittees have not sampled a remediated nitrate salt-bearing waste drum. Between July 22 and 29, 2014, LANL had surrogate samples of the waste tested by Southwest Research Institute of San Antonio, Texas. The surrogates were formulated using materials to approximate the remediated nitrate salt waste including *Swheat*™ kitty litter and a mixture of nitrate salts in both wet and dry samples. The samples were analyzed using US Environmental Protection Agency's *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846) Method 1040 (which is based on a test method adapted from the United Nations regulations and classification procedures for the international transportation of dangerous goods) to determine whether the D001 designation code could apply.

On July 25, 2014, the Permittees received preliminary, un-validated results from this testing that indicated that the surrogates sampled could be classified as oxidizers. Based on these results, LANL determined that it could not exclude the application of D001 to the remediated nitrate salt-bearing wastes. Based on this information and consultation with the Carlsbad Field Office, LANL determined to conservatively apply D001 to the remaining remediated nitrate salt-waste containers stored at LANL.

The final analytical reports for this test and all of the other testing that was conducted was included as an attachment to Isolation Plan, Revisions 2 and 3.

10) On September 3-5, 2014, the Permittees had additional surrogate samples representative of the remediated waste tested by Southwest Research Institute of San Antonio, Texas to determine if the surrogate samples meet the DOT oxidizer criteria when tested in accordance with the UN Manual of Tests and Criteria under DOT rules at 49 CFR 173.127 (a) in addition to SW-846, Method 1040. The surrogates for the remediated nitrate salt waste were comprised of a mixture of *Swheat*™ kitty litter and sodium nitrate in a ratio of 3:1. This mixture represents the main components of interest in the remediated waste, i.e., the organic kitty litter and the principal nitrate salt as indicated by the May 22, 2014 analysis. The additional testing determined that the surrogate mixture was a DOT Oxidizer, Packing Group II by the DOT test and a Category II oxidizer by Method 1040. Additional analytical tests for ignitability have also been conducted on various surrogates related the investigation of nitrate-salt bearing wastes.

11) The Permittees have finalized correspondence with Waste Control Specialists (WCS), the Waste Isolation Pilot Plant (WIPP), and any other agencies related to the assignment of EPA Hazardous Waste Number D001 to containers that were shipped to WCS and/or

WIPP. The Permittees have not yet received copies of corrected manifests. However, upon receipt of the corrected manifests, the Permittees will provide them to NMED within 15 business days. The Permittees have provided NMED with all of the Permittees' correspondence on this issue within Isolation Plan Revisions 2 and 3 by letter dated October 22, 2015 (ENV-DO-15-0293).

12) In late February 2015, the Permittees identified an additional 3 parent containers designated as within waste stream LA-MIN04 to be suspect nitrate salt-bearing waste containers. The 3 parent containers produced 10 daughter waste containers: 3 daughters are designated as LA-MDH01 (i.e., debris) and 7 daughters are designated as LA-MIN04. The 10 daughter waste containers are located at Waste Control Specialists (WCS) (2 containers), WIPP (4 containers), and LANL (4 containers). All 4 containers located at LANL were in Pipe Overpack Containers (POCs). As a result of this reevaluation, the Permittees determined that the 10 daughter waste containers are suspected to hold nitrate salt-bearing waste.

13) On March 12, 2015, the Permittees identified an additional 2 parent waste containers designated as LA-MDH01 (i.e., debris) to be suspect nitrate salt-bearing waste containers. The parent waste containers produced 3 daughter waste containers also designated as LA-MDH01. The Permittees and CCP reviewed generator AK documentation, RTR videos, and conducted interviews with SMEs to determine if these 3 daughter waste containers held any nitrate-salt bearing wastes. As a result of this reevaluation, the Permittees determined that the 3 daughter waste containers, located at WIPP, were suspected to hold nitrate salt-bearing waste.

14) On March 27, 2015, the Permittees placed the POCs in the TA-54-375 Perma-Con®.

15) After the approval of LANL Isolation Plan, Revision 3 on April 27, 2015, the Permittees discontinued visual and temperature monitoring of unremediated nitrate salt waste containers and removed them from isolation and into compliant storage within another permitted unit.

16) On August 13, 2015, the Permittees overpacked the POCs into 85 gallon overpack containers within the TA-54-375 and placed them back in storage within the TA-54-375 Perma-Con®.

III. Waste Container Categories

The current inventory of nitrate salt-bearing waste containers covered by this plan and stored at LANL can be divided into two categories: 1) remediated nitrate salt-bearing wastes; and 2)

unremediated nitrate salt-bearing wastes. A third category of containers that originated from the nitrate evaporator and cementation operations within TA-55 are cemented legacy and newly generated wastes and are not covered under this plan but are currently undergoing reevaluation as described in Section VII.

This plan addresses isolation, securing and/or treatment of the remediated nitrate salt-bearing wastes. In this plan, "remediated" containers are defined as LANL unconsolidated nitrate salts that were remediated with kitty litter absorbent and were repackaged into new drums. "Unremediated" containers are defined as LANL unconsolidated nitrate salts drums to which absorbent material has not been added. Isolation Plan, Revision 3, removed unremediated nitrate salt-bearing waste containers from secured isolation and allows for the storage of these waste containers in other compliant permitted storage at Technical Area (TA)-54, Area G.

To identify all of the nitrate salts-bearing waste containers generated, a focused review of the generator records was conducted. Unconsolidated nitrate salts were only generated at TA-55 in a specific room and glove box from 1979 through 1991. It is important to note that after 1991, all nitrate wastes were cemented.

Following the original review of generator records, it was determined that all of the nitrate salt parents exist as subsets in both a debris (LA-MHD01.001) and cemented (LA-CIN01.001-Cans) waste stream. The LA-MHD01.001 waste stream includes over a thousand containers, but only 164 original parent drums were determined to contain nitrate salts in the original assessment. LA-CIN01.001-Cans waste stream also includes over a thousand containers, but only 103 original parent drums were determined to contain nitrate salts in the original assessment.

In total, there were 267 original nitrate salt parent containers identified during the initial query. A large portion of these 267 parent containers had been remediated into nitrate salt daughter containers. As a result, the original inventory of nitrate salt-bearing waste containers was 707. After remediation, all of the remediated nitrate daughters were assigned to two homogeneous absorption waste streams; LA-MIN02-V.001 and LA-MIN04-S.001. However, after Real-time Radiography (RTR), daughter containers may have been re-assigned to a final waste stream based on the volume percentages of the final waste content.

The above-referenced waste streams, LA-MHD01.001, LA-CIN01.001, LA-MIN02-V.001 and LA-MIN04-S.001 are not solely dedicated to nitrate salts. All containers in waste streams LA-MHD01.001, LA-CIN01.001, LA-MIN02-V.001 and LA-MIN04-S.001 do not contain nitrate salts and therefore, not all require isolation or management as nitrate salts.

The Permittees' approach to the focused review discussed above was conservative. The original list of 707 includes containers that contain nitrate salt-bearing waste or are suspected of containing nitrate salt-bearing waste.

Additional information on the Permittees' evaluation and identification of LANL nitrate salt drums is provided in the *Summary of Evaluation and Identification of LANL Nitrate Salt Containers*. (Attachment 1)

The inventory of LANL nitrate salt-bearing waste containers changed upon discovery of the newly-identified nitrate salt-bearing waste containers in February and March 2015. This brought the total inventory of nitrate salt-bearing waste containers to 720 containers. The total parent containers was raised to 272 containers. Changes to the inventory were proposed in March 2015 when the Permittees presented NMED with a proposed inventory recommending the removal of 97 waste containers from the inventory. The NMED concurred with the removal of 10 of those containers from the inventory on March 20, 2015. Three of the containers removed from the inventory were original parent containers that were shipped off-site for direct disposal because they did not require remediation. One of the containers removed from the inventory is located within the TA-54-375 Perma-Con®.

As a result of inventory changes, the current total inventory of LANL nitrate-salt bearing waste containers can be summarized as follows:

- 269 parent nitrate salt waste containers either remain parent containers or were remediated for a total inventory of 710 nitrate salt-bearing waste containers.
    - 29 of the 710 waste containers are parent nitrate salt waste containers that remain in storage at LANL.
    - Three of the 710 waste containers were shipped off-site for direct disposal because they did not require remediation.
    - 678 of the 710 waste containers are remediated nitrate salt-bearing waste containers.

Of the 710 identified nitrate salt-bearing containers, a total of 89 remain at LANL, 60 are remediated daughter containers and 29 are unremediated parent containers.

If any additional nitrate salt-bearing waste containers are identified based on new information, these containers will be managed in the same manner as the currently identified nitrate salt-bearing waste containers. The Permittees will notify NMED during the technical calls as established in Section IX.

Characterization for the third category, cemented legacy and newly generated cemented wastes from the nitrate processing line at TA-55, has recently undergone reevaluation, as discussed in Section VII. These wastes do not require isolation, however, legacy cemented nitrate waste containers generated since 1991 that contain free liquids have been conservatively recharacterized as ignitable and corrosive.

IV. Immediate and Current Actions for Remediated Nitrate Salt-Bearing Waste Containers

There are currently 60 remediated nitrate salt-bearing waste containers at LANL. The Permittees validated this number through review of data from the Waste Compliance and Tracking System (WCATS) database and a field walk-down verification. Below is a description of the activities the Permittees have taken and currently conduct to address isolating and securing the remediated nitrate salt-bearing waste containers.

1) On May 16, 2014, LANS applied five LANL tamper indicating devices (TIDs) to drum number 68685 as shown in the attached photo (Attachment 2, photo 1). This TRU waste drum is the sister drum related to the breached drum at WIPP (drum 68660 was confirmed as the damaged drum during the May 22, 2014 WIPP entry, and drum 68685 is its sibling). Additionally, a member of the DOE Los Alamos Field Office observed the application of the TIDs.

   On May 16, 2014, drum number 68685 was placed inside an SWB along with three empty dunnage drums (Attachment 2, photo 2) and was sealed. LANS applied two additional TIDs to either end of the SWB as shown in the attached photo (Attachment 2, photo 3).

   On May 16, 2014, the empty parent containers for the two drums of initial interest (68660 and 68533) in the WIPP underground repository were identified onsite at LANL. As a result, LANS applied TIDs to both empty parent containers (69120 and 68359) during the early afternoon of May 16, 2014. This evolution was observed by DOE Los Alamos Field Office. Since that time S855793 was determined to be the parent container of drums 68685 and 68660.

   These TIDs, and all subsequent TIDs, were installed in accordance with the LANL TID User Manual, NMCA-TID-FWI-002 R.1 (Attachment 3) by trained and qualified LANL TID users.

   No additional TIDs have been applied to date, nor do the Permittees intend to install any additional TIDs at this time. However, additional TIDs will be applied as necessary to ensure that valuable information is not lost or as otherwise needed.

   If directed to open the containers, the TIDs must be removed by qualified TID personnel in accordance with the TID User Manual (Section 3.21). In this instance, a two-person rule must be followed to verify chain of custody has been maintained and to verify that the TID has been properly destroyed once removed. Additionally, to ensure the TIDs are not removed without approval from the Facility Operations Director (FOD), they also

have postings that clearly address that the TIDs cannot be removed without FOD approval.

2) On May 18, 2014, the Permittees completed overpacking the 57 remediated nitrate salt-bearing waste containers at LANL into SWBs. These containers were first placed into isolated storage in Dome 230 at TA-54, Area G, which has an active fire protection system. This dry-pipe fire protection system is not included within the LANL Hazardous Waste Facility Permit ("Permit"), Attachment D ("Contingency Plan") as it was inoperable during the re-application process for the Permit. This system became operable in November 2011, and currently the Permittees have chosen not to credit this system as fire control equipment in the Contingency Plan.

3) Additionally, as described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including Dome 230. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

4) The Permittees moved all remediated nitrate salt-bearing waste SWBs originally identified at LANL to the TA-54-375 Perma-Con® located at TA-54, Area G. This move was completed on June 3, 2014.

5) The 4 newly identified remediated nitrate salt-bearing waste containers located at LANL were moved from Domes 232 and 153 into the TA-54-375 Perma-Con® on March 27, 2015. These containers were overpacked into 85 gallon waste containers on August 13, 2015.

6) As described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including TA-54-375. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

   The Los Alamos Fire Department (LAFD) is manned and available 24-hours a day. They are able to utilize fire hydrants in the event of a fire or reaction. Additionally, the LANL emergency management organization is also on call 24-hours a day, and will respond promptly.

   The TA-54-375 Perma-Con®, as a permitted unit, is authorized under the LANL Permit for storage of mixed TRU wastes. The dry-pipe fire protection systems within the Perma-Con® is not included within the Permit Contingency Plan as the Perma-Con® has generally been used for processing waste containers, a process that requires added

safety/emergency controls more prescriptive than those of normal waste storage. Therefore, currently the Permittees have chosen not to credit these systems as fire control equipment in the Contingency Plan.

A pre-action fire suppression system (FSS) was installed in the TA-54-375 Perma-Con® in February 2013. The FSS is designed as an ordinary group 2 pre-action sprinkler system to protect the moderate hazard operations in the Perma-Con®. A drawing of the FSS in Dome 375 is found in *375 Permacon Nitrate-Salt Waste Container Abnormal Conditions,* EP-AREAG-RM-AOP-1299, R.1 (Attachment 4). This system uses water for fire suppression, which is compatible with the nitrate salt waste. Should the fire suppression system activate, TA-54-375 has curbing that provides approximately 49,000 gallons of retention capacity.

The sprinkler system pre-action valve is automatically activated by a combination of any 2 of 3 types of electronic initiating devices located in the Dome or the Perma-Con®: smoke detection, heat detection, or fire alarm pull stations. During an event, fire alarm pull stations can be accessed and manually activated by staff. Pull stations are located in accordance with National Fire Protection Association (NFPA) standards in the Dome and the Perma-Con®. Also, access is facilitated by maintaining emergency egress aisles with a minimum aisle space of two feet in the Dome and the Perma-Con®. Further, in compliance with Permit Section 3.5.1(1), the Permittees will maintain adequate aisle space to allow for the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within TA-54-375 Dome and Perma-Con®. Finally, in the event of an abnormal condition, staff will evacuate quickly and will promptly report to 911, the operations center or the shift manager. Should an abnormal condition be observed, the Permittees will implement their emergency response plan and provide notice to NMED within 24 hours.

The Perma-Con® is constructed of stainless steel frame and sheeting. It is a contamination-control structure that is temperature-controlled and equipped with a High Efficiency Particulate Air (HEPA) filtration and fire suppression system. The Perma-Con® is also maintained at negative pressure. Additionally, the remediated drums were overpacked into new SWBs and newly identified nitrate salt-bearing POCs were overpacked into 85 gallon waste containers. SWBs are considered robust enough to prevent lid loss due to deflagration or fire based on information in DOE-STD-5506-2007, they would act as a barrier to provide a significant measure of worker protection. Should an event occur, the TA-54-375 Perma-Con® is designed to contain a radiological release.

7) The Permittees are monitoring, on a daily basis, the temperature of the SWBs and 85 gallon containers that contain remediated nitrate salt-bearing waste drums. As discussed above, all remediated nitrate salt-bearing containers are overpacked in SWBs or 85 gallon

containers. Temperature measurements are taken of the top surface of the overpack container using a thermocouple, infrared thermometer, or Infrared Imaging Camera. The target temperature at which the nitrate salt-bearing waste containers are maintained in the TA-54-375 Perma-Con® is less than 90 °F.

The Permittees maintain records of all temperature monitoring. These activities will be performed in accordance with LANL's Procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246, R.6 (Attachment 5). These records will be updated on a daily basis. The temperature data (both daily, and if conducted as an additional measure, hourly) that the Permittees have collected since the Isolation Plan was implemented was included with the Isolation Plan, Revision 2 as two attachments. The attachments were discs containing documentation of daily and hourly temperature measurements obtained by the Permittees up to the time the Permittees began including temperature data in the written submissions provided to NMED, as established in Section IX. Between the data included with the Isolation Plan, Revision 2 in an attachment to that document and the data that the Permittees provide in the written submissions, the Permittees have provided a current set of information to NMED. Additionally, these records and all temperature data (both daily, and if conducted as an additional measure under, hourly) will be available to NMED for inspection.

The Permittees performed visual inspections of these containers on an hourly basis, 24 hours per day, until the approval of the Permittees request to change the frequency of visual inspections from hourly to daily received on November 20, 2015 (ESHID-601027). On November 30, 2015, the Permittees began conducting daily visual inspections to identify abnormal conditions (e.g., signs of smoking and fire, evidence of deterioration, bulging). These activities are performed in accordance with LANL's Procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246, R.6. The Permittees maintain records of all visual monitoring. (See, Attachment 5) These records are updated on a daily basis and are available to NMED for inspection.

Recent studies, analysis, and a head space gas data report (Attachment 12) provides additional understanding of the safety of remediated nitrate salt-bearing waste containers onsite in the TA-54, Area G, Dome 375 Perma-Con®. The HSG data report demonstrated the correlation of HSG concentrations with environmental temperature, and showed that temperature influences the rate of chemical reaction. The HSG results provided a measure of chemical reactivity of the remediated nitrate salt waste stream that has greater fidelity than either temperature or visual monitoring. In fact, the HSG analysis can be used as an indicator of increased chemical reactivity and as an input to initiate a facility response for abnormal operating conditions. Visual inspection of the drums, while providing confirmation of an abnormal environment, is not a leading indicator of an

abnormality. It is expected that any visual indication of an abnormality will be accompanied by a hot gas release, which would be detectable through continuous remote temperature monitoring of the overpack container lid. For these reasons, a change from hourly visual inspections to daily visual inspections was requested by the Permittees and approved by the NMED.

Additionally, the Permittees are using continuous air monitors (CAMs) with alarm capability, and will continue their use until further notice. There are CAMs in place in the TA-54-375 Perma-Con® that can provide remote data if there is a significant airborne release. Lastly, the Emergency Response/Hazardous Materials organization has been briefed on the storage configuration.

Action levels have been established and response instructions prepared. These are contained in the LANL procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246, R.6 (Attachment 5). Should an abnormal condition be observed, the Permittees will implement their emergency response plan and provide notice to NMED within 24 hours. Area G's building emergency plan is found in Attachment 6, and associated procedures are found at Attachments 7, 8, and 9.

8) The overpacks containing remediated nitrate salt-bearing waste containers are spaced an adequate distance apart to limit any potential interactions between the containers. This distance has been determined to be a minimum of 1 (one) foot between containers. This distance is based on the Permittees' review of evidence from the event at WIPP, a calculation on the heat transfer from a container undergoing a similar reaction, and a review of fire protection and Permit requirements. The containers are currently stored with a minimum of 2 feet between containers and will not be moved.

   The Permittees have reviewed photographs of the impacted drum in WIPP Room 7, Panel 7 and the adjacent containers. From the photographs, the adjacent drum and the adjacent SWB appear to have minimal damage and no release. The adjacent drums are in contact with the impacted drum and the adjacent SWBs are within inches of the impacted drum.

   The Permittees have performed a preliminary calculation on the minimum separation distance between containers to ensure that an incident in one container will not impact an adjacent container. Assuming the offending container reaches a maximum temperature of approximately 1100°F and that the adjacent container does not to exceed 200°F, the heat generated from the offending container drops off to below 200°F within 1 inch. The 2 foot spacing in use provides additional assurance that the adjacent containers will not be impacted by the heat generated during an exothermic event in a single container. Drawings that include the locations of the containers are included in *375 Permacon Nitrate-Salt Waste Container Abnormal Conditions*, EP-AREAG-RM-AOP-

1299, R.1 (Attachment 4). The use of fire curtains in between containers will not provide a measurable reduction in the thermal conductivity across the 24 inches but does provide protection from flame impingement.

Containers in the TA-54-375 Perma-Con® are placed in rows that allow for emergency egress and that have Permit compliant spacing between each row. If used, the fire curtains will be placed within a row (that is, between the adjacent containers in that row) to mitigate the potential for interaction between adjacent containers. The Permittees have procured fire curtains are rated to a continuous temperature of 1800°F and intermittent temperatures of 2500°F.

The NFPA consensus standards were also reviewed and NFPA 211 provided the most similar type of control. NFPA 211 covers the installation of chimney pipes and stoves and the distance recommended between the pipe and unprotected combustibles is 18 inches. There are no unprotected combustibles in the Perma-Con®s in Domes 231 and 375.

This 2 foot distance also meets the requirements in Permit Section 3.5.1(1). This section requires the Permittees to maintain adequate aisle space to allow for the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within the TA-54-375 Dome and Perma-Con®.

The Permittees have purchased fire resistant curtains that are not in use, but may be used in lieu of spacing. Containers will be placed in rows that allow for safe egress and that have Permit compliant spacing between each row. If used, the curtains will be placed within a row (that is, between the adjacent containers in that row) to mitigate the potential for interaction between adjacent containers. The fire curtains are rated to a continuous temperature of 1800°F and intermittent temperatures of 2500°F. This temperature well covers the temperature at which a breached container is estimated to reach. Prior to using fire resistant curtains, the Permittees will discuss the details of their use with NMED during the technical calls established in Section IX.

The Permittees will protect workers by restricting access to the remediated nitrate salt-bearing waste containers. Only those personnel performing the ongoing container monitoring activities (e.g., daily monitoring), other sampling/data collection work (e.g., periodic head space gas sampling), necessary maintenance activities (e.g., corrective or preventative maintenance), and other required inspections (e.g., Permit required inspections) will be allowed into the storage areas. This is documented in Standing Order EWMO-AREAG-SO-1247, R.2 (Attachment 10). Also, there will be warning signs posted at the entrance to the TA-54-375 Perma-Con® that will inform personnel of access restrictions.

Additionally, all originally identified remediated nitrate salt-bearing waste (in May 2014) were packed in new drums and overpacked into new SWBs, and suspect nitrate salt-bearing waste is located in 85 gallon overpacked POCs. Since SWBs and 85 gallon overpacked POCs are considered robust enough to prevent lid loss due to deflagration or fire, based on information in DOE-STD-5506-2007, they would act as a barrier to provide a significant measure of worker protection. No other protective shields or barriers are deemed necessary for the protection of workers at this time.

Furthermore, the ongoing data collection activities provide continuing information on the physical condition of the waste so that appropriate additional worker safety measures can be taken, if required.

9) Prior to moving nitrate salt-bearing containers, the Permittees will notify the LANL Emergency Operations Center (EOC). The EOC will notify the Los Alamos Fire Department and other responders, if needed. The Permittees will notify the EOC at the completion of the move. The Permittees do not anticipate that responders will be present during the movement of these containers, or that responders will be present/alerted during other actions.

10) The Permittees have updated all procedures and safety basis documents to convert the processing facilities into storage facilities.

11) SWBs and 85 gallon containers display the required labels for all inner containers or are reclassified as a new container in WCATS. This means that the container either displays the container identification number for the 55-gallon nitrate salt-bearing waste container within the overpack or displays a new container number. The 60 subject containers (including the sister drum to the breached drum in WIPP) have been clearly labeled with the appropriate warning labels and any other required labeling. Specifically, the containers have the hazardous waste labels required by Permit Section 3.6(1) and the remediated nitrate salt-bearing waste containers are also marked as “Radioactive”, as required by Permit Section 3.6(1). The four 85 gallon containers have been labeled as containing “Free Liquids” and have been placed on adequate secondary containment within the TA-54-375 Perma-Con®. Additionally, three of the remediated nitrate salt-bearing waste containers that are overpacked in SWBs within the TA-54-375 Perma-Con® have been identified as containing free liquids. The SWBs were not placed on secondary containment when this discovery was made because movement of the SWBs is prohibited. Additionally, there are visual inspections conducted daily that would identify leaked liquid and the facility has procedures that will be followed in the event of a spill or leak within the TA-54-375 Perma-Con®.

12) The Permittees have conducted HSG sampling on all 54 SWBs and four 85 gallon containers that contain nitrate salt-bearing waste containers. Each SWB has been sampled for at least seven days.

Gas chromatography with thermal conductivity detection is used for the analysis of He_2, H_2, O_2, N_2, CH_4, CO, CO_2, and NO_4 in HSG samples. The HSG sample data (H_2, CO_2, CO, and N_2O) that the Permittees collected from the time the Isolation Plan was implemented through September 11, 2014 was included as an attachment to Isolation Plan Revisions 2 and 3. In conjunction with the data in those revisions and the data that the Permittees have provided in the written submissions, the Permittees have provided a current set of information to NMED. Attachment 11 graphically presents the H_2, CO_2, CO, and N_2O data collected for seven SWBs that are currently daily or twice weekly sampled. The CO_2 values are adjusted by the quantity of CO_2 in the field blank (i.e., the amount of CO_2 in the air at the time the sample is taken is subtracted from the CO_2 reading from the container). No other adjustments are made to the data.

He_2 and CH_4 have not been detected in HSG samples, and O_2 and N_2 are observed at atmospheric concentrations. More detailed information on these compounds is available to the NMED at their request. If there is any change to this status, the Permittees will inform the NMED during the technical calls established in Section IX.

The Permittees began this HSG sampling on May 19, 2014, when they began daily HSG sampling of SWB 68685. This SWB contains TRU waste drum 68685 which is the sister drum related to the breached drum at WIPP.

On June 18, 2014, the Permittees began HSG sampling on the additional SWBs containing nitrate salt-bearing waste containers, in order to better be able to compare and evaluate results against SWB 68685. On July 24, 2014, the Permittees began daily HSG sampling of SWB SB50522. On August 13, 2014, LANL had conducted HSG sampling of all 55 SWBs that contain remediated nitrate salt-bearing waste. The Permittees transitioned to sampling a subset of the 55 SWBs on a regular basis (this subset may change over time). All of this headspace gas monitoring was an additional measure above those described in the original May 19, 2014 Isolation Plan and the May 29, 2014 Revised Isolation Plan.

On September 3, 2014, upon receipt (email) of the NMED's letter dated August 29, 2014, the Permittees immediately resumed daily HSG sampling of SWBs 68685 and SB50522. (The Permittees had been sampling both of these containers on a daily basis until August 28, 2014, when they shifted sampling to twice per week. The Permittees had also conducted HSG sampling of both SWBs on September 2, 2014.)

The Permittees continue to conduct HSG sampling to measure concentrations of H_2, CO_2, CO and N_2O. The Permittees:

1. Conduct daily HSG sampling of SWB SB50522 and the SWB that contains 68685.

2. Periodically sample HSG of 52 other SWBs and four 85 gallon containers within the TA-54-375 Perma-Con®. HSG sampling occurs on a schedule that ensures that each of the containers are sampled for HSG at least once per calendar month. The Permittees began implementation of this monthly HSG sampling in September, 2014. The monthly schedule is supported by the graphical presentations of the H_2, CO_2, CO and N_2O data in Attachment 13 which indicate stability in the analyzed gas constituents and is protective of human health and the environment.

HSG sampling was conducted for at least seven days on the four newly identified POCs (prior to overpacking). After the seven day sampling was completed, the POCs (now 85 gallon containers) were added to the monthly schedule described above. Additionally, the SWB that was removed from the inventory of nitrate salt-bearing waste containers was removed from this schedule in September 2015. The Permittees include HSG data (H_2, CO_2, CO and N_2O) in the written submissions provided to NMED, as established in Section IX. Between the data included with the Isolation Plan, Revisions 2 and 3 and the data that the Permittees provide in the written submissions, the Permittees have provided a current set of information to NMED. Additionally, these records and all temperature data will be available to NMED for inspection.

Additionally, as part of initial investigations, the Permittees performed solid phase micro-extraction (SPME) analyses. This work was performed as part of the Permittees additional measures. SPME monitors for trace levels of organic compounds (< 1ppm). The detection limits for organic compounds without SPME is sufficient to establish that concentrations of organic vapors do not approach flammability limits. SPME was performed for the purpose of detecting organic molecules which could be an ignition initiator at very low concentrations. No noteworthy detections of compounds were observed. A summary of this data with graphical presentation of the data (prior to September 2014) was included as an attachment to Isolation Plan Revisions 2 and 3. SPME analyses was discontinued in September 2015, because no detections for organic compounds were observed during the time the analyses was conducted and the Permittees deemed that there was no value added to continuing SPME analyses.

- The Permittees evaluated the HSG data (H_2, CO_2, CO, and N_2O) collected from SWB SB50522 from July 24, 2014 through September 11, 2014.

SB50522 contains four drums, with the following container identification numbers and waste stream identification numbers:

- Container 69490 (LA-MIN02-V.001)
- Container 69271 (LA-MIN03-NC.001)
- Container 68799 (LA-MIN03-NC.001)
- Container 57653 (LA-CIN01.001)

The range (high to low) of H_2 levels the Permittees observed in HSG data during that time frame was 28,020 parts per million (ppm) to 6,986 ppm. On July 30, 2014, the Permittees installed additional filters in the SWB to decrease concentrations. This approach was successful and concentrations of H_2 are present at a lower level. Form August 18, 2014 through September 11, 2014, H_2 levels remained below 10,000 ppm. The range (high to low) of CO_2 levels the Permittees observed in HSG data was 76,858 ppm to 39,338 ppm during that time frame.

The range of temperature measurements the Permittees observed during hourly temperature measurements through November 17, 2015 were:

SB50522 Temperature	Degrees Fahrenheit
High	84.1
Low	31.8

For comparison the ambient temperature range in Dome 375 Cell 1 where SB50522 is located during the same time period is:

Dome 375 Cell 1 Temperature	Degrees Fahrenheit
High	90.6
Low	29.3

Prior to packaging the four containers into SB50522, the Permittees conducted flammable gas analysis on three of the containers (57653, 69271 and 69490). (Note: although flammable gas analysis is not required for the LA-MIN03-NC.001 waste stream it was conducted for 69271.) The Quantitation Reports for flammable gas analysis for the three containers were provided as an attachment to Isolation Plan Revisions 2 and 3.

13) The Permittees also evaluated the HSG data (H_2, CO_2, CO, and N_2O) collected from all of the SWBs with remediated nitrate salt-bearing waste through September 11, 2014 and the discussion below describes this evaluation. The Permittees continue to evaluate HSG data and the results of that evaluation are described in the modeling report included as Attachment 12.

As background information, radiolytic processes produce simple gas molecules from the interaction of radiation with organic and inorganic material in TRU waste. Hydrogen is typically the principal gas produced from the interaction of radiation with organic material. During headspace analysis for hydrogen, levels of other gases including CO, CO_2, and N_2O are also measured. Gaseous CO_2 can also be formed from radiolysis, and its concentration depends on the specific composition of the waste. From studying the radiolysis of selected simulated TRU waste, the relative amount of CO_2 and H_2 that is produced has been established under a range of conditions. From these investigations, the ratio of the amount of CO_2 to H_2 produced was greatest for poly vinyl chloride, with a maximum ratio for this material to be 6.5 CO_2/H_2. Other waste types did not produce as much CO_2 and therefore this ratio would be less than 6.5.

The conducted HSG analysis initially selected revealed that some drums had CO_2 to H_2 ratios of >100. This suggests that gas generation in some cases cannot be attributed solely to radiolysis of the waste. This supposition is reinforced by the observation of nitrous oxide > 1,000 ppm, which would likely be indicative of nitrate salt chemistry. Atmospheric concentrations for these gases are approximately 450 ppm and 350 parts per billion (ppb) respectively.

LANL began characterizing the headspace gas of 55 SWBs containing remediated nitrate salt-bearing waste for Volatile Organic Compounds (VOCs) by Gas Chromatography/ Mass Spectrometry (GC-MS) and for permanent gases using GC with a Thermal Conductivity Detector (GC-TCD). Permanent gases are those that remain gaseous at standard temperature and pressure. Daily monitoring of a subset of these 55 SWBs was initiated on May 19, 2014. All 55 SWBs have now been characterized. Elevated concentrations of HSG compounds have been observed at concentrations well above normal atmospheric concentrations in some of these 55 SWBs (Attachment 13). These concentrations cannot be explained based on radiolysis of waste drum content and suggest that the gases are being produced from other processes. Specifically, N_2O is believed to result from the oxidation of material contained within the nitrate salt containing waste. The N_2O concentrations observed, ranging from (100 – 9000 ppm), are above the normal atmospheric concentration of ~ 350 ppb. The Permittees have ongoing work that may provide insight into this chemistry.

While high CO_2 concentrations (and potentially the ratio of CO_2 and H_2) are expected to be proportional to the magnitude of potential changes taking place in any given drum, they are not, on their own an indicator of significant changes to the waste within the container. To date, LANL has collected over 700 HSG samples. The graphical representation of this HSG data indicates stability in the analyzed gas constituents and supports the monthly sampling schedule set out in Section IV.10 above.

The Permittees initially suspected the CO_2 to H_2 ratio might be an indicator of radiolytic decomposition, and tracked that ratio. However, analysis of the HSG data (H_2, CO_2, CO, and N_2O) gathered to date indicates there are potentially other gas generating mechanisms occurring within some containers. The concentrations of oxidation products (e.g., CO_2 and N_2O) is ancillary to the H_2 concentration measurement. While it provides additional insight into the nitrate salt-bearing waste, the Permittees no longer consider tracking the CO_2 to H_2 ratio to be a useful indicator. The Permittees have focused ongoing analyses on the monitoring of H_2 concentrations and temperature measurements rather than ratio of CO_2 and H_2 because: the lower flammability limit (LFL) for H_2 is established; both H_2 gas concentrations and temperature are readily measured; and actionable levels can be established. The H_2 and temperature measurements are a more direct way to monitor potential changes in the waste.

14) The Permittees currently utilize a combination of temperature measurement and regularly collected HSG data as indicators to track chemical reactivity and as a basis for validating container safety. Modeling has been conducted and an interpretation of HSG observations has been drafted in support of this approach (Attachment 12). If the HSG concentrations were to depart from the expected trends based on the storage temperature and previous concentrations (e.g., higher CO_2 concentrations than expected based on the model) the Permittees could infer increasing chemical reactivity and potentially, increased hazard. For example, in 2015, the temperature dependent concentrations have been significantly lower in the summer when compared to those measured in the summer of 2014. If concentrations were to exceed the most recent values and approach those of 2014, there would be a strong indication that chemical reactivity has increased and therefore concern for safety would be increased.

15) If the Permittees observe an H_2 concentration at or above 20,000 ppm (~50% of the lower explosive limit [LEL]), they will conduct daily HSG (H_2, CO_2, CO, and N_2O) for that SWB.

    If the Permittees observe an H_2 concentration at or above 30,000 ppm (~75% of the LEL), they will install additional filters in the SWB, if the SWB is configured to accept additional filters. (This approach was successfully implemented by the Permittees with SB50522. Concentrations of H_2 were reduced after the installation of additional filters in that SWB, and have since been maintained at a lower level.)

    If additional filters cannot be added to the SWB or if concentrations are not reduced to below 30,000 ppm at the next daily HSG sample, then the Permittees will apply a 15 foot stand-off exclusion zone. (The stand-off exclusion zone is a 15 foot area that is used at LANL to surround a container that is or has become unvented, thereby unable to vent contents adequately. This area is segregated from normal operations except those

operations specific to disposition or inspection of the container of concern. Surrounding containers may exist in the exclusion zone. Entry into the exclusion zone is controlled by the Facility Operations Director (FOD) who will determine what actions can be taken – including entry for sampling, temperature measurements or visual monitoring.) This approach is consistent with the hazard analysis that has been performed for an unvented drum discovery. The Permittees will notify LANL Emergency Management to assume responsibility for the container if the container poses a threat, e.g., bulging.

The Permittees include HSG data (H_2, CO_2, CO, and N_2O) in the written submissions provided to NMED, as established in Section IX.

16) The isolation configuration described in this section continues to be protective of human health and the environment in light of the observed concentrations of H_2 and CO_2 in SWBs and 85 gallon containers, and in light of the conservative assignment of EPA Hazardous Waste Number D001. The facility being used for isolation is compliant with the LANL Hazardous Waste Facility Permit. The fire suppression systems, climate control and filtration systems, and other mechanisms described above are designed to protect human health and the environment in the event of a reaction within a container, a release, a fire, or an explosion. The Permittees continue to evaluate the effectiveness of the isolation configuration and will make changes to this configuration as appropriate.

V. Immediate and Current Actions for Unremediated Nitrate Salt–Bearing Waste Containers

There are currently 29 unremediated nitrate salt-bearing waste containers at LANL. The Permittees validated this number through review of data from the WCATS database and a field walk-down verification conducted prior to May 29, 2014. Below is a description of the activities DOE/LANS implemented isolating, securing, and then removing from isolation the unremediated nitrate salt-bearing waste containers.

1) The 29 unremediated containers were first placed into isolated storage in Dome 230 at TA-54, Area G, which has an active fire protection system. This dry-pipe fire protection system is not included within the Permit Contingency Plan as it was inoperable during the re-application process for the Permit. This system became operable in November 2011, and currently the Permittees have chosen not to credit this system as fire control equipment in the Contingency Plan.

   Additionally, as described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including Dome 230. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

2) The Permittees moved all unremediated nitrate salt-bearing waste containers at LANL to the Perma-Con® in Dome 231 located at TA-54, Area G. This move was completed on June 3, 2014.

3) The Permittees monitored the temperature daily of the 85-gallon overpacks that contain unremediated nitrate salt-bearing waste drums from the time the Isolation Plan was implemented until the approval of the Isolation Plan, Revision 3 on April 27, 2015. Daily temperature measurements were taken of the external surface of the 85-gallon overpack using a calibrated infrared thermometer. The target temperature at which the nitrate salt-bearing waste containers were maintained while in isolation was less than 90°F.

   The Permittees maintain records of all temperature monitoring. These activities were performed in accordance with LANL's Procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246. The temperature data (both daily, and if conducted as an additional measure, hourly) that the Permittees collected since the Isolation Plan was implemented was included with the Isolation Plan, Revision 2 as two attachments. The attachments were discs containing documentation of daily and hourly temperature measurements obtained by the Permittees up to the time the Permittees began including temperature data to NMED in the daily written submissions provided to NMED, as established in Section IX. Between the data included with the Isolation Plan, Revision 2 in Attachments 8 and 9 of that plan and the data that the Permittees provided in the written submittals, the Permittees provided a complete set of information to NMED. Additionally, these records and all temperature data (both daily, and if conducted as an additional measure, hourly) are available to NMED for inspection.

   The Permittees also performed visual inspections of these containers on an hourly basis, 24 hours per day, to identify abnormal conditions (e.g., signs of smoking and fire, evidence of deterioration, bulging) from the time the Isolation Plan was implemented until the approval of the Isolation Plan, Revision 3. These activities were performed in accordance with LANL's Procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring,* EWMO-AREAG-FO-DOP-1246. The Permittees will maintain records of all such visual monitoring. These records are available to NMED for inspection.

   Additionally, the Permittees used continuous air monitors CAMs with alarm capability. There were CAMs in place in the TA-54-231 Perma-Con® for the entire time unremediated nitrate salt-bearing waste containers were stored within the Perma-Con®. Lastly, the Emergency Response/Hazardous Materials organization were briefed on the storage configuration while the containers were isolated.

4) During isolation, unremediated nitrate salt-bearing containers were spaced an adequate distance apart to limit any potential interactions with other containers. This distance has

been determined to be 2 feet between containers. This distance was based on the Permittees' review of evidence from the event at WIPP, a calculation on the heat transfer from an SWB undergoing a similar reaction, and a review of fire protection and Permit requirements.

5) During isolation, the Permittees protected workers by restricting access to the unremediated nitrate salt-bearing waste containers. Only those personnel performing the ongoing container monitoring activities (e.g., daily temperature monitoring), other sampling/data collection work (e.g., periodic head space gas sampling), and other required inspections (e.g., Permit required inspections) were allowed into the storage areas. This is documented in Standing Order EP-AREAG-SO-1247. Also, there were warning signs posted at the entrance to the Perma-Con® in Dome 231 informing personnel of access restrictions.

6) Additionally, all unremediated nitrate salt-bearing waste is in 55-gallon drums that have been overpacked into 85-gallon containers of good integrity.

7) This waste has been stored above-ground for many years and the Permittees continued data collection activities to provide information on the physical condition of the waste so that appropriate additional worker safety measures could be taken, if required.

8) Further evaluation of unremediated nitrate salt waste led to the conclusion that the 29 unremediated nitrate salt-bearing waste containers do not require specific isolation from other waste containers stored at permitted units at TA-54 Area G. Unremediated salts are determined to not present the potential hazard of spontaneous combustion or enhanced combustion in their current configuration; therefore, they can be stored in any area in which combustible material is minimized and separated from the nitrate salt waste containers, without fear of a release. Attachment 13 for this Isolation Plan details the assessment conducted to reach this conclusion.

9) As a result of this evaluation, the Permittees received NMED approval to move the 29 unremediated nitrate salt-bearing waste containers located within the Dome 231 Perma-Con® from isolation and into a compliant permitted storage unit at TA-54, Area G, Pad 9 within Dome 230. Storage of the waste containers within Dome 230 will continue to be protective of human health and the environment. In light of the conservative assignment of EPA Hazardous Waste Number D001 and D002 (D002 conservatively assigned to some containers as described above), storage of the containers will meet all applicable conditions in Permit Section 2.8 and all other applicable sections of the LANL Hazardous Waste Facility Permit.

   Dome 230 at TA-54, Area G, is equipped with an active dry-pipe fire protection system. Additionally, as described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G,

Table D-2, fire control equipment is located throughout Area G, including Dome 230. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

Additional precautions that will be maintained for these containers of ignitable waste include:

- CAMs with alarm capability are located within TA-54, Area G, Dome 230.
- Waste will be stored with adequate aisle space (at least 2 feet) and separate from other wastes within the permitted unit.
- The waste will be protected from sources of ignition by facility procedure.
- Sources of open flames will not be allowed in, on, or around the containers and smoking is not permitted within the boundaries of TA-54, Area G.
- Dome 230 has appropriate lightning protection for storage of ignitable waste.
- Non-sparking tools will be used when managing ignitable waste containers (e.g., opening waste container or sampling waste).
- Movement of the containers will be achieved using a drum grappler or a forklift.
- Dome 230 is designed for secondary containment, but the 26 unremediated nitrate salt-bearing waste containers that have free liquids are stored on secondary containment pallets or the containers will be separated or segregated to prevent any contact with accumulated liquids as required by Permit Section 3.7. The remaining 3 containers will be stored elevated.
- Waste containers are not stacked.

VI. Remediation Planning

1) The Permittees have established a "Remediation Team" to identify a path forward for remediation of these containers as necessary and appropriate. The Remediation Team has met regularly. The Permittees have met with NMED on multiple occasions to discuss the Team's progress, and will continue these communications.

   As discussed in Paragraphs IV.2 and IV.3 above, the Permittees have overpacked the 56 remediated nitrate salt-bearing waste containers at LANL into 54 SWBs. These 54 SWBs are currently located in the TA-54-375 Perma-Con®. As discussed in IV.4 above, an additional four 85 gallon containers are also located in the TA-54-375 Perma-Con®.

   NMED and the Permittees have had initial discussions on these potential remediation actions and the Permittees will continue their contact with NMED to coordinate

meeting(s) to discuss these potential actions in more detail. The Permittees will use these meetings to help develop a proposal for submittals to NMED.

2) Any treatment plans or proposals that are developed by the Remediation Team shall be discussed with NMED. These plans or proposals shall include, but not be limited to, the neutralization steps, the reagents used, the location of the process for treating wastes, and any other key specific information related to all potential treatment options. Any treatment plans that are developed shall detail which characteristic (toxicity, reactivity, ignitability, corrosivity) mixed TRU wastes the Perma-Con®s (or other locations such as the glovebox at the Waste Characterization Reduction and Repackaging Facility [WCRRF]) are authorized to treat – including, as appropriate, the removal of the characteristics of ignitability (D001) and/or corrosivity (D002). Permittees shall discuss with NMED any permit modifications or authorizations that may be necessary for treatment of the nitrate salt-bearing wastes.

3) The key events, actions and activities to be documented as specified in the treatment plan. The Permittees will maintain records of all key events, actions and activities related to the disposition of the unremediated nitrate salt-bearing waste as documented in the treatment plan (e.g., safe storage configuration, the neutralization steps, the reagents used, the location of the process for treating drums). These records will be updated and be available to NMED for inspection.

VII. Cemented Legacy and Newly Generated Cemented Nitrate Salt-Bearing Waste

Since 1991, the nitrate salt waste stream generated from the evaporator process at TA-55 has been sent to cement fixation immediately upon generation. Remediated and unremediated nitrate salt-bearing waste containers generated at TA-55 prior to 1991 are discussed above. Additional information about the review that the Permittees conducted to identify containers with nitrate salt-bearing waste is included in Enclosure 2 of the Permittees' letter to NMED dated September 19, 2014 (DIR-14-149). This enclosure also includes a discussion on how the evaluation was conducted for a specific subset of waste containers (all of which were pre-1991 containers). The discussions below include information about the Permittees' characterization of both legacy and newly generated cemented nitrate salt-bearing waste that has been generated since 1991.

Some containers from the subset of the TA-55 cemented waste stream (CIN01) include small quantities of dewatered liquids with the potential for containing nitrate compounds. The liquid is believed to have originated from dewatering of the cemented waste over time. The Permittees continued evaluation of the contents of these containers. Free liquid in one unremediated cemented waste container (No. S811785, LA-CIN01.001) was analyzed and found to contain oxidizing compounds, specifically nitrate in the ~34% wt. range. The Permittees identified 448

waste containers stored at LANL that were either verified to contain free liquids or were awaiting RTR review for presence of free liquids.

The Permittees decided to conservatively label and manage these waste containers in the interim as ignitable (D001) and corrosive (D002) waste pending completion of multiple concurrent actions. This is described in *Self-Disclosure of Non-Compliances Resulting From the Extent of Condition Review Los Alamos National Laboratory Hazardous Waste Facility Permit No NM0890010515* (DIR-15-127 or ESHID-600898). The Permittees then implemented a sampling and analysis effort to analyze LA-CIN01 waste containers to confirm or deny the applicability of the ignitability characteristic (D001). In addition to the one container discussed above, additional waste containers were sampled and analyzed to confirm the chemical composition of the contents. Analytical results provided to the NMED-HWB (ENV-DO-15-0313 or ESHID-601010) were used to determine that D001 and D002 were applicable for the subset of the LA-CIN01 waste stream that contain liquids (ADESH-15-162 or ESHID-601002). Management of these containers continues to be consistent with these types of wastes and do not require special isolation under this plan. Concurrently, the Permittees have reviewed existing RTR data (available for most of the LA-CIN01 waste containers), and will schedule RTR analysis for the remaining containers without RTR data, or pre-screen data, as soon as practicable.

The cementation process that is utilized for newly generated cemented waste at TA-55 would remove any characteristics of ignitability and reactivity from the nitrate salt waste stream, if applicable. The nitrate salt waste in containers generated at TA-55 after 1991 has been cemented. The cemented waste is therefore not ignitable per the definition in 40 CFR 264.21 (Characteristic of Ignitability) or reactive per the definition in 264.23 (Characteristic of Reactivity).

The waste characterization by Acceptable Knowledge used at TA-55 to demonstrate that the cement from the stabilization process for newly generated waste meets the waste acceptance criteria at WIPP was centered around two primary elements (1) no free liquids greater than 1% were present in the cemented waste and 2) the Portland cement created an inert solid monolith. These elements support the determination that the waste does not exhibit the characteristics of ignitability and reactivity.

The ignitability characteristic is not a concern for the following reasons: (1) the cement from the stabilization process is a solid and does not meet the definition of a liquid per 40 CFR 261.21(a)(1); (2) the cement has never exhibited the characteristic of an ignitable solid that is capable "under standard temperature and pressure of causing fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard" per 40 CFR 261.21(a)(2); and (3) the cement has never exhibited oxidizing behavior per 40 CFR 261.21(a)(4).

The reactivity characteristic has never been observed regarding cement, and further, review of AK documentation processes involved with this waste stream do not indicate the potential for reactivity. The cement has never exhibited the following properties per 40 CFR 261.23: (1) it is normally unstable and readily undergoes violent change without detonating; (2) it reacts violently with water; (3) it forms potentially explosive mixtures with water; (4) when mixed with water, it generates toxic gases, vapors or fumes in a quantity sufficient to present a danger to human health or the environment; (5) it is capable of detonation or explosive reaction if it is subjected to a strong initiating source or if heated under confinement; and (6) it is readily capable of detonation or explosive decomposition or reaction at standard temperature and pressure.

The basis for this determination has been established by direct personnel observations, the facility operating record, and the chemical nature of the Portland cement used in the LANL stabilization process. LANL staff has never observed any ignitable or reactive behavior associated with the cemented waste from the stabilization process. Facility records also confirm that no ignitable or reactive behavior was ever observed from the cemented waste. Lastly, Portland cement by its chemical nature will not react with oxidizers and has no available hydrogen, oxygen, and carbon molecules to help sustain a reaction. In addition, the stabilization process produces a solid monolith, which is an absorber of heat, further reducing any potential for reactive behavior within the cement matrix.

Characterization and stabilization (cementation) treatment of newly generated evaporator bottom waste at TA-55 is conducted in accordance with the Permit as approved. The waste treated at the TA-55 Mixed Waste Stabilization Unit is characterized using the procedure outlined in Permit Attachment C (Waste Analysis Plan), Section C.3.2.4.

Based on the above facts, the Permittees recommend that no further controls be implemented at this time for the legacy cemented nitrate salt-bearing waste generated since 1991 or the newly generated cemented nitrate salt-bearing waste. However, it should be noted that the legacy cemented waste is continuing reevaluation as described above and the Permittees will communicate the outcomes of the evaluation with the NMED.

VIII. Immediate Action Implementation Schedule

All actions within the schedule have been completed and implementation of the LANL Isolation Plan is conducted and communicated with NMED in the meetings and written submissions established in Section IX.

Activity	Due Date
Remediated Nitrate Salt-Bearing Waste Containers	

Activity	**Due Date**
Overpacking (into SWBs) of all nitrate salt-bearing wastes at LANL	Completed 5/18/14
Movement of SWBs to designated areas (e.g., Domes 230, 231 and 375) – (Remediated nitrate salt-bearing drums were in Dome 230, but have been moved to the 375 Perma-Con®)	Move to Dome 230 completed on 5/1/14. All remaining moves completed on 6/3/14
Daily/Hourly monitoring of containers	Daily monitoring began on 5/1/14. Hourly monitoring began on 5/17/14. Daily visual (rather than hourly) began on 11/30/2015.
Appropriate spacing of SWBs	Completed in Dome 230 on 5/1/14. Completed in Dome 375 & 231 Perma-Con®s on 6/3/14
Updating procedures/safety basis documents as appropriate	Completed on 5/30/14 Procedures are updated as necessary to incorporate changes.
Labels for SWBs (display inner container label)	Completed 5/18/14
Remediation Team kick off	Completed 5/20/14
Unremediated Nitrate Salt-Bearing Containers	
Movement of 85-gallon drums to designated areas (e.g., Domes 230, 231 and 375)	Began in Dome 230 on 5/1/14. All remaining moves completed on 6/3/14.
Daily/Hourly monitoring of containers	Daily/Hourly; began on 5/20/14 Daily/Hourly monitoring of containers was discontinued after the approval of Isolation Plan Revision 3 on 04/27/2015.
Appropriate spacing of containers	Completed in Dome 230 on 5/1/14. Completed in Domes 375 and 231 Perma-Con®s on 6/3/14
Updating procedures/safety basis documents for immediate implementation actions as appropriate	Completed 5/30/14
Remediation Team kick off	Completed 5/20/14

IX. Updates/Submissions

The Permittees shall provide updates to NMED during the monthly pre-scheduled technical calls. The Permittees shall also provide updates to NMED in the form of a monthly written submissions that will be sent to NMED via electronic mail (email) by close of business (COB) on the 3rd Wednesday of each month until NMED indicates otherwise. For purposes of this Plan, daily refers to business days, and excludes state and federal holidays.

All submissions related to of the May 19, 2014, *Administrative Order*; the July 10, 2014, April 27, 2015, May 8, 2015, and August 12, 2015 letters from NMED regarding *Modification to May 19, 2014*, Administrative Order shall be placed in both the electronic and hard-copy Information Repositories within five (5) working days of submission to NMED.

All procedures and plans attached to this Revised Isolation Plan may be revised by the Permittees as required. Revisions will be submitted to NMED and placed in Information Repositories as required in this Section IX.

All submissions required by NMED's Order (and modifications to that Order) will be sent to the following addresses:

Bureau Chief
Hazardous Waste Bureau
2905 Rodeo Park Drive East, Building 1
Santa Fe, New Mexico 87508-6303

Division Director
Resource Protection Division
Harold Runnels Building
1190 Saint Francis Drive, PO Box 5469
Santa Fe, New Mexico 87502-5469

Attachment 1

LA-UR-14-23807
May 29, 2014

Summary of Evaluation and Identification of LANL Nitrate Salt Containers

Los Alamos
NATIONAL LABORATORY
EST. 1943

Prepared by the Environmental Programs Directorate

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BACKGROUND

Los Alamos National Laboratory (LANL) staff along with the Planning and Technical Solutions (PTS) team within the LANL TRU Waste Program (LTP) evaluated generator data to identify unconsolidated nitrate salts in the aboveground transuranic (TRU) waste container population. The evaluation was conducted from January to May 2012 to identify Technical Area 55 (TA-55) TRU waste containers that were consistent with the Central Characterization Project (CCP) Nonconformance Report (NCR) (NCR-LANL-0509-09) issued for drums with uncemented nitrate salts that originated from the TA-55 evaporator operations. Forty-eight (48) containers were identified in the NCR that may have required a waste stream reassignment consistent with homogeneous solids.

In addition, in May 2012, the LANL Carlsbad Office Difficult Waste Team authored a white paper (Amount of Zeolite Required to Meet the Constraints Established by the EMRTC Report RF 10-13: Application to LANL Evaporator Nitrate Salts, May 08, 2012) that established the remediation requirements for the Waste Isolation Pilot Plant (WIPP) to affirm that the final mixture of LANL nitrate salts meets WIPP acceptance criteria. The nitrate salt evaluation was conducted to identify the population of active aboveground containers that required management as unconsolidated nitrate salts in accordance with the newly identified requirements. Containers that had been, dispositioned, or belowground were considered beyond the scope of the evaluation.

EVALUATION METHODS

- Extracted all containers with LANL generator Waste Codes A25 (Leached Process Residues), A26 (Evaporator Bottom/Salts), A27 (Nitrate Salts), and A28 (Chloride Salts) that had originated from TA-55. These waste codes had been in use since 1971.
- Initially identified 2,568 containers across all solution packages and waste streams.
- Containers with generator Waste Code A28 were eliminated after initial review indicated all containers with A28 Waste Code were indeed from TA-55 chloride operations and not nitrate operations.
- Dates of generation of interest were from 1979 to 1991 because these dates spanned the period between the start-up of TA-55 nitrate evaporator operations in 1979 and full implementation of new evaporator and cement fixation operations in 1991. The latter eliminated the generation of unconsolidated nitrate salt wastes but allowed the generation of individual cemented cans on a case-by-case basis.
- The mid-1980s represent a time period when unconsolidated and cemented nitrate salts were generated concurrently, but the same generator Waste Codes were applied.
- Over 1,700 active aboveground containers were evaluated for the presence of unconsolidated nitrate salt in bags with attached generator Waste Codes of A25, A26, and A27.
- Reviewed and summarized TA-55 nitrate operational procedures to establish criteria for presence of unconsolidated nitrate salts.
- Identified processes that generated nitrate salts and eliminated those that did not, such as chloride salt operations.
- Examined waste generator records including discardable waste forms and logs that contained itemized descriptions of waste items that were not part of radioactive solid waste disposal forms and database comment fields.

- Discussed nitrate solution evaporation and cement fixation processes with TA-55 personnel (some since retired) to confirm timing of cementation process changes.

RESULTS OF INITIAL NITRATE SALT EVALUATION JUNE 2012

- Identified two hundred and sixty-five (265) nitrate salt or suspect original parent containers based on review of generator data. These had been independently assigned by CCP personnel to TA-55 waste streams LA-MHD01.001 and LA-CIN01.001-Cans (Table 1).
- All other containers in TA-55 waste streams LA-MHD01.001 and LA-CIN01.001-Cans not listed in Table 1 were considered to contain other waste forms, such as debris or cemented materials, and not nitrate or suspect nitrate salts.
- No nitrate or suspect nitrate salt containers were identified in TA-55 homogeneous waste streams (e.g., LA-MIN02-V.001 or LA-MIN04-S.001 or from other TAs).
- Assigned the following salt types to active TRU waste containers:
  - ***Nitrate*** salt, based on generator records that indicated unconsolidated nitrate salt or process room number or glovebox number associated with nitrate operations evaporator or waste management operations, because not all of the legacy records included waste or process descriptions.
  - ***Suspect*** nitrate salt, based on generator records that indicated nitrate salt or process room number or glovebox number, but the container was assigned to a cemented waste stream and additional information was thought necessary for proper assignment (e.g., real-time radiography [RTR] or evidence of cementation such as presence of cans during remediation or visual examination).
  - ***Miscellaneous***, based on generator records that indicated homogeneous solids were generated from operations other than TA-55 nitrate operations.
- Established Salt Type as data field in Container Management tracking spreadsheet.
- Containers that did not explicitly receive salt type designations were assigned *Not Applicable* because they are not nitrate salts.

No TA-21 (TA-55 predecessor facility) nitrate salts were identified because the TA-21 nitrate solutions were cemented.

Table 1
Summary of Initial Nitrate Salt Assignments to Original, Parent, TRU Waste Containers

Salt Type and Waste Stream	Count of Containers
Nitrate	**189**
LA-CIN01.001-Cans	**25**
SP 36	7
SP 37	18
LA-MHD01.001	**164**
SP 72	163
SP 78	1

Suspect	**76**
LA-CIN01.001-Cans	**76**
SP 36	1
SP 57	44
SP 72	31
Grand Total	**265**

PROGRESSION OF NITRATE SALT CONTAINERS FROM AUGUST 2012 TO APRIL 2014

As of May 2012, 376 containers existed because thirty-three (33) parent drums had been processed through the Waste Characterization, Reduction and Repackaging Facility (WCRFF) that resulted in a moderate population of active remediation daughters. Table 2 summarizes the population of nitrate and suspect nitrate salt containers as of July 31, 2012, and includes the Solution Package (SP) assignments. This date captures the assignment of salt types after the initial evaluation, but before additional nitrate salt drum processing had occurred.

Remediated daughter containers, created as part of the waste sorting and repackaging operations at WCRRF, were initially assigned to the homogeneous waste stream LA-MIN04-S.001.

Table 2
Summary of Nitrate and Suspect Nitrate Salt Containers, Including Waste Stream and Solution Package Codes (Data as of July 31, 2012)

Salt Type, Waste Stream, and Container Type	Count of Containers
Nitrate	**300**
Original	**156**
LA-CIN01.001-Cans	25
SP 36	7
SP 37	18
LA-MHD01.001	131
SP 72	130
SP 78	1
Remediation Daughter	**144**
LA-MHD01.001	128
SP 72	128
LA-MIN04-S.001	16
SP 72	16
Suspect	**76**
Original	**76**
LA-CIN01.001-Cans	76
SP 36	1
SP 57	44
SP 72	31
Grand Total	**376**

The nitrate salt container remediation process, including waste sorting, neutralization, and absorption of liquids according to the revised requirements, started in October 2012 and continued through March 2014 at WCRFF. Table 3 summarizes the population of nitrate and suspect nitrate salt containers as of May 8, 2014. This date captures the progression of the two hundred and sixty-five (265) initially identified nitrate and suspect nitrate salt drums through remediation and disposition operations largely conducted as part of the 3,706 Waste Campaign. Table 3 includes containers identified as "*Original*" that were not remediated as part of the 3,706 Waste Campaign and retained their original inner package configurations, as received from the TA-55 generator. These original containers were staged at LANL and had not yet been remediated at WCRRF, but may have been placed in compliant overpacks such as an 85-gal. drum or a standard waste box.

Table 3
Summary of Nitrate and Suspect Nitrate Salt Containers, Including Container Types and Waste Streams (Data as of May 8, 2014)

Salt Type, Waste Stream and Container Type	Count of Containers
Nitrate	**549**
LA-CIN01.001-Cans	**26**
Original in overpack	1
Original	24
Remediation Daughter	1
LA-MHD01.001	**84**
Remediation Daughter	84
LA-MIN02-V.001	**436**
Remediation Daughter	436
LA-MIN04-S.001	**3**
Remediation Daughter	3
Suspect	**154**
LA-CIN01.001-Cans	**89**
Original	7
Remediation Daughter	82
LA-MHD01.001	**4**
Remediation Daughter	4
LA-MIN02-V.001	**61**
Original in overpack	3
Remediation Daughter	58
Grand Total	**703**

As a result of radiological release at WIPP, a subsequent review of the 2012 nitrate salt evaluation was performed. This review of containers with nitrate, suspect nitrate salt, or miscellaneous salt types included review of remediation records and RTR data reports and videos. This review resulted in the identification of two (2) original containers (S855943 and S824181) that were not assigned as unconsolidated nitrate salts in July 2012. The assignment of nitrate salt type to the two (2) parent containers results in the assignment of nitrate salt type to four (4) remediation daughters. These four (4) containers were remediated and managed as nitrate salts. Table 4 summarizes the population of nitrate and suspect nitrate containers as of May 21, 2014, and their locations. This date captures the progression of the 265 originally identified nitrate and suspect nitrate salt drums in 2012, the expansion of the population through creation of remediation daughter, and their disposition, including the two (2) newly identified parents and their daughters. Table 4 summarizes the population of nitrate and suspect nitrate salt containers by waste stream and location, as of May 21, 2014.

The creation of remediation daughter drums during waste sorting, neutralization, absorption of liquids, and repackaging resulted in the redistribution of wastes from the parent to the daughters and subsequent reassignment of waste stream designations. For example, the parent container may have been assigned

to waste stream LA-MHD-01.001, a remediation daughter that contained more than 50% by volume homogeneous solids, and was reassigned to MIN02-V.001 by CCP. The majority of nitrate salt remediation daughters were reassigned to homogeneous solid waste stream LA-MIN02-V.001, including the four (4) remediation daughters discussed in the previous paragraph. A few were assigned to the homogeneous LA-MIN04-S.001 waste stream if they appeared to contain little nitrate salt material. Some remediation daughters may have retained the LA-MHD-01.001 or LA-CIN01.001 waste stream assignment if they contained more than 50% debris by volume or if the waste appeared to be cemented, respectively.

Table 4
Summary of Nitrate and Suspect Nitrate Salt Containers,
Including Waste Streams, Container Types and Locations (Data as of May 21, 2014)

Location	Container Type	Salt Type	Waste Stream	Count of Containers
LANL	**Original**	Nitrate	LA-CIN01.001-Cans	24
		Suspect	LA-CIN01.001-Cans	1
	Remediation Daughter	Nitrate	LA-MHD01.001	9
			LA-MIN02-V.001	21
		Suspect	LA-CIN01.001-Cans	1
			LA-MHD01.001	2
			LA-MIN02-V.001	24
	Original in overpack	Nitrate	LA-CIN01.001-Cans	1
		Suspect	LA-MIN02-V.001	3
LANL Total				**86**
WCS	**Original**	Suspect	LA-CIN01.001-Cans	1
	Remediation Daughter	Nitrate	LA-CIN01.001-Cans	1
			LA-MHD01.001	2
			LA-MIN02-V.001	100
		Suspect	LA-CIN01.001-Cans	2
			LA-MIN02-V.001	7
WCS Total				**113**
WIPP	**Original**	Suspect	LA-CIN01.001-Cans	5
	Remediation Daughter	Nitrate	LA-MHD01.001	73
			LA-MIN02-V.001	270
			LA-MIN04-S.001	3
		Suspect	LA-CIN01.001-Cans	79
			LA-MHD01.001	2
			LA-MIN02-V.001	21
WIPP Total				**453**
WIPP Panel 7	**Remediation Daughter**	Nitrate	LA-MIN02-V.001	49
		Suspect	LA-MIN02-V.001	6
WIPP Panel 7 Total				55
Total				**707**

DISCUSSION OF IDENTIFICATION OF NITRATE SALT CONTAINERS

This report summarizes the evaluations conducted to identify nitrate and suspect salts in the aboveground TRU inventory. The evaluation started in January 2012 with the identification of forty-eight (48) containers in NCR-LANL-0509-09. The evaluation focused on Waste Codes A25, A26, A27 and A28 that were a required part of the generator documentation. Containers that had been dispositioned or were belowground were not included in the evaluation. The initial evaluation in 2012 identified two hundred and sixty-five (265) nitrate salt or suspect nitrate salt original parent containers based on review of generator data. Forty (40) of the containers in the NCR were confirmed to be unconsolidated nitrate salts. The eight (8) other containers were identified as other salt or waste types. Two (2) additional nitrate salt containers were recently identified that brought the count of original parent containers to two hundred and sixty-seven (267). The processes of waste sorting, neutralization, absorption of liquids, and waste repackaging created remediation daughters that expanded the population nitrate or suspected nitrate salts to seven hundred and seven (707) containers, as summarized in Table 4.

The nitrate salt evaluation focused on the generation processes that created the nitrate salt wastes from TA-55 nitrate operations. The population of nitrate and suspect nitrate salt waste containers were identified and tracked through remediation, characterization, and disposition. The waste stream assignments were independently determined by CCP and were not considered an essential part of the assignment of nitrate or suspect nitrate salt type to specific containers. Thus, nitrate and suspect nitrate salt wastes were initially identified to exist in both LA-MHD01.001 and LA-CIN01.001-Cans waste streams. The salt type Suspect was assigned to containers in waste stream LA-CIN01.001-Cans until other independent evidence, such as visual examination or RTR, was obtained. This was not generally available in 2012 but was available and used in the May 2014 review of these containers. As described, all of the other containers in TA-55 waste streams LA-MHD01.001 and LA-CIN01.001-Cans were considered to contain other waste forms, such as debris or cemented materials, and were not, and are not, considered to contain unconsolidated nitrate or suspect nitrate salts. The WCRRF remediation technicians noted that some of the bags of salts appeared to be physically cemented. These were apparently retained in the LA-CIN01.001 waste stream.

The rest of the TRU waste inventory at TA-54 Area G that was not part of the focused evaluation was determined not to contain unconsolidated nitrate salts. Table 5 summarizes all TA-55 waste generated before 1991 that do not contain unconsolidated nitrate salts. The year 1991 represents full implementation of the new TA-55 nitrate solution evaporator and cement fixation operations that completely eliminated the generation of unconsolidated nitrate salt wastes. The Cemented and Miscellaneous salt (e.g., chlorides and other salt residues) waste streams are benign based on their chemical and physical characteristics. The remaining combustible and noncombustible trash, equipment, scrap metal, glass, plastic, and absorbed liquids do not contain any salt residues and are considered safe for storage based on current packaging configurations.

Table 5
Summary of other Homogeneous Solid and Debris TRU Wastes Generated at TA-55 Prior to 1991 That Do Not Contain Unconsolidated Nitrate Salts (Data as of May 28, 2014)

Waste Stream	Bldg Code	Waste Stream Description	Count of Containers
LA-CIN01.001	TA-55	Cemented	431
		Miscellaneous	81
LA-MHD01.001	TA-55	Cemented	1
		Miscellaneous	10
		Combustible Decontamination Waste	3
		Scrap Metal	16
		Other Combustibles	19
		Combustible Lab trash	12
		Non-Combustible Lab Trash	18
		Non-Property Numbered Equip.	1
		Property Number Equip.	3
		Non-Combustible Filter Media	3
		Glass	3
		Plastics	2
		Combustible Trash	1
LA-MIN02-V.001	TA-55	Silicon Base Oil on Vermiculite	1
LA-MIN04-S.001	TA-55	Miscellaneous	1
Total			**606**

ATTACHMENTS

Attachment 1 Summary of Legacy Nitrate Salt Timeline from 2012 Evaluation

Activities	**1984** - (7/6/84 Approval Date) MST-12 Procedure – Procedure: 485-REC-R00 Treatment of Evaporator "Bottoms"	**1987** - (2/18/87 Approval Date) MST-12 Standard Operating Procedure – Procedure: 485-REC-R01 Treatment of Evaporator Bottoms	**1989** - (2/9/89 Approval Date) MST-12 Standard Operating Procedure – Procedure: 485-REC-R02 Treatment of Evaporator Bottoms	**1991** - 9/22/91 (Approval Date) NMT-2 Safe Operating Procedure – Procedure: 485-REC-R01 Computer Operated Nitric Acid Volume Reduction and Treatment of Evaporator Bottoms	**1995** - (8/31/95 Approval Date) NMT-2 Safe Operating Procedure – Procedure: 485-REC-R03 Computer Operated Nitric Acid Volume Reduction and Treatment of Evaporator Bottoms	**1996** - (11/20/96 Approval Date) NMT-2 Safe Operating Procedure – Procedure: 485-REC-R04 Nitric Acid Process Evaporator	**1997** - (9/9/97 Approval Date) NMT-2 Safe Operating Procedure – Procedure: 485-REC-R05 Nitric Acid Process **Evaporator (EV)**	**2002** - (4/23/2002 Approval Date) NMT-2 Work Instruction – Procedure: NMT2-WI-002-REC-485 Nitric Acid Process Evaporator (Supersedes procedure NMT2-SOP-REC-485-R06)
	No Location Specified in the Procedure	**Location:**	**Location:**	**Location: (Computer Operated Evaporators)**	**Location: (Computer Operated Evaporators)**	**No Location Specified in the Procedure**	**No Location Specified in the Procedure**	**Location:**
Salts vacuum dried	Salts are vacuum dried	Salts are vacuum dried for at least 15 minutes						
Salts packaged in double bags	Salts are packaged in double bags	Salts are place in plastic bags/taped (salt is bagged as soon as it looks dry enough)						
Salts bagged out for disposal	Salts are placed in a 55-gal drum	Salts are discarded and bagged out	Salts are bagged out or given additional washing if not discardable					
Salts transferred to cement fixation (CF)				Salts are redissolved and added to the bottoms and filtered; otherwise, are transferred to CF in 5-L ss cans. Bottoms are transferred to CF	Filtrates and salts are transferred to CF if they meet discard limit per PFD	Bottoms is sent to CF; otherwise, to IX if above discard limit	Filtrate is sent to CF per PFD	Residue and salt are removed from the EV and sent to CF if it meets the discard limit; otherwise, to ion exchange

Activities	**1984** - (7/6/84 Approval Date) MST-12 Procedure – Procedure: 485-REC-R00 Treatment of Evaporator "Bottoms"	**1987** - (2/18/87 Approval Date) MST-12 Standard Operating Procedure – Procedure: 485-REC-R01 Treatment of Evaporator Bottoms	**1989** - (2/9/89 Approval Date) MST-12 Standard Operating Procedure – Procedure: 485-REC-R02 Treatment of Evaporator Bottoms	**1991** - 9/22/91 (Approval Date) NMT-2 Safe Operating Procedure – Procedure: 485-REC-R01 Computer Operated Nitric Acid Volume Reduction and Treatment of Evaporator Bottoms	**1995** - (8/31/95 Approval Date) NMT-2 Safe Operating Procedure – Procedure: 485-REC-R03 Computer Operated Nitric Acid Volume Reduction and Treatment of Evaporator Bottoms	**1996** - (11/20/96 Approval Date) NMT-2 Safe Operating Procedure – Procedure: 485-REC-R04 Nitric Acid Process Evaporator	**1997** - (9/9/97 Approval Date) NMT-2 Safe Operating Procedure – Procedure: 485-REC-R05 Nitric Acid Process **Evaporator (EV)**	**2002** - (4/23/2002 Approval Date) NMT-2 Work Instruction – Procedure: NMT2-WI-002-REC-485 Nitric Acid Process Evaporator (Supersedes procedure NMT2-SOP-REC-485-R06)
	No Location Specified in the Procedure	**Location:**	**Location:**	**Location: (Computer Operated Evaporators)**	**Location: (Computer Operated Evaporators)**	**No Location Specified in the Procedure**	**No Location Specified in the Procedure**	**Location:**
Solution (supernatant transferred to CF)	Supenatant solution is tranferred to CF if it contains the ff: Pu-242 and Uranium	Reduced solution goes to CF (Solutions are transferred to CF)	Bottoms are filtered and the solutions goes to CF	Distillate is transferred to TA-50		Distillate is transferred to TA-50 per PFD	Distillates to TA-50 if they meet discard limit per PFD	Distillate is transferred to TA-50 if it meets the discard limit; otherwise, it is redistilled
	Filteraid was used to absorb any moisture	If salts are not discardable, they are washed with 7 M HNO3		Bottoms are filtered and sent back to ion ex. for reprocessing if discard limit is exceeded	Distillate is transferred to TA-50; otherwise, transferred it's reprocessed through EV	Bottoms are filtered and salts remain in the filter is washed with water		Bottoms are filtered and washed with water to further dissolve and send to CF or ion ex. for reprocessing per PFD
	Supernatant solution containing no salts or Pu is recycled/ reprocessed	Chemicals use: 15.9 M HNO3	Solution goes back to ion ex. for reprocessing	Salt is transferred to CF if it meets the discard limit and bagged out per PFD				
	Drums have lead lined and poly liner							

Attachment 2 Itemized List of 265 Original, Nitrate, and Suspect Nitrate Containers

Original Container ID	PKG_ID	Salt Type	Waste Stream	Type	Code	Dataset Date
S793450	S793450	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S793724	S793724	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S794448	S794448	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S801676	S801676	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S802641	S802641	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S802701	S802701	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S802739	S802739	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S802833	S802833	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S802853	S802853	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S802959	S802959	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S803078	S803078	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S803613	S803613	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S804948	S804948	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S804989	S804989	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S804995	S804995	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S805051	S805051	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S805289	S805289	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S811613	S811613	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S811692	S811692	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S811734	S811734	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S811812	S811812	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S811834	S811834	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S811872	S811872	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S813223	S813223	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S813385	S813385	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S813389	S813389	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S813471	S813471	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S813475	S813475	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S813545	S813545	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S813562	S813562	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S813601	S813601	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S813620	S813620	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S813676	S813676	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S814859	S814859	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S815176	S815176	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816304	S816304	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816305	S816305	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012

Original Container ID	PKG_ID	Salt Type	Waste Stream	Type	Code	Dataset Date
S816342	S816342	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816357	S816357	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816374	S816374	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816394	S816394	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816434	S816434	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S816440	S816440	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816469	S816469	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816664	S816664	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816667	S816667	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816692	S816692	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S816768	S816768	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S816773	S816773	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816810	S816810	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S816828	S816828	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816837	S816837	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S816890	S816890	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S816900	S816900	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S816915	S816915	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S818255	S818255	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S818354	S818354	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S818370	S818370	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S818382	S818382	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S818412	S818412	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S818435	S818435	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S818449	S818449	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S821203	S821203	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S822541	S822541	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S822542	S822542	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S822599	S822599	Nitrate	LA-CIN01.001-Cans	Original	36	7/31/2012
S822679	S822679	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S822713	S822713	Nitrate	LA-CIN01.001-Cans	Original	36	7/31/2012
S822838	S822838	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S822844	S822844	Nitrate	LA-CIN01.001-Cans	Original	36	7/31/2012
S822876	S822876	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S822952	S822952	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S823004	S823004	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S823016	S823016	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S823124	S823124	Nitrate	LA-CIN01.001-Cans	Original	36	7/31/2012
S823125	S823125	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012

Original Container ID	PKG_ID	Salt Type	Waste Stream	Type	Code	Dataset Date
S823126	S823126	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S823127	S823127	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S823153	S823153	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S823166	S823166	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S823184	S823184	Nitrate	LA-CIN01.001-Cans	Original	36	7/31/2012
S823187	S823187	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S823194	S823194	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S823221	S823221	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S823229	S823229	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S823276	S823276	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824184	S824184	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824187	S824187	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824188	S824188	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824208	S824208	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824468	S824468	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S824508	S824508	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824541	S824541	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824551	S824551	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824660	S824660	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S824967	S824967	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S825020	S825020	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S825021	S825021	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S825639	S825639	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S825664	S825664	Nitrate	LA-MHD01.001	Original	78	7/31/2012
S825730	S825730	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S825810	S825810	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S825878	S825878	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S825879	S825879	Nitrate	LA-CIN01.001-Cans	Original	36	7/31/2012
S825902	S825902	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832040	S832040	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832140	S832140	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832141	S832141	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832143	S832143	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832144	S832144	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832145	S832145	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832146	S832146	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S832147	S832147	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832148	S832148	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832149	S832149	Nitrate	LA-MHD01.001	Original	72	7/31/2012

Original Container ID	PKG_ID	Salt Type	Waste Stream	Type	Code	Dataset Date
S832150	S832150	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832155	S832155	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832156	S832156	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832241	S832241	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832320	S832320	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832340	S832340	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832448	S832448	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832464	S832464	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832499	S832499	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S833037	S833037	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S833261	S833261	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S833409	S833409	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S833481	S833481	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S833846	S833846	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S833937	S833937	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S834406	S834406	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S834539	S834539	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S834633	S834633	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S835283	S835283	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S835372	S835372	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S835376	S835376	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S841239	S841239	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S841240	S841240	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S841251	S841251	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S841292	S841292	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S841314	S841314	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S841320	S841320	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S841627	S841627	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S842181	S842181	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S842213	S842213	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S842234	S842234	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S842446	S842446	Suspect	LA-CIN01.001-Cans	Original	36	7/31/2012
S842463	S842463	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S842526	S842526	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S842528	S842528	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S843528	S843528	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S843593	S843593	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S843594	S843594	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S843672	S843672	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012

Original Container ID	PKG_ID	Salt Type	Waste Stream	Type	Code	Dataset Date
S843673	S843673	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S843962	S843962	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S844213	S844213	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S844215	S844215	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S844253	S844253	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S844573	S844573	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S844602	S844602	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S844684	S844684	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S844689	S844689	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S845031	S845031	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S845072	S845072	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S845104	S845104	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S845201	S845201	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846088	S846088	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846096	S846096	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846107	S846107	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846132	S846132	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S845338	S845338	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846037	S846037	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846055	S846055	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S846168	S846168	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846172	S846172	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846195	S846195	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S846660	S846660	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851415	S851415	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S851416	S851416	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S851418	S851418	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S851426	S851426	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851432	S851432	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851436	S851436	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851506	S851506	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851682	S851682	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851739	S851739	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851752	S851752	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851764	S851764	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851772	S851772	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S851852	S851852	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S852513	S852513	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S852530	S852530	Nitrate	LA-MHD01.001	Original	72	7/31/2012

Original Container ID	PKG_ID	Salt Type	Waste Stream	Type	Code	Dataset Date
S852588	S852588	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S852590	S852590	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S852592	S852592	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S852593	S852593	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S852883	S852883	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S852895	S852895	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S852923	S852923	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S852931	S852931	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S852952	S852952	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S853006	S853006	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S853279	S853279	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S853326	S853326	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S853482	S853482	Suspect	LA-CIN01.001-Cans	Original	57	7/31/2012
S853492	S853492	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S853641	S853641	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S853714	S853714	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S853771	S853771	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S853898	S853898	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S853899	S853899	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S854616	S854616	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S855126	S855126	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S855139	S855139	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S855216	S855216	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S855240	S855240	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S855290	S855290	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S855566	S855566	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S855677	S855677	Suspect	LA-CIN01.001-Cans	Original	72	7/31/2012
S855793	S855793	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S860014	S860014	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S860093	S860093	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S860095	S860095	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S860096	S860096	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S861975	S861975	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S861976	S861976	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S861980	S861980	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S861995	S861995	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S862241	S862241	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S862255	S862255	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S862411	S862411	Nitrate	LA-MHD01.001	Original	72	7/31/2012

Original Container ID	PKG_ID	Salt Type	Waste Stream	Type	Code	Dataset Date
S862888	S862888	Nitrate	LA-CIN01.001-Cans	Original	37	7/31/2012
S863696	S863696	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S863787	S863787	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S863788	S863788	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S863789	S863789	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S864213	S864213	Nitrate	LA-CIN01.001-Cans	Original	36	7/31/2012
S864662	S864662	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S864663	S864663	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S864694	S864694	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S870065	S870065	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S870213	S870213	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S870338	S870338	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S870381	S870381	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S870475	S870475	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S870478	S870478	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S871844	S871844	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S873554	S873554	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S881562	S881562	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S881563	S881563	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S881569	S881569	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S881570	S881570	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S881607	S881607	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S881608	S881608	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S883130	S883130	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S891279	S891279	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S891387	S891387	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S891513	S891513	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S892963	S892963	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S900215	S900215	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S901114	S901114	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S910170	S910170	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S910171	S910171	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S910172	S910172	Nitrate	LA-MHD01.001	Original	72	7/31/2012

Attachment 2

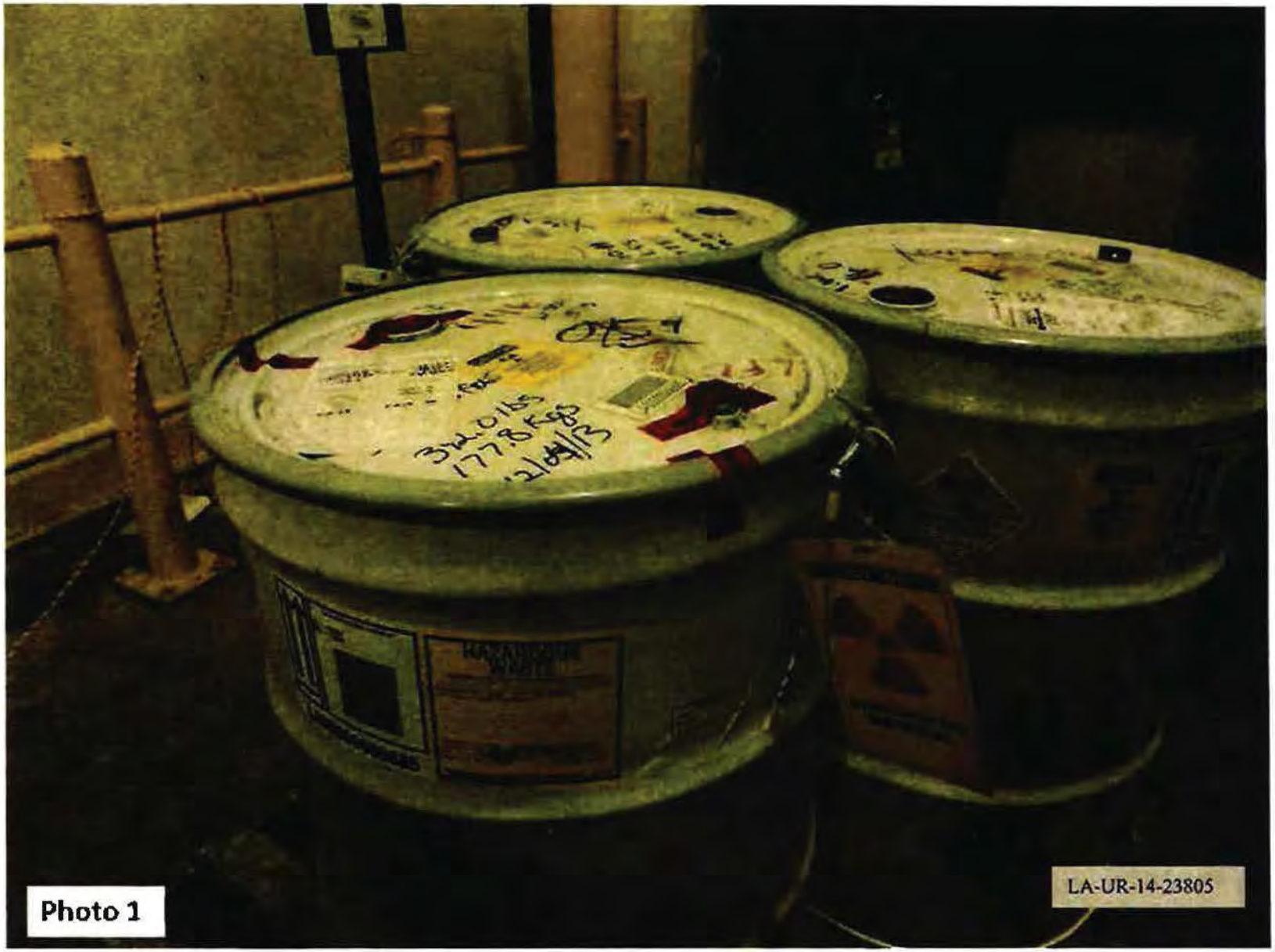

Photo 1
LA-UR-14-23805



Photo 2


Photo 3
LA-UR-14-23805

Attachment 3

Los Alamos NATIONAL LABORATORY Nuclear Material Control & Accountability Program **Functional Work Instruction**	**TID User Manual**	Operating Procedure Number: **NMCA-TID-FWI-002**
		Revision: 1
		Effective Date: 3/14/2014
		Review Date: 3/14/2016
	Preparer: Dana Sandoval	Date: 2/10/2014
	Team Leader: Carol Slaughter	Date: 2/24/2014
	Group Leader: Michael Kaufman	Date: 3/14/2014



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History of Revisions

Revision	Effective Date	Action	Pages Revised	Description
000	9/11/13	☒ New ☐ Major revision ☐ Minor revision ☐ Reviewed, no change		
1	2/11/14	☐ New ☐ Major revision ☒ Minor revision ☐ Reviewed, no change	5 7, 19, 59	Changed reference to DOE O 474.2. TID Inventory form change.

1.0 PURPOSE

This User Manual sets forth the characteristics and requirements of the Laboratory Tamper Indicating Device (TID) Program. A TID is a device, such as a seal, that is applied to a container, door or object. The TID indicates tampering or entry has occurred. This program has been designed to enhance the control and protection of special nuclear material (NM) held by Los Alamos National Laboratory (LANL). The TID program is intended to complement existing Nuclear Material Control and Accountability (MC&A) programs. TIDs alert knowledgeable personnel of unauthorized tampering with a container, door, or object to which a TID has been affixed. TIDs are only considered a reliable safeguard when they are used in conjunction with an effective material surveillance program.

LANL's policy is to comply with Department of Energy (DOE) manual requirements for use of TIDs consistent with the graded safeguards described in DOE O 474.2, "*Nuclear Material Control and Accountability*." TIDs are administered by the Material Control and Accountability Group (SAFE-4) Nuclear Material Control Team.

TID personnel must have adequate training before applying, removing, voiding, or verifying TIDs. TIDs are a benefit only if they have been properly applied to readily indicate when they have been compromised.

2.0 SCOPE

2.1 WHEN TIDS ARE USED

TIDs are used before an accountability measurement, when the special nuclear material (SNM) transferred between material balance areas (MBA) is 50 grams (fissile) or more, when transporting NM from one material access area (MAA) to another or for external transfers containing accountable quantities of SNM.

2.2 BENEFITS OF USING TIDS

TIDs are only a benefit if they have been properly applied or have an intrinsic seal so that it is easy to detect when a container has been compromised. Improperly applied TIDs negate the benefits they provide under the graded safeguards requirements.

LANL acknowledges the validity of TIDs on items and shipping containers applied by other sites in the DOE complex.

3.0 PROCEDURE

3.1 RESPONSIBILITIES

3.1.1 TID ADMINISTRATOR

SAFE-4, TID Administrator in the Security, Safeguards, and Emergency Response Division is responsible for the TID Program, written procedures, procurement, storage, oversight of the RoboCrib, oversight of LANL TID training, for the TID program and other TID related activities.

3.1.2 RESPONSIBLE LINE MANAGERS

- Request the establishment of a TID account.
- Appoint a TID custodian and one or more designated TID alternates by completing form MCA-F201 (see Attachment 4).
- Appoint TID users by completing form MCA-F202 (see Attachment 5).
- Appoint TID users to utilize RoboCrib by completing form MCA-F233 (see Attachment 20).
- Ensure the designated TID custodians, designated TID alternates and TID users attend all required TID training. Ensure, with the assistance of the TID custodian, the TID training for all group personnel is current.
- Ensure group compliance with the TID Program.

NOTE: TID custodians and alternates may be assigned as the TID custodian or alternate to ONLY one TID account. The TID custodian and alternate can be designated as a TID user in multiple accounts.

3.1.3 TID CUSTODIANS/ALTERNATES

- May perform custodial functions in only one account.
- TID custodians/alternates assigned to the specific account are the ONLY individuals to have access to the TID repository, and TID records.
- Request TIDs, as needed, from the TID Administrator.
- Provide locked repository for TIDs and associated records.
- Ensure TIDs are issued sequentially to designated TID users assigned to their account.
- Ensure appropriate type of TID is issued for the intended use.

- Ensure appropriate application/removal forms are correctly filled out. TID records must be maintained for all TIDs, both applied and removed from item.
- All forms and documentation associated with the TID program must be kept in a TID Log Book, which includes:
  - TID Access Record (MCA-F219, see Attachment 17)
  - TID Application Forms (see Attachments)
  - TID Removal Forms (see Attachments)
  - TID Inventory Form (MCA-F217, see Attachment 16)
  - Discrepancy File
  - TID Users List (MCA-F200, see Attachment 3 or MCA-F205, see Attachment 6)
  - Intrinsically Tamper Indicating Item Forms (MCA-F208, see Attachment 8)
  - TID User Manual
- Records are kept INDEFINITELY. The records can be taken to the TID Administrator for archiving. (see Change of Documentation Custody)
- Maintain TID documentation and training records of TID users.
- Conduct biannual TID inventories on un-used TIDs and document the results of the inventory on the TID Inventory Form (MCA-F217, see Attachment 16).
- Participate in annual TID audit by the TID Administrator.
- Serve as the verifier as needed when TIDs are applied or removed within their TID account.
- Ensures TID's are updated on the nuclear material accountability system database.

NOTE: TID custodians and alternates may be assigned as the TID custodian or alternate to ONLY one TID account. The TID custodian and alternate can be designated as a TID user in multiple accounts.

NOTE: TIDs MUST NOT be left unattended.

3.1.4 TID USERS

- Ensure appropriate type of TID is issued for the intended use and is applied correctly.
- Ensure TID training is completed.
- Serve as the TID applicator, remover, or verifier when applying or removing TIDs. TID users may be authorized to conduct TID-related activities in more than one account.
- Ensure proper application, removal, verification, voidance, destruction and/or disposal of TIDs.
- Have knowledge of container contents.
- Complete and sign appropriate forms and return to the TID custodian/alternate.
- After the application of a TID, ensure that the correct TID serial number is entered into the nuclear material accountability system database.

NOTE: If using RoboCrib, please see TID User Responsibilities for RoboCrib.

NOTE: TIDs MUST NOT be left unattended.

3.2 PERSONNEL AUTHORIZED TO APPLY, REMOVE, VERIFY, AND DISPOSE OF TIDS

- The TID custodian/alternate CANNOT apply or remove TIDs in the TID account in which they are designated as a TID custodian or alternate. The TID custodian and alternate can however, verify TID application or removal of a TID within their TID account.

  NOTE: A TID custodian or alternate that is designated as a TID user in another TID account may perform TID user functions (apply/remove/verify) within that TID account.

- Qualified TID users are authorized to perform the TID application/removal/verification function provided they are assigned to that designated TID account.
- The TID Administrator may be called out to apply/remove/verify TIDs in any TID account.

  NOTE: Two-person rule applies to all TID activities.

NOTE: If using RoboCrib, please see TID User Responsibilities for RoboCrib.

3.3 CHANGE OF TID RESPONSIBILITIES

3.2.1 CHANGE WITHIN THE TID ACCOUNT

When a change occurs within a TID Account, the following actions are required:

1. Form (MCA-F200 or MCA-F205) must be sent to the TID custodian by the TID Administrator.

   NOTE: MCA-F200, Verification of TID Account (see Attachment 3), is a form that contains signatures from the Responsible Line Manager (RLM), TID custodian, TID alternate, and MBA custodian, verifying the TID users in a specific TID account.

NOTE: MCA-F205 is a form sent to the TID custodian when any type of change has been made to their TID account.

2. The TID custodian must verify the TID users in their specific TID account.
3. When the TID users are verified, form MCA-F200 must be completed, signed, and sent to the TID Administrator.

3.2.2 REMOVING TID USERS WITHIN A TID ACCOUNT

When TID custodians/alternates/users request removal from a TID account, the following actions are required:

1. Form MCA-F207 must be completed, signed and sent to the TID Administrator.
2. A signed copy must be retained in the TID Log Book.
3. The TID Administrator must notify the TID custodian and TID user of the change.
4. The TID Administrator will send an updated form MCA-F205 to the TID custodian with the current listing of authorized personnel for the TID account.

3.2.3 CHANGE OF TID CUSTODIAN/ALTERNATE

When a change of TID custodian/alternate is required, the following actions are required:

1. The existing TID custodian notifies the TID Administrator.
2. The incoming TID custodian/alternate must be appointed by the RLM. Form MCA-F201 must be completed, signed and sent to the TID Administrator.
3. The incoming and outgoing TID custodian/alternate must perform a 100% inventory of all TID holdings within the TID account.
4. The TID repository combinations/keys MUST be changed.

NOTE: If the outgoing TID custodian will remain as the TID alternate, a change of lock combinations/keys is not required.

5. When the inventory and the change of the repository combination/keys are complete, both incoming and outgoing TID custodian/alternate must note the inventory on the TID Inventory Form (MCA-F217, see Attachment 16) and sign. The form MCA-F201 is sent to the TID Administrator.
6. Changes are considered effective upon receiving notification from the TID Administrator.
7. The TID Administrator must send an updated form MCA-F205 to the TID custodian with the current listing of the TID account.

NOTE: The designated TID custodian/alternate/user must be qualified. If the requested TID user is new to the TID Program he or she must take the initial TID training.

3.2.4 DESIGNATING A NEW TID USER

When a TID user is requested, the following actions are required:

1. The incoming TID user must be appointed by the RLM. Form MCA-F202 must be completed, signed and sent to the TID Administrator.

NOTE: The designated TID custodian/alternate/user must be qualified. If the requested TID user is new to the TID Program, he or she must take initial TID training.

2. Changes are considered effective upon receiving notification from the TID Administrator.

3.4 FREQUENCEY AND METHOD OF TID VERIFICATION

TIDs require verification in a number of instances and under a variety of conditions.

TIDs must always be verified in the following instances:

- immediately before and after TID application,
- prior to removing, breaking, or voiding a TID,
- prior to receiving a container into a MBA,
- prior to shipping a container from an MBA,
- when selected (randomly or otherwise) during a physical inventory,
- as required during any occurrence investigation, and
- when a TID discrepancy has been reported.

NOTE: Receiver is not required to accept a shipment if a TID discrepancy exists.

NOTE: The verifier MUST be familiar with the contents of the container.

NOTE: If using RoboCrib, please see RoboCrib Verification.

3.5 NUCLEAR MATERIAL ACCOUNTABILITY SYSTEM DATABASE

Following application of a TID, the TID custodian/alternate must ensure that the TID serial number is entered into the nuclear material accountability system database.

Following removal of a TID, the TID custodian/alternate must ensure that the TID serial number is removed from the nuclear material accountability system database.

NOTE: The TID custodian/alternate/user assigned to the specific TID account and who is a nuclear material accountability system user is authorized to update the TID field on the nuclear material accountability system.

NOTE: If using RoboCrib, please see the TID User Responsibilities for RoboCrib.

3.6 CONDITIONAL VARIANCES

A conditional variance is any deviation from TID program requirements and may be granted in special cases. All requests for such variances must be forwarded to the TID Administrator and must include documentation justifying the request. The TID Administrator reviews and forwards the request to the NM Control and Performance Assurance Team Leader and SAFE-4 Group Leader for final approval.

NOTE: All conditional variances must be evaluated by the TID Administrator, NM Control and Performance Assurance Team Leader, and SAFE-4 Group Leader to

ensure no other graded safeguards requirements are diminished in any way and in order to maintain compliance with DOE Orders. Each variance must have an expiration date and must be in effect only until that date, unless a formal extension is requested and granted, prior to the expiration.

3.7 STORAGE

TIDs are not classified, however they are strictly controlled. The TID Administrator distributes TIDs to TID custodians/alternates, who are responsible for locked containment of the TIDs until they are to be applied. An approved safe is not a requirement for TID storage but at a minimum, a locked repository with controlled key or combination access must be provided to ensure detection should malevolent entry occur.



NOTE: Access to the locked repository is limited to TID Custodians/Alternates ONLY.

NOTE: All TID logbook documentation must be maintained and controlled by the TID custodian/alternate. The TID Log Book is stored in the locked repository along with assigned TIDs.

The TID custodian/alternates must maintain the TID Access Record form (MCA-F219, see Attachment 17), recording all access to the locked repository.

3.8 ROBOCRIB

The RoboCrib program allows only assigned personnel to use the RoboCrib to dispense TIDs. The Request for RoboCrib TID User form (MCA-F233, see Attachment 20), must be completed and submitted to the TID Administrator prior to attending the TID RoboCrib Initial training. All TID users using RoboCrib MUST have access to the nuclear material accountability system before they are allowed to dispense TIDs from RoboCrib. The TID user must maintain an active red crypto card, which will allow them to conduct activity within the nuclear material accountability system. Once the TID user successfully completes the RoboCrib Initial training the TID Administrator will notify the TID users that approval to use the RoboCrib has been granted.



3.8.1 TID USER RESPONSIBILITIES FOR ROBOCRIB

TID users are responsible for:

- **TID Use:** ensure appropriate type of TID issued for the intended use and is applied correctly.

NOTE: TID users CANNOT return unused TIDs. All unused TIDs MUST be physically destroyed and voided from the nuclear material accountability system.

- **TID Training:** ensure that TID training, RoboCrib Initial training and LANMAS/LAMCAS user training is complete. RoboCrib will only issue TIDs to qualified TID users whom have completed all training requirements.
- **TID Application, Removal, or Verification:** serve as the TID applicator, remover, or verifier when applying or removing TIDs. TID users may be authorized to conduct TID-related activities within TA-55 ONLY.

NOTE: The user who dispenses the TID MUST be the applicator of the TID.

- **Proper Procedural Operations:** ensure proper application, removal, voidance, destruction and/or disposal of TIDs.

NOTE: TID MUST be applied or voided as soon as possible, within the same working day.

- **Container Contents:** have knowledge of container contents.

NOTE: All TIDs MUST be accounted for within the nuclear material accountability system.

- **Intrinsically Tamper Indicating Items:** Have physical characteristics that, upon visual inspection, will immediately indicate tampering and violation of their integrity. When these items are created, the TID user will be responsible for providing the TID Administrator with the Intrinsically Tamper Indicating Item Form (MCA-F208). On the form, the TID user is required to complete the LOT ID, MBA #, Date, SNM, MT, Description of Item, Storage Location, Application Signature, Verifier Signature and the Derivative Classifier review. When the INTR item is altered the TID user is responsible for entering the removal into the nuclear material accountability system.

NOTE: TID users MAY NOT use any type of gloves when dispensing TIDs.

3.8.2 ROBOCRIB ISSUANCE

TIDs can be issued from RoboCrib by scanning the TID users badge on the badge reader.

The z # will display and then the TID user can click on the "Login" button.



The TID user will need to click on the "Issue" button.



The TID user can select the type of TID (selected TID type will be highlighted). The TID user can click the "Issue" button.



Once this step has been completed the RoboCrib door will open and the TID user can retrieve the TID requested. Once the transaction is completed the login screen will display.



Transactions must be made one at a time.

NOTE: Multiple TIDs cannot be dispensed in a single transaction.

NOTE: TIDs must be applied or voided as soon as possible, within the same working day.

3.8.3 NUCLEAR MATERIAL ACCOUNTABILITY SYSTEM USING ROBOCRIB

After the application or removal of a TID, ensure that the correct TID serial number is entered into the system. The user who dispenses the TID is responsible for properly entering on the nuclear material accountability system.

NOTE: All TIDs MUST be accounted for in the nuclear material accountability system.

When a TID is being applied or removed to a container/material that is not on the nuclear material accountability system the transaction MUST be recorded. (i.e., applying/removing from pencil drops, empty containers, hoods, etc.)

When a TID has been voided the transaction MUST be recorded on the nuclear material accountability system as a void.

NOTE: A detailed description as to why the TID was voided MUST be entered.

If the TID user has a TID that has been dispensed from RoboCrib and is not being used, the TID user needs to physically destroy the TID and document it on the nuclear material accountability system as a "Void" with a detailed description as to why it was voided.

3.8.4 ROBOCRIB VERIFICATION

The TID Administrator will verify activities conducted through RoboCrib in conjunction with the nuclear material accountability system.

Verification of all activities will happen on a regular basis to ensure the TID users are entering the information accurately. If the TID users are not entering the nuclear material accountability system transactions accurately, further actions must be taken.

3.8.5 ROBOCRIB DISCREPANCY NOTIFICATION DOCUMENTATION

When a reportable TID discrepancy is discovered, the TID user is required to report the discrepancy to the RLM. Stop processing activities and segregate the discrepancy item.

The documentation of the investigation is forwarded to the TID Administrator.

If the TID discrepancy is not resolved within two hours from the time it was discovered then the TID user MUST notify the TID Administrator to initiate further investigation.

3.8 DISTRIBUTION

The TID Administrator distributes the TIDs to the TID custodian/alternates assigned to a specific TID account. The TID Administrator issues the TIDs to the TID account, the TID custodian/alternate verifies TID's that are being issued then signs the TID Administrator's TID Log Book.

It is the responsibility of the TID custodian/alternate to secure the TIDs in a locked repository and log the receipt of the SAFE-4 TIDs in the TID Log Book.

The TID custodian/alternate must complete the following steps when a TID user requests a TID:

1. The TID custodian/alternate must complete the TID Access Record Form (MCA-F219, see Attachment 17), indicating the date and time the repository is accessed.
2. The TID custodian/alternate must check the form (MCA-F200 or MCA-F205) to acknowledge the TID user and TID verifier are qualified and assigned to the specific TID account.
3. The TID custodian/alternate issues the appropriate type of TID in sequential order.
4. The TID user must sign the application form under the "Issued to" section next to the TID they are being issued. The TID verifier witnessing the issue must sign the "Issued Verifier" section. The TID custodian/alternate provides the TID user with the appropriate TID Application Form.
5. When the TID is applied and the application form is completed the TID user must return the form to the TID custodian/alternate.

NOTE: Once the TID user obtains the TID they must apply it, or maintain control of the un-used TID. If the TID is not applied it must be returned to the TID custodian/alternate.

NOTE: The TID Log Book must be kept in a locked repository along with the TIDs.

NOTE: TIDs may not be issued from one TID custodian's account to another TID custodian's account.

3.9 ABNORMAL EVENTS

If an abnormal event occurs during working hours please contact the TID Administrator.

If an abnormal event occurs outside normal working hours, the event must be documented and the TID Administrator must be notified the next business day. Unclassified documentation of the event must be provided to the TID Administrator via E-mail.

3.10 TID AUDITS

The TID Administrator audits the records and TID holdings of each TID custodian/alternate annually.

A schedule must be coordinated with the TID custodian/alternate and other affected personnel. Once a schedule is finalized, the TID Administrator provides the audit schedule to the TID custodian/alternate and the RLM.

The TID custodian will be audited on the following items:

- TID Access Record (MCA-F219),TID Application Forms (see Attachments),
- TID Removal Forms (see Attachments),
- TID Inventory Form (MCA-F217, see Attachment 16),
- Discrepancy File,
- TID Users List (MCA-F200, see Attachment 3 or MCA-F205, see Attachment 6),
- Intrinsically Tamper Indicating Item Forms (MCA-F208, see Attachment 8), and
- TID User Manual.

NOTE: A copy of 12 months of the above-listed TID records must be provided to the TID Administrator.

Upon completion of the TID audit, the TID administrator will send documentation to each RLM and TID custodian describing the results of the MC&A TID audit.

NOTE: If using RoboCrib, please see RoboCrib Verification.

3.11 TID INVENTORY

The TID custodian/alternate is required to conduct biannual TID inventories on un-used TIDs and document the results of the inventory on the TID Inventory Form (MCA-F217, see Attachment 16).

NOTE: TID records are kept INDEFINITELY.

3.12 TID GRAM

A TID GRAM (Attachment 1) is used by the TID Administrator to notify all TID custodian/alternates/users and RLMs that a change has been made to the TID Program. TID GRAMs also emphasize a requirement when a trend of deficiencies has been noted.

3.13 TID DISCREPANCIES

TID verification specifically requires an examination of each TID, sufficient to ensure that none of the TID discrepancies listed below exist:

- TID number discrepancy (i.e., missing, unreadable)
- Unauthorized TID
- Broken, damaged or deteriorating TID
- TIDs missing from TID custodian/alternate's inventory
- TIDs missing from NM containers
- Intrinsic discrepancies, such as prying, disassembling, or cutting the item to the point of violating its intrinsic characteristics
- Improperly applied TID
  - Mylar applied over tape or label
  - Mylar applied over old "voids"
  - Mylar applied less than 1 inch below lid
  - Mylar pulled too tightly and does not adhere to top of container
  - Mylar not applied on opposite sides of lid
  - Old "voids" not cleaned off container
  - Cup-Wire (Type E) Seal, Quickseals, and Multi-loks applied too loosely
  - Cup-Wire (Type E) Seal and Quickseals with no "figure eight"
  - Cup-Wire (Type E) Seal, Quickseals, and Multi-loks, where wire did not go through hole in bolt
  - Cup-Wire (Type E) Seal, where sleeve is not crimped properly

NOTE: If a discrepancy occurs, stop ALL processing activities for the item(s) in question, and segregate the item(s) in question, if possible.

The following actions are required:

1. Immediately notify a TID custodian/alternate and RLM. Stop processing activities and segregate the discrepancy item.

2. If the TID discrepancy cannot be resolved within two hours from the time of discovery, the TID custodian/alternate notifies the TID Administrator to initiate further investigative action.

3. A TID discrepancy requires the TID custodian/alternate to provide documentation of the incident to the TID Administrator detailing the incident, how it was resolved, and what steps will be taken to prevent future incidents.

4. The TID custodian/alternate must forward the documentation from the investigation and resolution of the TID discrepancy to the TID Administrator.

5. All TID discrepancies documentation must be maintained in the TID custodian/alternate records.

3.14 CONTAINER AND DEVICES

The TID user who applies TIDs to containers and devices must use the proper hardware (i.e., bolts, nuts, wire, copper collar, etc.) associated with TID application. This hardware is designed so that any unauthorized attempt to access the NM will compromise the TID.

To meet the requirements, a container must be constructed so that all means of access will violate the TID or the integrity of the container.

The following Table shows authorized containers on which TIDs can be applied:

Container Type	TID Type
Hagen Container	Multi-lok, Cup-Wire (Type E) Seal, Quickseal
5 gallon Metal Bolt-Ring Containers	Mylar
6M Shipping Drum	Multi-lok
DOT certified drums	Multi-lok, Cup-Wire (Type E) Seal, Quickseal
Pressure cooker	Multi-lok, Mylar
Solution bottles	Mylar
Doors	Mylar
Dressing jars	Mylar
Paint cans	Mylar
Glovebox doors	Mylar
Slip top containers	Mylar
Glass vials	Mylar
Nalgene bottles	Mylar
Waste drums	Multi-lok, Cup-Wire (Type E) Seal, Quickseal

3.14 TID RECORDS/ FILES

The TID custodian/alternate must maintain the following records/files in the TID repository. All required records/files are subject to audit by SAFE-4, DOE/Los Alamos Field Office and other auditing agencies.

The following forms must be in the TID Log Book:

- TID Access Record (MCA-F219),
- TID Application Forms (see Attachments),
- TID Removal Forms (see Attachments),
- TID Inventory Forms (MCA-F217, see Attachment 16),
- Discrepancy File,
- Current TID Users List (MCA-F200 or MCA-F205),
- Intrinsically Tamper Indicating Item Forms (MCA-F208, see Attachment 8), and
- TID User Manual.

NOTE: TID Log Book documentation is kept INDEFINITELY, access records are required to be kept for one year.

NOTE: The TID custodian/alternate must take old TID documentation to the TID Administrator for storage.

3.15 CHANGE OF DOCUMENTATION CUSTODY

When the TID logs books reach capacity the TID custodian/alternate can hand carry or mail their TID documentation to the TID Administrator.

The TID custodian/alternate must handle documentation according to LANL procedures. The TID custodian/alternate needs to pay particular attention to ensuring that OUO/UCNI/CLASSIFIED information is not included without being properly marked.

- If the documentation is sent through the mail, Change of Documentation Custody form (MCA-F231, see Attachment 19), must be included.
- If the documentation is hand carried, the TID Administrator will have the TID custodian/alternate sign the Change of Documentation Custody form (MCA-F231, see Attachment 19), acknowledging that they are relinquishing the custody of their documentation to the TID Administrator.

3.16 TID FORMS

All forms are located on the LANL homepage under- Security- Nuclear Materials- Tamper Indicating Devices- TID forms- Tamper Indicating Device (TID) Form.

3.17 TYPES OF TIDS

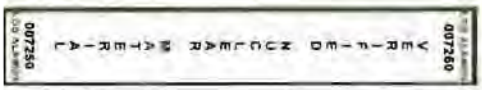
TIDs that are authorized in the LANL TID program are explained below and are documented in Attachment 2.

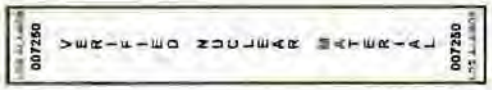
3.17.1 TIDS PREVIOUSLY USED

The following TIDs are still valid and are grandfathered into the TID program.

3.17.1.1 MYLAR

A Verified Nuclear Material TID contains a green border. This type of TID was applied to an item/container upon completion of a verification of accountability measurement.





A Confirmed Nuclear Material TID contains a yellow border. This type of TID was applied to an item/container upon completion of a confirmation measurement.



A Nonverified Nuclear Material TID contains a red border. This type of TID was applied to an item/container upon completion of a measurement that had been determined to be non-defensible or if an item/container had received no measurement.



A Mylar TID is a pressure-sensitive adhesive TID. It is 1 ¼ X 13" inches, made of Mylar and has tamper indicating qualities when lifted or removed. Pressure-sensitive adhesive TIDs are uniquely serialized, color coded, and have specific usages. Mylar TIDs are color coded blue and are applied prior to any measurement.



3.17.1.2 QUICKSEAL

The Quickseal is a plastic mechanism that clasps with a self cut wire. It contains a unique serial number.



3.17.2 TIDS CURRENTLY IN USE

3.17.2.1 CUP-WIRE (TYPE E) SEAL

The Cup-Wire (Type E) Seal TID is made of 1 inch diameter copper that consists of two halves, with the same unique serial number on both halves.



3.17.2.2 MYLAR

Mylar TIDs are pressure-sensitive and are physically the same size as the previously used TIDs. When removal or attempted removal/defeat occurs, the Mylar TID shows a clear "VOID/OPEN" security message but does not leave a residue on the surface of the container. They also contain a barcode for inventory and tracking purposes. These TIDs are also uniquely serialized and contain six numerical digits followed by the letter "L." These adhesive TIDs are red in color with the words "NUCLEAR MATERIAL" printed in black along the adhesive strip.



The QUARANTINE Mylar TIDs provides the same concept as the red Mylar TID shown above. These TIDs are to be applied by the MC&A team and cannot be removed. When removal or attempted removal/defeat occurs, the Mylar TID shows a clear "VOID/OPEN" security message but does not leave a residue on the surface of the container. They also contain a barcode for inventory and tracking purposes. These TIDs are also uniquely serialized and contain six numerical digits followed by the letter "Q." These adhesive TIDs are blue in color with the words "QUARANTINE DO NOT TAMPER CONTACT MC&A" printed in white along the adhesive strip.



3.17.2.3 MULTI-LOK

The Multi-lok TID has a free end of twisted-wire cable. The cable is passed through a hasp on the container and then inserted into a hole in a metal box. The box has spring loaded balls which allow the wire to pass by when initially inserted but bind with attempts to retract the wire. The metal box contains a unique identifier, but the wire does not.



3.18 INTRINSICALLY SEALED ITEMS

The LANL TID Program defines intrinsically sealed items as items that have physical characteristics that upon visual inspection will immediately indicate tampering and violation of their integrity. The types of items that are considered to be intrinsically tamper indicating are:

- special form radioactive material, defined by 49 CFR,
- sealed sources, defined by Procedure (P)121, *Radiation Protection*,
- fuel elements/fuel rods,
- welded containers (e.g. 3013 container),
- weapon assemblies/subassemblies/artillery shells, and
- other sealed sources not defined by P121 (e.g. PuBe, AmBe).

3.18.1 DETERMINATION OF AN INTRINSICALLY SEALED ITEM

When an item is being considered for the determination "intrinsically sealed," the TID custodian/alternate/user will complete the Intrinsically Tamper Indicating Item Form (MCA-F208, see Attachment 8) and submit it to the TID Administrator. The TID Administrator or SAFE-4 Representative must visually inspect the item before making a determination. Once the item is determined to be intrinsically sealed, an "INTR####" will be assigned to the item on the nuclear material accountability system to identify the item as being intrinsically sealed.

If an intrinsically sealed item is altered (removed from a welded container, disassembled, and/or processed), the TID custodian/alternate/user must remove the INTR identifier from the seal field in the nuclear material accountability system.

NOTE: If using RoboCrib, please see the TID User Responsibilities for RoboCrib.

3.18.2 CONTAINERIZATION OF INTRINSICALLY SEALED ITEMS

Items identified as intrinsically sealed must be packaged in an outside container (if applicable), and can be containerized on the nuclear material accountability system with the approval of the TID Administrator. The outside packaging can have a conventional TID placed on it. Because intrinsically sealed items get the same safeguards credit as other items marked with conventional TIDs, this designation will aid SAFE-4 in selecting items to be inventoried during the physical inventories.



3.18.3 INTR FORM PROCEDURES

To submit an item to the TID Administrator for approval, the TID custodian/alternate/user must complete the portion indicated "To be filled out by TID custodian/alternate/user" on the Intrinsically Tamper Indicating Item Form (MCA-F208, see Attachment 8).

NOTE: The INTR form (MCA-F208) MUST be reviewed by a Derivative Classifier before it is submitted to the TID Administrator.

The TID custodian/alternate/user must complete the following sections of the form:

1. LOT ID -- Document the nuclear material accountability system LOTID
2. MBA #- The MBA/account where the item is currently located.
3. Date- The date of which the Intrinsically Tamper Indicating form is being completed.
4. SNM- Enter the element weight of the item.
5. Material Type (MT)- The item's material type(s)
6. Description of Item- Physical description of the item, what type of item it is (e.g., PuBe source, Rocky Flats pit, etc.), any other pertinent information that will aid in intrinsic determination.

7. Storage Location- Tech Area, building number, room and/or cabinet identifier.
8. TID Custodian/Alternate signature (if applicable)- The custodian/alternate requesting the designation or responsible for the item.
9. Applicator (signature) - The TID user that welded the item.
10. Verifier (signature) - The TID user that verified the weld.

When the TID custodian/alternate/user has completed the form (MCA-F208, see Attachment 8), the form must be sent to the TID Administrator for approval.

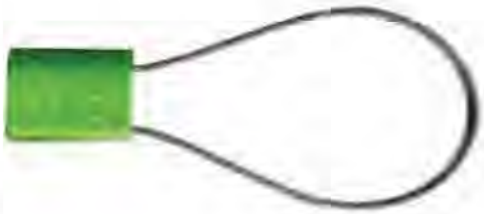
When the TID Administrator receives the Intrinsically Tamper Indicating Item form (MCA-F208, see Attachment 8), the TID Administrator or the SAFE-4 Representative shall contact the TID custodian/alternate/user to set up a time for the evaluation.

Once the item is approved the item will be assigned an "INTR####" by the TID Administrator.

If there are any questionable items that indicate INTR, the responsible TID custodian/alternate/user will be contacted to have the item investigated and/or validated.

3.19 NON-LANL TIDS

Items shipped from another facility with a Non-LANL TID are considered part of the LANL TID Program. Upon receiving the item, the receiving group must inspect the container and TID to verify that the container is sealed properly, to ensure the TID is not broken, damaged, or improperly applied, and to make sure the TID number corresponds to that provided by the shipper. The TID user must log the removal of the Non-LANL TID on the Non-LANL TID Removal Form (MCA-F220, see Attachment 18) and the TID verifier must verify the removal and destruction of the TID.



3.20 PROCEDURES FOR APPLICATION OF TIDS

3.20.1 CUP-WIRE (TYPE E) SEAL

When the Cup-Wire (Type E) Seal TID is attached to an object, it must be done in a manner that requires breaking the wire or destroying the TID to open the object.

Obtain the following equipment and material:

- Cup-Wire (Type E) Seal (top and bottom)
- Braided wire
- Crush-type sleeves/collars
- Pliers or a pair of wire cutters capable of crimping collars

NOTE: An authorized TID applicator and a TID verifier must be present when TIDs are applied.

The TID verifier must witness the application of the TID, verifying the following procedure has been followed by the TID applicator:

1. Verify that serial number of the TID bottom and top cups are identical.
2. Find a strategic location on the container where you will apply the TID. The location must ensure that the container cannot be opened without destroying the TID's integrity.
3. Estimate the length of wire needed and cut that amount from the roll. (Exact length will depend on the container).
4. Run the wire ends through the fixture and bring the ends together equally. For drums, insert wire through the hole in the bolt, into the gap in the split lug of the ring, and across one half of the lug (see photo). Remove any slack in the wire by pulling it "finger-tight." Then pull the end of the wire around the half lug, through the gap, and around the other half lug in a "figure-8."



5. Slip the TID bottom cup down the wire until it is in position near the fixture.
6. Thread the wire ends through the crimping sleeve.



7. Slide the crimping sleeve along the wire until it is in position near the TID bottom cup.
8. Use the pliers to crimp the sleeve firmly on the wire.



9. Trim the wire ends, leaving approximately ½ inch beyond the crimped sleeve end.
10. Loop the remaining ends of the wire into the inner cup area, then pull on the cup while pushing the wire and sleeve into the inner cup, ensuring that there will be no interference with closure of the TID.
11. Place the top cup over the bottom cup and apply firm pressure with fingers around the rim of the bottom cup to ensure full closure.



12. Tug on the applied cup seal to ensure that it has been applied correctly.
13. Inspect the Cup-Wire (Type E) Seal.

NOTE: If the wire was damaged during application or full closure was not achieved, cut the wire, remove the TID, and apply another Cup-Wire (Type E) Seal. The Cup-Wire (Type E) Seal that was removed must be voided and rendered unusable, and must be noted on the Cup-Wire (Type E) Seal TID Removal Form (MCA-F216, see Attachment 15) and removed from the nuclear material accountability system database.

14. The TID verifier must inspect the TID for proper application.
15. The TID applicator/verifier must complete the Cup-Wire (Type E) Seal TID Application Form (MCA-F212, see Attachment 11) and return the form to the TID custodian/alternate.

NOTE: Following application of a TID, the TID custodian/alternate must ensure the TID serial number is entered into the nuclear material accountability system database.

3.20.2 MYLAR

The Mylar TID consists of an adhesive strip that, when applied, acts as a seal on the item/container. It is applied in a manner that requires destroying the TID in order to open the object.

Obtain the following equipment and material:

- Mylar TID
- Scissors (if needed)

NOTE: An authorized TID applicator and a TID verifier must be present when TIDs are applied.

The TID verifier must witness the application of the TID, verifying the following procedure has been followed by the TID applicator:

NOTE: The container MUST be cleaned from any previous void markings before application.

1. Find a strategic location on the container where you will apply the TID. The location must ensure the container cannot be opened without destroying the TID's integrity.
2. Cut a Mylar TID in half for a large container if necessary. The Mylar TID must be located on the container so that it goes at least 1 inch down on each side and 1 inch across the top.

NOTE: If there is tape securing the container, be advised the Mylar TID must fit 1 inch below the tape down each side and 1 inch across the top.



3. If a Mylar TID is cut to fit on a large container, the ends must be placed on opposite sides of the container top from each other.
4. Inspect the Mylar TID.

NOTE: If the Mylar was damaged during application, remove the Mylar, and apply another Mylar. The Mylar that was removed must be voided and rendered un-usable, and must be noted in the Mylar TID Removal Form (MCA-F213, see Attachment 12) and removed from the nuclear material accountability system database.

5. The TID verifier must inspect the Mylar TID for proper application.
6. The TID applicator/verifier must complete the Mylar TID Application Form (MCA-F209, see Attachment 9) and return the form to the TID custodian/alternate.

NOTE: Following application of a TID, the TID custodian/alternate must ensure that the TID serial number is entered into the nuclear material accountability system database.

3.20.3 MULTI-LOK

The Multi-lok TID is a metal TID made of 1-inch clasps, a wire and a unique serial number. When the wire is inserted into the 1-inch clasp, it tightly secures the mechanism. The wire is sealed in a manner that requires breaking the wire or destroying the TID to open the object.

Obtain the following equipment and material:

- Multi-lok TID

NOTE: An authorized TID applicator and a TID verifier must be present when TIDs are applied. The TID verifier must witness the application of the TID, verifying the following procedure has been followed by the TID applicator.

1. Find a strategic location on the container where you will apply the TID. The location must ensure that the container cannot be opened without destroying the TID's integrity.
2. Run the loose wire end through the fixture on the container.
3. Insert the loose end of the wire into the clasp and pull the wire through the clasp to tighten.



NOTE: For drums, insert the wire through the hole in the bolt, into the gap in the split lug of the ring, and across one half of the lug, and then insert it into the clasp.

4. Tug on the Multi-lok to ensure that it has been applied accurately.



5. Inspect the TID and wire.

NOTE: If the Multi-lok was damaged during application or full closure was not achieved, remove the Multi-lok, and apply another Multi-lok. The Multi-lok that was removed must be voided and rendered unusable, and must be noted in the Multi-lok TID Removal Form (MCA-F214, see Attachment 13) and removed from the nuclear material accountability system database.

6. The TID verifier must inspect the TID for proper application.

7. The TID applicator/verifier must complete the Multi-lok TID Application Form (MCA-F210, see Attachment 10) and return the form to the TID custodian/alternate.

NOTE: Following application of a TID, the TID custodian/alternate must ensure that the TID serial number is entered into the nuclear material accountability system database.

3.21 PROCEDURES FOR REMOVAL, VOIDING AND DISPOSAL OF TIDS

3.21.1 CUP-WIRE (TYPE E) SEAL

When removing, voiding, and destroying a TID, the two-person rule applies. The TID user must destroy the TID and the TID verifier must verify the destruction. The Cup-Wire (Type E) Seal TID Removal Form (MCA-F216, see Attachment 15) must be completed and marked as a void.

NOTE: An authorized TID user and a TID verifier must be present when TIDs are removed from NM containers.

Before a previously-applied Cup-Wire (Type E) Seal is removed, an authorized TID verifier inspects it as follows:

1. Verify that the serial number of the TID bottom and top cups are identical.

2. Verify the TID is not broken, damaged, or improperly applied.

3. Verify the TID serial number corresponds to the serial number recorded on the latest nuclear material accountability system listing, shipper back-up papers, or container label.

4. If the inspection fails to verify (1.) or (2.) above, the TID user notifies the TID custodian/alternate. The TID custodian/alternate immediately investigates and resolves the TID discrepancy. TID discrepancies that cannot be resolved within two hours require immediate notification of the TID Administrator.

Once the above four items are resolved, continue with the following:

5. Cut the wire at least two inches away from the TID (if possible) and remove the TID and wire from the container.

6. The TID verifier examines the TID to verify that both halves have the same serial number and that there is no evidence of tampering. If the numbers do not match or there is evidence of tampering, the TID user notifies the TID custodian/alternate. The TID custodian/alternate immediately investigates and resolves the TID discrepancy. TID discrepancies that cannot be resolved within two hours require immediate notification of the TID Administrator.



7. If everything is in order, the TID remover destroys the TID by poking holes in it and disposes of it as unclassified waste.



8. The TID remover and TID verifier complete and sign the Cup-Wire (Type E) Seal TID Removal Form (MCA-F216, see Attachment 15), and return the form to the TID custodian/alternate.

NOTE: Following the removal of a TID, the TID custodian/alternate ensures that the TID serial number is removed from the nuclear material accountability system database.

3.21.2 MYLAR

When removing, voiding, and destroying a TID, the two-person rule applies. The TID user must destroy the TID and the TID verifier must verify the destruction. The Mylar TID Removal Form (MCA-F213, see Attachment 12) must be completed and marked as a void.

NOTE: An authorized TID user and a TID verifier must be present when TIDs are removed from NM containers.

Before a previously applied Mylar TID is removed, an authorized TID verifier inspects it as follows:

1. Verify that the TID is not broken, damaged, or improperly applied.

2. Verify that the TID serial number corresponds to the serial number recorded on the latest nuclear material accountability system listing, shipper back-up papers, or container label.

3. If the inspection fails to verify (1.) or (2.) above, the TID user notifies the TID custodian/alternate. The TID custodian/alternate immediately

investigates and resolves the TID discrepancy. TID discrepancies that cannot be resolved within two hours require immediate notification of the TID Administrator.

Once the above three items are resolved, continue with the following:

4. The TID verifier examines the TID to verify that both halves have the same serial number and that there is no evidence of tampering. If the numbers do not match or there is evidence of tampering, the TID user notifies the TID custodian/alternate. The TID custodian/alternate must immediately investigate and resolve the TID discrepancy. TID discrepancies that cannot be resolved within two hours require immediate notification of the TID Administrator.



5. If the inspection verifies the integrity of the TID, it must be removed by peeling the Mylar from the container ("VOID" markings will appear).

NOTE: The Mylar TIDs that are currently being used does not leave a residue on the surface of the container.

6. To clean the "VOID" markings, use an approved solvent or eraser, or scrape them.

7. If everything is in order, the TID remover ensures that all removed/voided TIDs are rendered unsuitable for reuse by cutting them in small pieces and disposing them as unclassified waste or by shredding them in a paper shredder.

8. The designated TID remover and TID verifier complete and sign the Mylar TID Removal Form (MCA-F213, see Attachment 12), and return the form to the TID custodian/alternate.



NOTE: Following the removal of a TID, the TID custodian/alternate ensures that the TID serial number is removed from the nuclear material accountability system database.

3.21.3 MULTI-LOK

When removing, voiding, and destroying a TID, the two-person rule applies. The TID user must destroy the TID and the TID verifier must verify the destruction. The Multi-lok TID Removal Form (MCA-F214, see Attachment 13) must be completed and marked as a void.

NOTE: An authorized TID user and a TID verifier must be present when TIDs are removed from NM containers.

Before a previously-applied Multi-lok TID is removed, an authorized TID verifier inspects it as follows:

1. Verify that the TID is not broken, damaged, or improperly applied.
2. Verify that the TID serial number corresponds to the serial number recorded on the latest nuclear material accountability system listing, shipper back-up papers, or container label.
3. Verify that there is no evidence of tampering.
4. If the inspection fails to verify (1.), (2.), or (3.) above, the TID user notifies the TID custodian/alternate. The TID custodian/alternate immediately investigates and resolves the TID discrepancy. TID discrepancies that cannot be resolved within two hours require immediate notification of the TID Administrator.

Once the above four items are resolved, continue with the following:

5. Cut the wire at the base of the loop away from the TID (if possible) and remove the TID from the container.



6. If everything is in order, the TID remover renders the TID unsuitable for reuse by cutting the wire and disposes of it as unclassified waste.



7. The designated TID remover and TID verifier complete and sign the Multi-lok TID Removal Form (MCA-F214, see Attachment 13), and return the form to the TID custodian/alternate.

NOTE: Following the removal of a TID, the TID custodian/alternate ensures that the TID serial number is removed from the nuclear material accountability system database.

3.21.4 QUICKSEAL

Quickseal's have been phased out of the LANL TID Program and are no longer issued to TID accounts. However, they may still be on containers from previous applications. When removing, voiding or disposing of a TID,

the two-person rule applies. The TID user must destroy the TID and the TID verifier must verify the destruction. The Quickseal TID Removal Form (MCA-F215, see Attachment 14) must be completed and marked as a void.

NOTE: An authorized TID user and a TID verifier must be present when TIDs are removed from nuclear material containers.

Before a previously-applied Quickseal TID is removed, an authorized TID verifier inspects it as follows:

1. Verify that the TID is not broken, damaged, or improperly applied.
2. Verify that the TID serial number corresponds to the serial number recorded on the latest nuclear material accountability system listing, shipper back-up papers, or container label, whichever is appropriate.
3. Verify that there is no evidence of tampering.
4. If the inspection fails to verify (1.), (2.), or (3.) above, the TID user notifies the TID custodian/alternate. The TID custodian/alternate immediately investigates and resolves the TID discrepancy. TID discrepancies that cannot be resolved within two hours require immediate notification of the TID Administrator.

Once the above four items are resolved, continue with the following:

5. Cut the Quickseal on the loop, and remove the TID and wire from the container.



6. Destroy the Quickseal by slicing the numbers with pliers.



7. If everything is in order, the TID remover renders the TID unsuitable for reuse and disposes of it as unclassified waste.



8. The designated TID remover and TID verifier complete and sign the Quickseal TID Removal Form (MCA-F215, see Attachment 14), and return the form to the TID custodian/alternate.

NOTE: Following the removal of a TID, the TID custodian/alternate must ensure that the TID serial number is removed from the nuclear material accountability system database.

4.0 TRAINING

The level of training on this functional work instruction is determined by training analysis in accordance with P781-1, Conduct of Training Manual and recorded on the document action request form (DAR).

The TID Training Program is provided to ensure that TID custodians/alternates/ users are trained in regards to the TID program.

4.1 INITIAL TRAINING

Authorized personnel must attend an initial training and demonstrate proficiency in applying the information provided for TIDs.

4.2 RE-QUALIFICATION TRAINING

TID custodians/alternates/users are required to complete re-qualification training every two years to retain their work assignments for the TID Program.

4.3 ROBOCRIB INITIAL TRAINING

TID users identified to use RoboCrib must attend an initial training and demonstrate proficiency in distributing TIDs.

5.0 DEFINITIONS AND ACRONYMS

5.1 DEFINITIONS

See LANL Definition of Terms or the Security Policy Resource.

Application Form: Forms required for documenting the application of TIDs. (MCA-F209, MCA-F210, MCA-F211, MCA-F212)

Controlled Conditions: Storage conditions that prevent access to controlled documents and TIDs by unauthorized individuals.

Deface: The act of altering the physical appearance of a TID so that re-use and acceptance as a valid TID is precluded.

Intrinsically Sealed: Items that have physical characteristics that visually indicate an attempt to remove material.

Knowledgeable Personnel: Persons familiar with the operational and nuclear materials activities being performed, who must be trained and qualified to the TID Program.

Locked Repository: A toolbox with a combination or key lock, a locked cabinet, or a locked safe.

MC&A: Material Control & Accountability

Nuclear Material Accountability System: The material accountability safeguards system is the hub of LANL's NM graded safeguards program. It is an essential element in detecting, verifying, and evaluating gains or losses in the Laboratory's

NM inventory. NM accounting and report generation are performed using the nuclear material accountability system.

Removal Forms: Forms required for documenting the removal, or voiding of TIDs. (MCA-F213, MCA-F214, MCA-F215, MCA-F216)

Responsible Line Manager (RLM): An individual with management responsibility for a TID account.

RoboCrib: A machine that dispenses TIDs to qualified TID users.

Tamper Indicating Device (TID): A device that may be used on items such as containers and doors, which because of its uniqueness in design or structure, reveals violations of containment integrity (devices that indicate, upon inspection, whether tampering or entry has occurred).

TID Administrator: SAFE-4 staff member assigned the responsibility for procuring, controlling, distributing, inventorying, and destroying TIDs.

TID Custodian/Alternate: Authorized individual who maintains and issues TIDs to authorized TID users assigned to the specific TID account.

TID Discrepancy: Any condition that is a deviation from the normal control or use of TIDs.

TID GRAM: Documentation issued from the TID Administrator to TID custodians/alternate/users and RLMs, informing them of any changes in the TID program and also used to pass along useful information.

TID Inventory Form: Used by TID custodians/alternates when TIDs are received from the TID Administrator or are being inventoried. (MCA-F217, see Attachment 17)

TID Log Book: A binder or folder that contains TID information maintained by the TID custodian/alternate.

TID User: Qualified individual who can apply/remove/verify TIDs in an assigned TID account. The TID user must have knowledge of container content.

5.2 ACRONYMS

See LANL Acronym Master List or the Security Policy Resource

Acronym	Definition
DOE	Department of Energy
INTR	Intrinsically Sealed
LANL	Los Alamos National Laboratory
MAA	Material Access Area
MBA	Material Balance Area
MC&A	Material Control and Accountability
MT	Material Type
NM	Nuclear Material
P	Procedure
RLM	Responsible Line Manager
SNM	Special Nuclear Material
TID	Tamper Indicating Device

6.0 REFERENCES

1. DOEO 474.2 Chg 2, Attachment 1 CRD, *Nuclear Material Control and Accountability*LANL Nuclear Material Control & Accountability (MC&A) Plan
2. 49 CFR
3. P121, *Radiation Protection*

7.0 ATTACHMENTS

Attachment 1- TID GRAM (sample)

SAMPLE



TID GRAM

May, 2010
TID GRAM #19

Subject: Change of TID Custodian/Alternate Responsibilities

There has been a change to the TID custodian/alternate responsibilities. TID custodians and alternates can no longer apply or remove TIDs in the TID account in which they are designated as a TID custodian or alternate. The TID custodian and alternate can however, verify TID application or removal in their TID account.

A TID custodian or alternate that is designated as a TID user in another TID account may perform TID user functions (apply/remove/verify) in that account.

An initial TID user course will be held on May 19th. To designate other TID users please, fill out the TID user form and sign up on the following link:

http://www.hr.lanl.gov/tiocourses/coursesearch.aspx?CourseNo=7273&scope=here&category_path=%252FOrganization%2523Operations%252FTraining%2523Education

Dana Sandoval
SAFE-4 Material Control & Accountability
Los Alamos National Laboratory
Phone: 5-3108
Email: danam@lanl.gov

UNCLASSIFIED

Authorized LANL TIDs

Nuclear Material Multi-lok



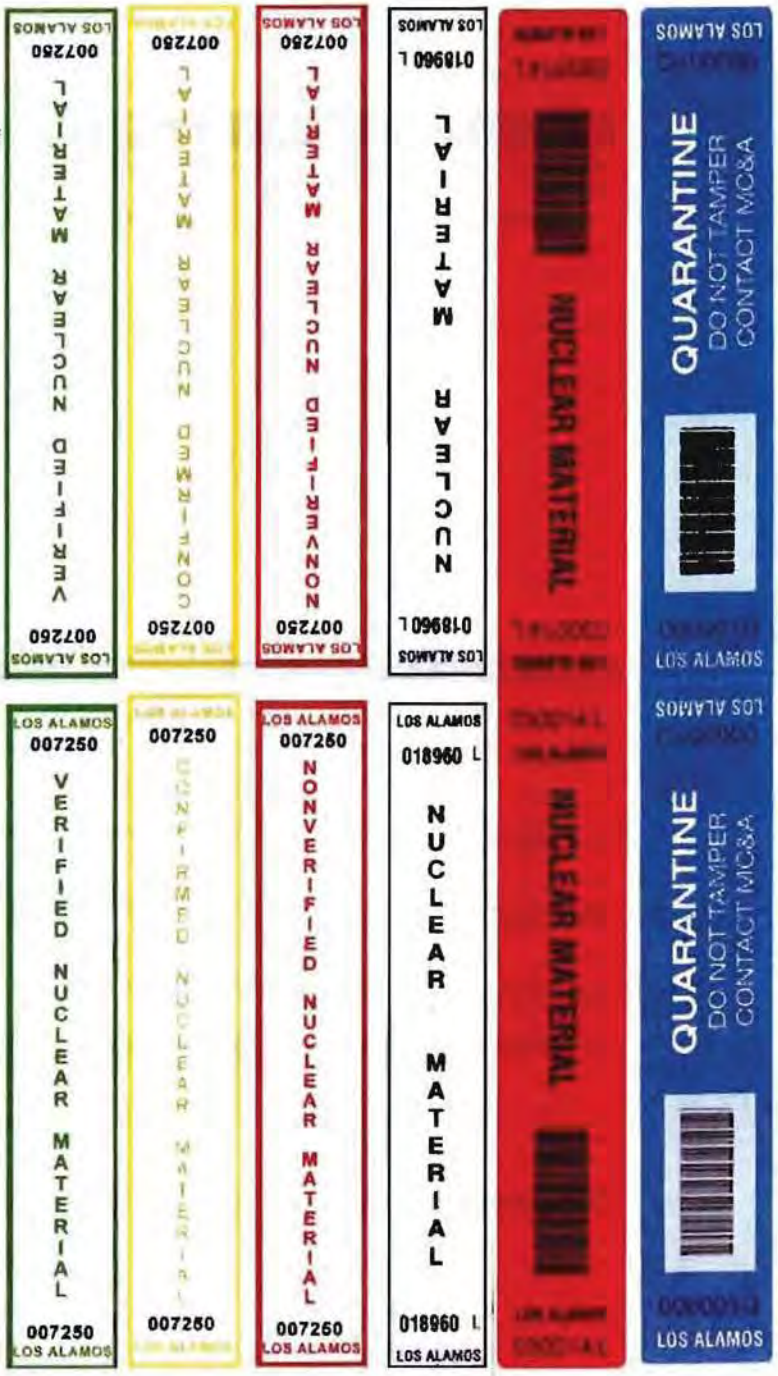
Nuclear Material Quickseal



Nuclear Material Cup-Wire (Type E) Seal



Nuclear Material Mylar



Los Alamos NATIONAL LABORATORY EST. 1943

Verification of TID Account

Date _____ TID Account # _____

TID Custodian _____

Please verify the following personnel are on your TID account

Account #	Z#	First Name	Last Name	Group	TID	Expiration Date

Signatures

_____
TID Custodian *Date*

_____
TID Alternate Custodian *Date*

_____
MBA Custodian *Date*

_____
Responsible Line Manager *Date*

WHEN FORM IS COMPLETED AND SIGNED, MAIL ORIGINAL TO: TID ADMINISTRATOR, MS-G735, SAFE-4
*****A copy must be kept in the TID Log Book for the TID Account*****

NMControl Form MCA-F200 January 22, 2009

Los Alamos NATIONAL LABORATORY EST 1943

Change of TID Custodian/Alternate

Date _____ TID Account # _____

Group _____

Existing TID Custodian _____ Z# _____

New TID Custodian / Alternate _____ Z# _____

Outgoing TID Custodian / Alternate _____ Z# _____

INCOMING AND OUTGOING TID CUSTODIANS/ALTERNATES MUST PERFORM A 100% INVENTORY OF THE UNUSED TID HOLDING

Has a 100% inventory been completed?	☐ Yes	☐ No
Have all TID's been accounted for?	☐ Yes	☐ No
Has the combinations/lock on the repository been changed?	☐ Yes	☐ No

Signatures

_____
Existing TID Custodian *Date*

_____
New TID Custodian / Alternate *Date*

_____
Outgoing TID Custodian / Alternate *Date*

_____
Responsible Line Manager *Date*

_____
TID Administrator *Date*

WHEN FORM IS COMPLETED AND SIGNED, MAIL TO: TID ADMINISTRATOR, MS-G735, SAFE-4

NMControl Form MCA-F201 May 17, 2010 _____

Los Alamos NATIONAL LABORATORY EST. 1943

Request for New TID User

Date _____

Group _____

TID Custodian (Print Name) _____ Z# _____

_____

TID Custodian Signature *Date*

Responsible Line Manager (Print Name) _____ Z# _____

_____

Responsible Line Manager Signature *Date*

New TID User (Print Name) _____ Z# _____

TID Account User will be assigned to _____

_____

New TID User Signature *Date*

WHEN FORM IS COMPLETED AND SIGNED, MAIL TO: TID ADMINISTRATOR, MS-G735, SAFE-4

NMControl Form MCA-F202 May 17, 2010

Los Alamos NATIONAL LABORATORY EST. 1943

TID Account

Date _____ TID Account # _____

TID Custodian _____

The following personnel are assigned to your TID account

Z#	First Name	Last Name	Group	TID	Training Expiration

A copy must be kept in the TID Log Book for the TID Account

Los Alamos NATIONAL LABORATORY EST 1943

TID User Removal Request

Date _____

Group _____

TID Custodian (Print Name) _____ Z# _____

TID Custodian Signature *Date*

Responsible Line Manager (Print Name) _____ Z# _____

Responsible Line Manager Signature *Date*

Remove TID User (Print Name) _____ Z# _____

TID Account User will be removed from account _____

Will the TID User be assigned to a TID account?

☐ Yes (TID user must complete form MCA-F202)

☐ No (TID user will be removed from the TID program)

To remain on the TID program you must be assigned to a specific TID account.

TID User Removal Signature *Date*

WHEN FORM IS COMPLETED AND SIGNED, MAIL TO: TID ADMINISTRATOR, MS-G736, SAFE-4

NMControl Form MCA-F207 May 17, 2010

Los Alamos NATIONAL LABORATORY

Intrinsically Tamper Indicating Item Form

LANMAS Entry

Date _____ LANMAS Transaction # _____ INTR ID _____

To be filled out by TID Custodian/Alternate/User

LOT ID _____ MBA # _____ Date _____

SNM _____ MT _____

Description of Item _____

Storage Location (TA, Bldg, Room, Safe and/or Cabinet Identifier) _____

Signatures

TID Custodian/ Alternate Signature (if applicable) *Z number* *Date*

Applicator Signature *Z number* *Date*

Verifier Signature *Z number* *Date*

Derivative Classifier

☐ Unclassified ☐ Confidential ☐ Secret ☐ Official Use Only	☐ Restricted Data ☐ Formerly Restricted Data ☐ National Security Information	☐ Unclassified Controlled Nuclear Information Not for Public Dissemination Unauthorized dissemination subject to civil and criminal Sanctions under section 148 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2168). Guidance Used: _____

DC Print Name/Z#:	Organization:	Signature:	Date:

SAFE-4 Evaluation (To be filled out by TID Administrator or SAFE-4 Representative)

Evaluation and Comment _____

Approved ☐ Yes ☐ No (If no, explain in comment section reason for rejection)

Signatures

TID Administrator or SAFE-4 Representative Signature *Z number* *Date*

MCA-F208 Rev. 0 March 2013

Attachment 9- MCA-F209 – Mylar TID Application Form

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MYLAR TID Application Form

TID Account #_____

TID NUMBER	LOT ID	LOCATION	SIGNATURE	Z #	GROUP	DATE	TRANS.# MASS UPDATE
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				

UNCLASSIFIED

May 14, 2010

NMControl Form MCA-F209

UNCLASSIFIED

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MULTI-LOK TID Application Form

TID Account #_____

TID NUMBER	LOT ID	LOCATION	SIGNATURE	Z #	GROUP	DATE	TRANS# MASS UPDATE
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				

UNCLASSIFIED

NMControl Form MCA-F210 May 14, 2010

UNCLASSIFIED

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Cup-Wire (Type E) Seal TID Application Form

TID Account #_____

TID NUMBER	LOT ID	LOCATION	1. APPLICATOR SIGNATURE 2. VERIFIER SIGNATURE	Z #	GROUP	DATE	TRANS.# MASS UPDATE
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				
			Issued to				N/A
			Issued Verifier				
			Applicator				
			Verifier				

UNCLASSIFIED

May 14, 2010

NMControl Form MCA-F212

Attachment 12- MCA-F213 – Mylar TID Removal Form

UNCLASSIFIED

Los Alamos NATIONAL LABORATORY EST 1943

MYLAR TID Removal Form

TID Account #_____

TID NUMBER	LOT ID	REMOVE (R) VOID (V)	LOCATION	1. REMOVER SIGNATURE 2. VERIFIER SIGNATURE	Z #	GROUP	DATE	TRANS.# MASS UPDATE
				1.				
				2.				
				1.				
				2.				
				1.				
				2.				
				1.				
				2.				
				1.				
				2.				

UNCLASSIFIED

May 14, 2010

NMControl Form MCA-F213

Attachment 13- MCA-F214 – Multi-Lok TID Removal Form

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MULTI-LOK TID Removal Form

TID Account #_____

TID NUMBER	LOT ID	REMOVE (R) VOID (V)	LOCATION	1. REMOVER SIGNATURE 2. VERIFIER SIGNATURE	Z #	GROUP	DATE	TRANS.# MASS UPDATE
				1				
				2				
				1				
				2				
				1				
				2				
				1				
				2				
				1				
				2				

UNCLASSIFIED

May 14, 2010

NMControl Form MCA-F214

UNCLASSIFIED

Los Alamos NATIONAL LABORATORY EST 1943

QUICKSEAL TID Removal Form

TID Account #_____

TID NUMBER	LOT ID	REMOVE (R) VOID (V)	LOCATION	1. REMOVER SIGNATURE 2. VERIFIER SIGNATURE	Z #	GROUP	DATE	TRANS.# MASS UPDATE
				1.				
				2.				
				1.				
				2.				
				1.				
				2.				
				1.				
				2.				
				1.				
				2.				

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NMControl Form MCA-F215 August 21, 2008

Attachment 15- MCA-F216 – Cup-Wire (Type E) Seal TID Removal Form

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Cup-Wire (Type E) Seal TID Removal Form

TID Account #_____

TID NUMBER	LOT ID	REMOVE (R) VOID (V)	LOCATION	1. REMOVER SIGNATURE 2. VERIFIER SIGNATURE	Z #	GROUP	DATE	TRANS # MASS UPDATE
				1. 2.				
				1. 2.				
				1. 2.				
				1. 2.				
				1. 2.				

UNCLASSIFIED

NMControl Form MCA-F216 August 21, 2008

UNCLASSIFIED

Los Alamos NATIONAL LABORATORY

TID Inventory Form

TID Account #_____

DATE	TIDs RECEIVED FROM SAFE-I	UNAPPLIED TIDs INVENTORIED	SIGNATURE	Z #	VERIFIER SIGNATURE	Z#

INVENTORIES ON THE TIDs MUST BE PERFORMED BIANNUALLY.

UNCLASSIFIED

February 10, 2014

NMControl Form MCA-F217

UNCLASSIFIED

Los Alamos NATIONAL LABORATORY

TID Access Record

TID Account #_____

DATE	TIME IN	TIME OUT	INITIAL	Z#

UNCLASSIFIED

NMControl Form MCA-F219 February 23, 2010

UNCLASSIFIED

Los Alamos NATIONAL LABORATORY EST. 1943

Non-LANL TID Removal Form

TID Account #_____

TID NUMBER	LOT ID	REMOVE (R) VOID (V)	LOCATION	1. REMOVER SIGNATURE 2. VERIFIER SIGNATURE	Z #	GROUP	DATE	TRANS # MASS UPDATE
				1. 2.				
				1. 2.				
				1. 2.				
				1. 2.				
				1. 2.				

UNCLASSIFIED

August 28, 2008

NMControl Form MCA-F220

Los Alamos NATIONAL LABORATORY EST 1943

Change of Documentation Custody Form

LANMAS Entry

Date _____ TID Account _____ Group _____

I (TID custodian/alternate) acknowledge that I am giving the LANL TID Administrator the documentation from my TID Log Book. I am acknowledging that it does not contain ANY classified documentation. If classified documentation needs to be transmitted to the LANL TID Administrator, I will follow the LANL Policy on transmitted classified documentation.

Signatures

TID Custodian/Alternate Signature *Z Number* *Date*

Derivative Classifier

☐ Unclassified ☐ Confidential ☐ Secret ☐ Official Use Only	☐ Restricted Data ☐ Formerly Restricted Data ☐ National Security Information	☐ Unclassified Controlled Nuclear Information Not for Public Dissemination Unauthorized dissemination subject to civil and criminal Sanctions under section 148 of the Atomic Energy Act of 1954, as amended (42 U.S.C. 2168) Guidance Used: _____

DC Print Name/Z#	Organization	Signature:	Date:

MCA-F231 Rev. 0 March 2013

Los Alamos NATIONAL LABORATORY EST 1943

Request for RoboCrib TID User

Date _____

Group _____

Responsible Line Manager (Print Name) _____ Z# _____

Responsible Line Manager Signature *Date*

Are the following courses completed:

TID curricula #1550 ☐ Yes ☐ No

LANMAS / LAMCAS curricula #10982 ☐ Yes ☐ No

Do you have an active red crypto card? ☐ Yes ☐ No

To enroll in the TID RoboCrib course you must have all curricula's above completed. You MUST maintain a red crypto card which, allows you to conduct TID activity within LANMAS.

TID User (Print Name) _____ Z# _____

TID User Signature *Date*

WHEN FORM IS COMPLETED AND SIGNED, SEND TO: TID ADMINISTRATOR, MS-G735, SAFE-4

To be filled out by SAFE-4

TID Administrator *Date*

NMControl Form MCA-F233 March 12, 2013

Attachment 4

375 Permacon Nitrate-Salt Waste Container Abnormal Conditions

Effective Date: October 8, 2015

The Responsible Manager has determined that the following organizations' review is required for initial procedure release as well as subsequent major revisions. Review documentation is contained in the Document History File:

Engineering
Environmental Compliance Programs
DSESH-EWMO Manager
Deployed IH&S Professional
Operations Managers
Quality Assurance
Radiation Protection
Safety Basis
Shift Operations Managers
TA-54 Operations Center SME
Emergency Management

Responsible Manager, EWMO Facility Operations Director

Les Sonnenberg	/ 290408	/ /s/ Les Sonnenberg	/ 10/07/15
Name (print)	Z#	Signature	Date

Classification Review: ☐ N/A ☒ Unclassified ☐ UCNI ☐ Classified _____

Teri Tingey	/ 200975	/ /s/ Teri Tingey	/ 10/07/15
Name (print)	Z#	Signature	Date

Working Copy / Information Only (circle one)
Initials / Date: _____/_____

LA-UR-15-28958

1.0 INTRODUCTION

1.1 Purpose

This Abnormal Operating Procedure (AOP) identifies conditions that may be indicative of problems with a nitrate salt waste container and describes the actions to take in response to these conditions, including initiating EP-DIV-RM-ERP-20200, EWMO Area Emergency Response. This document meets the requirements of the LANL Nitrate Salt-Bearing Waste Container Isolation Plan and the LANL Hazardous Waste Facility Permit with the New Mexico Environmental Department.

1.2 Scope

This AOP addresses the initial actions to identify potential problems with nitrate salt waste containers, initiate emergency response as required, make notifications not addressed within EP-DIV-RM-ERP-20200, and allow for further data collection to support both abnormal and emergency conditions.

This AOP does not address the characterization of field conditions or recovery activities.

2.0 ENTRY CONDITIONS

2.1 CAM Alarm

A CAM alarm activates within Dome 375.

2.2 Container Integrity

A nitrate salt waste container exhibits any of the following conditions:

- Loss of container integrity, such as evidence of leakage or compromised lid.
- Bulging such as expansion of side walls or top.
- Blistering paint on a container.

2.3 Container Temperature

A nitrate salt waste container temperature that is:

- Greater than 10°F higher than the ambient temperature.
- Greater than 90°F OR the PermaCon ambient temperature is greater than 90°F.

2.4 Conditions Requiring Emergency Response

A nitrate salt waste container exhibiting the following conditions requires an Emergency Response:

- Chemical reaction, such as smoke, fire, or release of internal contents to atmosphere.
- Container temperature that is greater than 15°F higher than the ambient temperature.

3.0 WORK STEPS

3.1 Immediate Response Actions

√	Time/Date	#	ACTIONS
Operations Center			
		1	**IF** Emergency Response is required due to a reported chemical reaction, such as smoke, fire, or release of internal contents to atmosphere, or a container temperature greater than 15°F above ambient, **THEN:** [A] **ENSURE** LAFD is notified via 911 and Emergency Operations Support Center (EOSC) at 667-6211 of a potential issue with a nitrate-salt waste container. [B] **EXIT** this procedure and **GO TO** EP-DIV-RM-ERP-20200, *EWMO Area Emergency Response*.
		2	**NOTIFY** the Shift Operations Manager at 505-231-8289.
		3	**IF** CAM alarm is reported, **THEN:** [A] **CONTACT** Radiation Protection to determine whether alarm is a true CAM alarm. [B] **IF** Radiation Protection determines it is not a true CAM alarm, **THEN DOCUMENT** determination in the Narrative/Comments section and **EXIT** this procedure.
		4	**OBTAIN** incident information from the Dome 375 personnel that made the initial notification and document the date/time of the request and the name of the person contacted in the Narrative/Comments section.
		5	**ENSURE** personnel have completed the applicable response (i.e., Notification, Off-Normal, Emergency) in accordance with EP-DIV-BEP-20048, *EWMO Division Building Emergency Plan*, and **DOCUMENT** date/time of completion in the Narrative/Comments section.
		6	**NOTIFY** personnel of incident status (e.g., Public address, 2-way radio, E-Pagers, cell phones, and/or face to face) and **DOCUMENT** the date/time of the notification in the Narrative/Comments section.

3.2 Subsequent Actions

√	Time/Date	#	ACTIONS
NOTE 1			*This subsection is executed at the request of the Shift Operations Manager/Designee or Facility Lead to gather additional information that may assist in appropriately responding to the issue in the field. Steps in this section may be performed out of sequence.*
NOTE 2			*The Facility Lead position is defined in EP-DIV-BEP-20048, EWMO Division Building Emergency Plan (BEP).*
Shift Operations Manager/Designee or Facility Lead			
		1	**NOTIFY** the Deployed Services Environmental Safety Health (DSESH) Manager and Engineering Manager within 2 hours of the event to assist the Shift Operations Manager and **DOCUMENT** the date/time of the notification and the name of the person contacted in the Narrative/Comments section.
NOTE			*When the Operations Manager is not physically present and/or on shift, the SOM will conduct the minimum notifications up the chain of command.*
		2	**NOTIFY** the Operations Manager of the event, and **REQUEST** the Operations Manager to contact the Facilities Operations Director (FOD), Associate Director of Nuclear and High Hazard Operations (ADNHHO), and Associate Directorate of Environmental Programs (ADEP).
		3	**OBTAIN** additional information (e.g., container numbers and location, site description and extent of situation, current weather conditions, etc.) that may assist in determining the source of the concern and planning of further investigation and corrective action efforts.
		4	**PROVIDE** the Completed By information and **SIGN**.

4.0 POST-PERFORMANCE ACTIVITIES

√	Time/Date	#	ACTIONS
Shift Operations Manager/Designee			
		1	**ATTACH** any notes or other documentation generated during the performance of this document to the Narrative/Comments page (e.g., photo of the white board).
		2	**PROCESS** the procedure as a quality record in accordance with EP-AP-10003, *Records Management*.

Narrative/Comments:

Completed By:

_____ / _____ / _____ / _____

Printed Name Signature Z# Date/Time

Attachment 5

Remediated Nitrate Salt Waste Container Monitoring

Effective Date: 11-30-2015

Next Review Date: 11-30-2018

Hazard Class:	☐	Low	☒	Moderate	☐	High/Complex
Usage Mode:	☐	Reference	☒	UET	☐	Both UET & Reference

The Responsible Manager has determined that the following organizations' review is required for initial procedure release as well as subsequent major revisions. Review documentation is contained in the Document History File.

Environmental Compliance Programs
EWMO Criticality Safety
DSESH-EWMO IH&S Professional
EWMO Shift Operations Supervisor
Quality Assurance
DSESH-EWMO Radiation Protection
EWMO Shift Operations Manager
EWMO Engineering
Safety Basis
WD-SRS Subject Matter Expert
WD-WPE Subject Matter Expert

Classification Review: ☐ Unclassified ☐ UCNI ☐ Classified

Art Crawford	/080070	//s/ Art Crawford	/11-23-2015
Name (print)	Z#	Signature	Date

Responsible Manager, WD-SRS Group Leader

Paul Newberry	/112056	//s/ Paul Newberry	/11-24-2015
Name (print)	Z#	Signature	Date

Working Copy / Information Only (circle one)
Initials / Date: _____/_____

This document fully satisfies the requirements of P300, Integrated Work Management, in order to systematically describe the work activity, the associated hazards, and the controls that **MUST** be employed to mitigate the risks.

REVISION HISTORY

Document No./Revision No.	Issue Date	Action	Description
EP-AREAG-FO-DOP-1246, R.0	May 29, 2014	New Procedure	Generated to incorporate EP-AREAG-SO-1237, TA-54 Area G Temperature Readings of Remediated Nitrate Salt Containers, EP-AREAG-SO-1244, TA-54 Area G Nitrate Waste Container Inspection. A Job hazard analysis was developed and controls incorporated into the procedure through precautions, limitations, warnings, cautions and notes.
EP-AREAG-FO-DOP-1246, R.1	Approved for Training	Major Revision	Revise procedure to incorporate container numbers into the procedure, checks, and actions for HVAC Low D/P and make editorial corrections as necessary. Section 6, added note to clarify Attachment 2 lists the container numbers. Correct step 5.[6] to revise word from smoking to smoke. Added Step 6.[8] to address container number discrepancies. This revision does not introduce any new hazards.
EP-AREAG-FO-DOP-1246, R.2	July 15, 2014	Major Revision	Revise procedure to incorporate ENV-CP comments and make editorial corrections as necessary. This revision does not introduce any new hazards.
EP-AREAG-FO-DOP-1246, R.3	August 1, 2014	Major Revision	Revise procedure to allow for performing the temperature measurements in TA-54-231 and TA-54-375 independent of each other. Allow for multiple infrared thermometers to be used. Delete control drum temperature readings throughout. Revise attachments to include a separate attachment for recording daily temperatures in each cell in TA-54-375. Make process improvement changes. Make editorial corrections as necessary. This revision does not introduce any new hazards. This revision is a total rewrite and revision bars have been omitted.
EWMO-AREAG-FO-DOP-1246, R.4	September 11, 2014	Major Revision	Revised procedure to change Procedure number from EP to EWMO. Deleted Step 6.[19] and the associated SOM initials for the daily review on Attachments 2 through 6. Moved Step 8.1[1] Operator signoff to the end of Sections 5 and 6. Deleted Step 8.1[1]. Delete SOM initials on attachments 2 through 6. Rev bars is in the left column display location of changes. No additional hazards were identified during this revision.

REVISION HISTORY (continued)

Document No./Revision No.	Issue Date	Action	Description
EWMO-AREAG-FO-DOP-1246, R.5	November 03, 2014	Major Revision	Revise procedure to incorporate the ability to use remote temperature indication from thermocouples and to update waste container numbers. This revision is a total rewrite and revisions bars have been omitted. This revision does not introduce any new hazards.
EWMO-AREAG-FO-DOP-1246, R.5 IPC-1	November 17, 2014	IPC	Revise procedure to change the drums in SWB LA00000070503 from "68553 and 69445" to "68540 and 68553". This revision does not introduce any new hazards.
EWMO-AREAG-FO-DOP-1246, R.6	March 26, 2015	Major Revision	Revise procedure to implement Specific Administrative Controls for daily visual inspection and monthly overpack inspection provided in AREAG-ESS-14-002-R3. This revision does not introduce any new hazards.
EWMO-AREAG-FO-DOP-1246, R.7	November 18, 2015	Major Revision	Incorporate a separate Attachment for documenting the daily visual inspection associated with SAC 4. Removed unremediated nitrate salt inspections at TA-54-231. Added section for headspace gas sampling. This revision does not introduce any new hazards. Revision constitutes a total rewrite.
EWMO-AREAG-FO-DOP-1246, R.8	November 30, 2015	Major Revision	Revised procedure to change the container temperature monitoring to once daily. Added Note that allows WR-SRS management to change inspection frequencies in Section 5 and 6. Remove 2nd Ambient temperature from Section 6. Rev bars in the left column display changes in the procedure. No additional hazards were identified in this revision.

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1. PURPOSE

This procedure provides instructions for monitoring remediated nitrate salt (RNS) waste containers.

2. SCOPE

Monitoring of RNS waste containers performed within this procedure includes:

- Daily visual inspections of waste containers in accordance with New Mexico Environment Department (NMED) approvals or the LANL Nitrate Salt-Bearing Waste Container Isolation Plan
- Daily visual inspections of waste containers in accordance with AREAG-ESS-14-002
- Daily temperature readings of waste containers in accordance with LANL Nitrate Salt-Bearing Waste Container Isolation Plan
- Monthly visual inspections of overpack closure in accordance with AREAG-ESS-14-002
- Periodic inspection of the TA-54 East Entrance Road into Area G following significant precipitation
- Periodic evaluation of waste container Headspace Gas Analysis

This procedure applies to Los Alamos National Laboratory (LANL) Waste Disposition (WD) Division and Environmental and Waste Management Operations (EWMO) personnel who will be monitoring RNS waste containers.

3. PRECAUTIONS AND LIMITATIONS

3.1 General Task Hazards and Controls

- General site hazards and their controls for TA-54 Area G are provided in EWMO-AP-20253, EWMO General Site Hazards and Controls. Personnel performing activities associated with this procedure **SHALL** meet facility access criteria, recognize the associated site hazards, and uphold the established controls.

- The calibrated infrared thermometer is equipped with a laser that can cause eye injury if the eye is exposed to the beam.

- Personnel associated with this procedure **SHALL** review and understand the requirements of the Radiological Work Permit (RWP).

3.1 General Task Hazards and Controls (continued)

- In the event of inclement weather or LANL closures, personnel who are not able to report for a planned shift or are required to leave prior to a shift's end shall contact the on-call Shift Operation Manager (SOM) to request guidance. Personnel shall not be placed in a potentially unsafe situation when trying to meet the inspection requirements of this procedure.

3.2 Safety Basis

- Procedure steps marked with the **($)** symbol implement key requirements associated with the facility's safety basis. These steps may not be changed without engineering approval to ensure that the Technical Safety Requirements (TSRs) and other associated requirements are maintained.

- Specific Administrative Controls (SACs) provided in AREAG-ESS-14-002 are unnumbered. To facilitate field implementation of the associated surveillances, numbers have been assigned and are provided in the following bullet.

- Safety basis requirements incorporated and controlled within this procedure include:
  - Standard Waste Boxes (SWBs) and Pipe Overpack Containers (POCs) containing RNS waste **SHALL** remain closed. (ESS-14-002, SAC 3)
  - SWBs and POCs (outer drum) containing RNS waste **SHALL** be visually inspected daily for signs of degradation. (ESS-14-002, SAC 4)

4. PREREQUISITE ACTIONS

NOTE *The listed prerequisite actions may be completed in any order.*

4.1 Planning and Coordination

Person in Charge (PIC)

[1] **ENSURE** that the performance of this procedure has been scheduled on the TA-54 Area G schedule.

[2] **ENSURE** that the procedure is the latest revision, and **IDENTIFY** this document as Working Copy or Information Only on the Title Page.

[3] **ENSURE** that, as a minimum, the following trained and/or qualified personnel are available for the performance of this procedure, as required:

- Two Nitrate Drum Observers (Sections 5 through 8)
- One Radiological Control Technician (RCT) (when performing operations within the TA-54-0375 PermaCon)

[4] **ENSURE** that a pre-job briefing is conducted for all personnel involved in the performance of this procedure in accordance with EP-DIV-AP-0112, EWMO Pre-Job Briefings.

[5] **IF** performing Section 6, Temperature Readings of RNS Waste Containers,
THEN ENSURE that EWMO-AREAG-WO-DOP-1249, TA-54 Area G Dome 0375 PermaCon Nitrate Salt Storage Round Sheet, has been completed within the last day.

[6] **IF** a precipitation event occurred since the last performance of this procedure,
THEN CONTACT the TA-54 Operations Center or the on-call SOM to determine if Section 8, TA-54 Area G East Entrance/Road into Area G Monitoring, needs to be performed.

4.2 Materials and Equipment

Nitrate Drum Observers

[1] **IF** performing Section 6,
AND an calibrated infrared thermometer is to be used to obtain the waste container temperatures,
THEN:

[A] **ENSURE** that a calibrated infrared thermometer within the calibration due date is available.

[B] **RECORD** the following infrared calibration information on the attachments (Attachments 2 through 5) that correspond to the monitoring locations:

- Brand name
- Model number
- Calibration due date
- File number

5. INSTRUCTIONS—VISUAL INSPECTIONS OF RNS WASTE CONTAINERS

This section is a stand-alone section and may be performed independently of, or in conjunction with, other Instructions sections.

This section can be performed to meet either of the following requirements:

- Daily visual inspection in accordance with NMED approvals or the LANL Nitrate Salt-Bearing Waste Container Isolation Plan, which is documented on Attachment 1, TA-54-0375 Daily TSR Visual Inspection of RNS Waste Containers Data Sheet
- Daily surveillance requirement in accordance with AREAG-ESS-14-002, SAC 4, which is documented on Attachment 1, TA-54-0375 Daily TSR Visual Inspection of RNS Waste Containers Data Sheet.

NOTE 1 *Visual inspection must be performed at least once daily.*

NOTE 2 *Surveillance inspection must be performed at least once DAILY within 24 hours.*

NOTE 3 *Visual and surveillance frequency may be increased at the discretion of the WD-SRS management.*

Nitrate Drum Observers

[1] **DETERMINE** which activity is to be completed:

- Daily visual inspection using Attachment 1
- Daily surveillance requirement using Attachment 1

[2] **ENSURE** that the prerequisite actions have been completed.

NOTE *Visual inspections are conducted from outside of the TA-54-0375 PermaCon through the windows.*

[3] **IF** assuming RNS waste container observation duties,
THEN DOCUMENT the following in the Comments section of Attachment 1:

- Time and assumption of duties
- Signature and Z number

[4] **RECORD** the date information and time of the inspection on Attachment 1.

5. INSTRUCTIONS—VISUAL INSPECTIONS OF RNS WASTE CONTAINERS (continued)

[5] **DETERMINE** whether the following PermaCon HVAC system components are operational, and **CHECK** (√) YES or NO on Attachment 1.

TA-54-0375

- FE-001, VFD-001 is ON and set to HAND, 30 to 60 Hz
- FE-002, VFD-002 is ON and set to HAND, 30 to 60 Hz
- PDA-001, PDA-002, and PDA-003 alarm light are not illuminated (panel outside cell)

[6] **IF** NO was checked (√) in the previous step,
THEN GO TO EP-AREAG-RM-ARP-1150, 375 PermaCon Low Cell D/P Alarm.

[7] **($) VISUALLY INSPECT** SWBs and POCs (outer drum) containing RNS waste for signs of degradation, indications of an abnormal condition including an internal reaction (e.g., chemical/thermal), and/or loss of container integrity, including:

- Evidence of deterioration such as signs of discoloration, paint peeling or yellowing
- Loss of container integrity such as evidence of leakage, or lid compromised
- Bulging such as pressurized, expansion of side walls, or round bottom
- Chemical reaction such as smoke or release of internal contents to atmosphere
- Signs of smoke and fire from a container

and **CHECK** (√) SAT or UNSAT on Attachment 1 for RNS waste containers at the storage location. (ESS-14-002, SAC 4)

[8] **IF** evidence of a chemical reaction such as smoke, fire, or release of internal contents to the atmosphere are discovered,
THEN PERFORM an emergency response in accordance with EP-DIV-BEP-20048, EWMO Division Building Emergency Plan (BEP).

[9] **IF** evidence of deterioration is discovered, such as signs of discoloration, paint peeling or yellowing, loss of container integrity such as evidence of leakage or a compromised lid, bulging, pressurization (expansion of side walls, or round bottom) are discovered,
THEN PERFORM an off-normal response in accordance with EP-DIV-BEP-20048.

[10] **RECORD** initials and Z number on Attachment 1.

[11] **PROVIDE** a description of any unsatisfactory conditions, notifications, and corrective actions in the Comments section of Attachment 1.

5. INSTRUCTIONS—VISUAL INSPECTIONS OF RNS WASTE CONTAINERS (continued)

[12] **IF** turning over RNS waste container observation duties,
THEN DOCUMENT the following in the Comments section of Attachment 1:

- Time and turnover of duties
- Printed name of relief
- Signature

[13] **PRINT** name, **SIGN**, and **RECORD** Z#, initials, and date on Attachment 1.

6. INSTRUCTIONS—TEMPERATURE READINGS OF RNS WASTE CONTAINERS

This section is a stand-alone section and may be performed independently of, or in conjunction with, other Instructions sections.

This section provides the instructions for performing temperature readings.

Temperature measurements must be performed at least once daily per LANL Nitrate Salt-Bearing Waste Container Isolation Plan. Temperature measurement frequency of one or more RNS containers may be increased at the discretion of WD-SRS management and documented on Attachment 5, TA-54 Area G RNS Waste Container Temperature Data Sheet

NOTE 1 *Daily waste container temperature measurements are obtained by entering the TA-54-0375 PermaCon and individually measuring and recording the waste container temperatures.*

NOTE 2 *Separate attachments are provided to allow for recording daily waste container temperatures independently as listed below:*

- *Attachment 2, TA-54-0375 Cell 1 RNS Waste Container Daily Temperature Data Sheet*
- *Attachment 3, TA-54-0375 Cell 2 RNS Waste Container Daily Temperature Data Sheet*
- *Attachment 4, TA-54-0375 Cell 3 RNS Waste Container Daily Temperature Data Sheet*

Nitrate Drum Observers

[1] **ENSURE** that all prerequisite actions have been completed.

[2] **IF** at any time during the performance of this section a chemical reaction such as smoke, fire, or release of internal contents to the atmosphere is discovered,
THEN PERFORM an emergency response in accordance with EP-DIV-BEP-20048.

6. INSTRUCTIONS—TEMPERATURE READINGS OF RNS WASTE CONTAINERS (continued)

[3] **IF** at any time during the performance of this section evidence of deterioration is discovered, such as signs of discoloration, paint peeling or yellowing, loss of container integrity such as evidence of leakage or a compromised lid, bulging, pressurization (expansion of side walls, or round bottom) are discovered,
THEN PERFORM an off-normal response in accordance with EP-DIV-BEP-20048.

[4] **RECORD** the date range and start time on the attachment (Attachment 2 through 5) that corresponds to the monitoring location.

[5] **DETERMINE** the ambient temperature (e.g., the wall of the contamination control enclosure or designated location using an calibrated infrared thermometer or the AMBIENT temperature indication on the TA-54-0375 PermaCon Control Room computer), and **RECORD** the ambient temperature (in °F) on the applicable attachment.

6. INSTRUCTIONS—TEMPERATURE READINGS OF RNS WASTE CONTAINERS (continued)

NOTE 1 *SWBs that were not packaged for Waste Isolation Pilot Plant (WIPP) shipment (without a LASBxxxxx number) identify the location of the RNS waste container inside by the location of the container label on the outside of the SWB.*

NOTE 2 *SWBs that were packaged for WIPP shipment (with a LASBxxxxx number) do not have the location of the RNS waste container identified on the outside of the SWB.*

NOTE 3 *The RNS waste container in a POC is a 12" diameter pipe component that runs vertically down the center of the overpack.*

NOTE 4 *The temperature indications for each waste container with an input to the TA-54-0375 PermaCon Control Room computer are labeled with the waste container number except for the ambient temperature thermocouple which is labeled AMBIENT.*

[6] **IF** the RNS waste container location within the overpack (i.e., POC or SWB) is known, **THEN OBTAIN** the RNS waste container temperature using one or both of the following methods, and **RECORD** the container number (Attachment 5 only) and the temperature on the applicable attachment:

- **MEASURE** the temperature (in °F) on the top approximate center of each RNS waste container, through the overpack lid, using an calibrated infrared thermometer
- **READ** the overpack temperature (°F) indication on the TA-54-0375 PermaCon Control Room computer

[7] **IF** the RNS waste container location within the overpack is **NOT** known, **THEN MEASURE** the temperature (in °F) on the top approximate center of each drum in the overpack, through the overpack lid, using an calibrated infrared thermometer, and **RECORD** the container number (Attachment 5 only) and the highest temperature measurement on the applicable attachment.

[8] **IF** a container's temperature is greater than 15°F above the ambient temperature, **THEN:**

[A] **EXIT** the PermaCon.

[B] **PERFORM** an emergency response in accordance with EP-DIV-BEP-20048.

6. INSTRUCTIONS—TEMPERATURE READINGS OF RNS WASTE CONTAINERS (continued)

[9] **IF** a container's temperature is greater than 10°F above the ambient temperature, **THEN:**

[A] **EXIT** the PermaCon.

[B] **PERFORM** an off-normal response in accordance with EP-DIV-BEP-20048.

[10] **IF** a discrepancy with a container number pre-populated on the attachment is discovered, **THEN:**

[A] **SUSPEND** operations.

[B] **REQUEST** applicable actions from the TA-54 Operations Center or SOM.

[11] **REPEAT** Steps 6.[7] through 6.[10] for the current cell until all of the RNS waste container temperatures have been recorded.

[12] **RECORD** the end time and **INITIAL** on the applicable attachment.

[13] **RECORD** "N/A" (not applicable) for temperature readings that were not recorded and **DOCUMENT** an explanation in the Comments section of the applicable attachment.

[14] **PROVIDE** a description of any unsatisfactory conditions, notifications, and corrective actions in the Comments section of the attachment (Attachment 2 through 5) that corresponds to the monitoring location.

[15] **REPEAT** Steps 6.[1] through 6.[14] for remaining RNS waste container locations.

[16] **PRINT** name, **SIGN**, and **RECORD** Z#, initials, and date on the applicable attachments (Attachments 2 through 5).

7. INSTRUCTIONS—OVERPACK INSPECTION OF RNS WASTE CONTAINERS

This section is a stand-alone section and may be performed independently of, or in conjunction with, other Instructions sections.

This section provides instructions for performing monthly inspections of the closure of the outer container containing RNS waste in accordance with AREAG-ESS-14-002, SAC 3.

Nitrate Drum Observers

[1] **ENSURE** that all prerequisite actions have been completed.

[2] **RECORD** the date and time for beginning the RNS waste container overpack inspection on Attachment 6, TA-54-0375 Monthly TSR Overpack Inspection of RNS Waste Containers Data Sheet.

NOTE *Visual inspections at TA-54-0375 are conducted from outside of the PermaCon through the windows.*

[3] **($) VISUALLY INSPECT** the outer container containing RNS waste to verify that the containers are closed (i.e., lid is in place and secured), and **CHECK** (√) SAT or UNSAT on Attachment 6 for the waste containers within each cell at TA-54-0375.
(ESS-14-002, SAC 3)

[4] **IF** UNSAT is checked for the inspection location,
THEN PERFORM an off-normal response in accordance with EP-DIV-BEP-20048.

[5] **PRINT** name, **SIGN**, and **RECORD** Z#, initials, and date on the Attachment 6.

8. INSTRUCTIONS—TA-54 AREA G EAST ENTRANCE/ROAD INTO AREA G MONITORING

This section is a stand-alone section and may be performed independently of, or in conjunction with, other Instructions sections.

This section is performed in response to significant precipitation (rain fall greater than 0.25 inches within 30 minutes or greater than a 0.5 inches in 24 hours of rain fall) that may cause damage or road deterioration of east entrance/road into TA-54 Area G. Weather information may be obtained from TA-54 Meteorological Station or National Oceanic and Atmospheric Administration (NOAA).

Shift Operations Manager or Designee

[1] **DETERMINE** if a significant precipitation event has occurred that may have caused damage or road deterioration to the east entrance/road into TA-54 Area G.

[2] **VISUALLY INSPECT** the TA-54 Area G East entrance/road for deterioration (e.g., washout).

[3] **IF** deterioration is observed and the TA-54 Area G East entrance/road is impassable, **THEN:**

[A] **NOTIFY** Emergency Management and Response **(**EM&R) that the road is impassable.

[B] **NOTIFY** Maintenance and Site Services to repair the deteriorated section of the road.

[4] **WHEN** the road repairs are complete,
THEN:

[A] **VISUALLY INSPECT** that the road is repaired and passable.

[B] **NOTIFY** EM&R that the TA-54 Area G East entrance/road is passable.

[C] **NOTIFY** Deployed Environmental Professional of road condition and repair activities for storm water tracking purposes.

9. INSTRUCTIONS—EVALUATION OF HEADSPACE GAS ANALYSIS OF RNS WASTE CONTAINERS

This section is a stand-alone section and may be performed independently of other Instructions sections.

NOTE 1 *The prerequisite actions do not apply to performance of this section.*

NOTE 2 *Headspace gas sampling is performed by Central Characterization Project personnel and analysis is performed by Chemistry Division personnel in accordance with their procedures.*

NOTE 3 *Minimum headspace gas sampling frequencies are defined in the LANL Nitrate Salt-Bearing Waste Container Isolation Plan.*

NOTE 4 *Evaluation of the headspace gas analysis results is performed using a combination of data review, graphical analysis, and statistical analysis. Departure of a headspace gas concentration from expected trends considers the storage temperature and previous concentrations and is primarily indicated by a headspace gas analysis result that is beyond three standard deviations from the mean of a set of previous concentrations.*

Waste Process Engineering Representative

[1] **EVALUATE** the headspace gas analysis results.

[2] **IF** a container's headspace gas hydrogen concentration is greater than or equal to 20,000 ppm hydrogen,
THEN ENSURE that daily headspace gas sampling and analysis have been initiated for that container.

[3] **IF** a container's headspace gas concentration for any gas indicates a departure from expected trends,
THEN:

[A] **DETERMINE** if the departure indicates an adverse condition (i.e., increasing chemical reactivity and a potentially increased hazard).

[B] **DETERMINE** if a resample or change in sampling frequency of the container is warranted and **INITIATE** the resample or change accordingly.

9. INSTRUCTIONS—EVALUATION OF HEADSPACE GAS ANALYSIS OF RNS WASTE CONTAINERS (continued)

[4] **IF** a container's headspace gas hydrogen concentration is greater than or equal to 30,000 ppm hydrogen or a departure from expected trends indicates an adverse condition, **THEN NOTIFY** the Operations Center or SOM to enter EP-AREAG-RM-AOP-1299.

[5] On a monthly basis, **COMPILE** the previous month's headspace gas analysis results and **SUBMIT** them to Records Management in accordance with EP-AP-10003.

10. POST-PERFORMANCE ACTIVITY

10.1 Disposition

SOM or designee

[1] **REVIEW** the applicable attachments (Attachments 1 through 6) for accuracy and completeness.

[2] **PRINT** name, **SIGN**, and **RECORD** Z#, initials, and date on the applicable attachments.

NOTE *Completing a Post-Job Review may be accomplished using the applicable P300 form or online (the preferred method since the institution has access to feedback and lessons learned http://int.lanl.gov/safety/iwmc/ [Click on the Submit IWD Part 4 Post-Job Review]).*

[3] **IF** any of the following occur:

- A new activity was completed for the first time
- A request was made by anyone involved with the performance of this procedure to perform a post-job review
- An abnormal event occurred
- A revision to an existing procedure was issued and it has been determined by the procedure owner or designee that a Post-Job Review is required,

THEN PERFORM a Post-Job Review in accordance with P300.

[4] **IF** the Post-Job Review identified any necessary changes to this procedure,
THEN INITIATE a revision to this procedure.

10.2 Records Processing

Nitrate Drum Observers

[1] **ENSURE** that documents generated by the performance of this procedure are processed as follows:

Record Identification	Record Type Determination	Protection/Storage Methods	Processing Instructions
Attachment 1, TA-54-0375 Daily TSR Visual Inspection of RNS Waste Containers Data Sheet Attachment 2, TA-54-0375 Cell 1 RNS Waste Container Daily Temperature Data Sheet Attachment 3, TA-54-0375 Cell 2 RNS Waste Container Daily Temperature Data Sheet Attachment 4, TA-54-0375 Cell 3 RNS Waste Container Daily Temperature Data Sheet Attachment 5, TA-54 Area G RNS Waste Container Temperature Data Sheet Attachment 6, TA-54-0375 Monthly TSR Overpack Inspection of RNS Waste Containers Data Sheet	QA Record	Supervision **SHALL** implement a reasonable level of protection to prevent loss and degradation. Records should be maintained in a one-hour fire rated metal file cabinet when not in use.	When the records are ready for final disposition, the record is transferred to Records Management in accordance with EP-AP-10003, Records Management.

11. REFERENCES

AREAG-ESS-14-002, Transuranic (TRU) Waste Drums Containing Treated Nitrate Salts May Challenge the Safety Basis

EP-AREAG-RM-AOP-1299, 375 Permacon Nitrate-Salt Waste Container Abnormal Conditions

EP-AREAG-RM-ARP-1150, 375 PermaCon Low Cell D/P Alarm

EP-AP-10003, Records Management Procedure For ADEP Employees

EP-DIV-AP-0112, EWMO Pre-Job Briefings

EP-DIV-BEP-20048, EWMO Division Building Emergency Plan (BEP)

EWMO-AP-20253, EWMO General Site Hazards and Controls

EWMO-AREAG-WO-DOP-1249, TA-54 Area G Dome 375 PermaCon Nitrate Salt Storage Round Sheet

LANL Nitrate Salt-Bearing Waste Container Isolation Plan

P300, Integrated Work Management

P330-6, Nonconformance Reporting

ATTACHMENT 1
Page 1 of 1

TA-54-0375 DAILY TSR VISUAL
INSPECTION OF RNS WASTE CONTAINERS DATA SHEET

5.[4] Date: _____

ESS-14-002, SAC 4 Inspection Time (5.[4])	HVAC Operational (5.[5])	**($)** Visual Inspection (ESS-14-002, SAC 4) (5.[7])	Nitrate Drum Observers Initials and Z# (5.[10])
	☐ YES ☐ NO	☐ SAT ☐ UNSAT	

Comments: _____

5.[13] Performed by: _____ / _____ / _____ / _____ / _____
Nitrate Drum Observers (print) Signature Z # Initials Date

10.1[2] Reviewed By: _____ / _____ / _____ / _____ / _____
SOM or designee (print) Signature Z # Initials Date

ATTACHMENT 2
Page 1 of 3

TA-54-0375 CELL 1 RNS WASTE CONTAINER DAILY TEMPERATURE DATA SHEET

6.[4] Date: From _____ to _____

	Monday 6.[4] Start Time: _____	Tuesday 6.[4] Start Time: _____	Wednesday 6.[4] Start Time: _____	Thursday 6.[4] Start Time: _____	Friday 6.[4] Start Time: _____	Saturday 6.[4] Start Time: _____	Sunday 6.[4] Start Time: _____
TA-54-0375 Cell 1							
Calibrated infrared thermometer (4.2[1][B])	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____
Ambient Temperature (6.[5])	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F
Container ID #	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])
68685							
LA00000070503 68540							
LA00000070503 68553							
69445							
69618							
69013							
LASB50522							
LASB50452							
LASB50431							
LASB50069							
LASB50073							
69636							
69616							
69417							

ATTACHMENT 2
Page 2 of 3

6.[4] Date: From _____ to _____

Container ID #	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])
TA-54-0375 Cell 1 (continued)							
69620							
69520							
69641							
69298							
LASB02203							
End Time (6.[12])	_____	_____	_____	_____	_____	_____	_____
6.[12]	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____

Comments:

ATTACHMENT 2
Page 3 of 3

6.[4] Date: From _____ to _____

6.[16] Performed by:

Nitrate Drum Observer (print)	Signature	Z#	Initials	Date
	/	/	/	/
	/	/	/	/
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	/	/	/	/
	/	/	/	/
	/	/	/	/
	/	/	/	/
	/	/	/	/

10.1[2] Reviewed by:

SOM or designee (print)	Signature	Z#	Initials	Date
	/	/	/	/

ATTACHMENT 3
Page 1 of 3

TA-54-0375 CELL 2 RNS WASTE CONTAINER DAILY TEMPERATURE DATA SHEET

6.[4] Date: From _____ to _____

	Monday 6.[4] Start Time: _____	Tuesday 6.[4] Start Time: _____	Wednesday 6.[4] Start Time: _____	Thursday 6.[4] Start Time: _____	Friday 6.[4] Start Time: _____	Saturday 6.[4] Start Time: _____	Sunday 6.[4] Start Time: _____
TA-54-0375 Cell 2							
Calibrated infrared thermometer (4.2[1][B])	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____
Ambient Temperature (6.[5])	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F
Container ID #	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])
LASB02198							
68638							
69615							
69635							
69642							
69630							
69633							
68430							
68631							
69634							
68567							
94227							
LASB50442							
69644							
LASB50443							
69638							

ATTACHMENT 3
Page 2 of 3

6.[4] Date: From _____ to _____

Container ID #	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])
TA-54-0375 Cell 2 (continued)							
68624							
68507							
69568							
69553							
69598							
LASB50559							
69015							
69639							
69637							
End Time (6.[12])	_____	_____	_____	_____	_____	_____	_____
6.[12]	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____

Comments:

ATTACHMENT 3
Page 3 of 3

6.[4] Date: From _____ to _____

6.[16] Performed by:

Nitrate Drum Observer (print)	Signature	Z#	Initials	Date
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Nitrate Drum Observer (print)	Signature	Z#	Initials	Date
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10.1[2] Reviewed by:

SOM or designee (print)	Signature	Z#	Initials	Date
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ATTACHMENT 4
Page 1 of 3

TA-54-0375 CELL 3 RNS WASTE CONTAINER DAILY TEMPERATURE DATA SHEET

6.[4] Date: From _____ to _____

	Monday 6.[4] Start Time: _____	Tuesday 6.[4] Start Time: _____	Wednesday 6.[4] Start Time: _____	Thursday 6.[4] Start Time: _____	Friday 6.[4] Start Time: _____	Saturday 6.[4] Start Time: _____	Sunday 6.[4] Start Time: _____
TA-54-0375 Cell 3							
Calibrated infrared thermometer (4.2.[1][B])	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____
Ambient Temperature (6.[5])	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F
Container ID #	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])
69519							
69645							
94068							
93605							
69548							
69604							
LASB50529							
LASB50418							
69036							
LASB50451							
69559							
LASB50448							
87827							

ATTACHMENT 4
Page 2 of 3

6.[4] Date: From _____ to _____

Container ID #	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])
TA-54-0375 Cell 3 (continued)							
87826							
87823							
87825							
End Time (6.[12])	_____	_____	_____	_____	_____	_____	_____
6.[12]	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____	NDO: _____ NDO:_____

Comments:

ATTACHMENT 4
Page 3 of 3

6.[4] Date: From _____ to _____

6.[16] Performed by:

Nitrate Drum Observer (print)	Signature	Z#	Initials	Date
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10.1[2] Reviewed by:

SOM or designee (print)	Signature	Z#	Initials	Date
	/		/	/

ATTACHMENT 5
Page 1 of 3

TA-54 AREA G RNS WASTE CONTAINER TEMPERATURE DATA SHEET

6.[4] Date: From _____ to _____ Location: _____

	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____	Start Time: 6.[4] _____
Calibrated infrared thermometer (4.2[1][B])	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____	Brand: _____ Model: _____ Cal. Due Date: _____ File Number _____
Ambient Temperature (6.[5])	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F	_____°F
Container ID # (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])

ATTACHMENT 5
Page 2 of 3

6.[4] Date: From _____ to _____ Location: _____

Container ID # (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])	Temp (°F) (6.[6]/6.[7])
End Time (6.[12])	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____	_____
6.[12]	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____	NDO: _____ NDO: _____

ATTACHMENT 5
Page 3 of 3

6.[4] Date: From _____ to _____ Location: _____

Comments:

6.[16] Performed by:

Nitrate Drum Observer (print)	Signature	Z#	Initials	Date
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10.1[2] Reviewed by:

SOM or designee (print)	Signature	Z#	Initials	Date
				/ /

ATTACHMENT 6
Page 1 of 1

TA-54-0375 MONTHLY TSR OVERPACK
INSPECTION OF RNS WASTE DATA SHEET

7.[2] Date and time: _____

RNS Waste Container Storage Area	**($)** Overpack Closure Visual Inspection (7.[3]) (ESS-14-002, SAC 3)
TA-54-0375 Cell 1	☐ SAT ☐ UNSAT
TA-54-0375 Cell 2	☐ SAT ☐ UNSAT
TA-54-0375 Cell 3	☐ SAT ☐ UNSAT

Comments: _____

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7.[5] Performed by: _____ / _____ / _____ / _____ / _____
Nitrate Drum Observer (print) Signature Z # Initials Date

10.1[2] Reviewed By: _____ / _____ / _____ / _____ / _____
SOM or designee (print) Signature Z # Initials Date

Attachment 6

EP-DIV-BEP-20048, R.1

EWMO Division Building Emergency Plan (BEP)

Effective Date: 12/10/13

The Responsible Manager has determined that the following organizations' review/concurrence is required for the initial document, and for major revisions, a same type and level review is required. Review documentation is contained in the Document History File:

Emergency Planning and Preparedness
Operations Center SME
Engineering
Facility Operations Director (FOD)
Fire Protection Engineering
Industrial Hygiene and Safety
Operations Managers
Quality Assurance
Training
Radiation Protection
Shift Operations Managers
SME WCRRF, RANT, TA-54 SOSs

Responsible Manager, EWMO Facility Operations Director

Steve M. Henry	/ 219172	/ /s/ Steve Henry	/ 12/10/13
Name (print)	Z#	Signature	Date

Classification Review: ☐ N/A ☒ Unclassified ☐ UCNI ☐ Classified _____

Teri Tingey	/ 200975	/ /s/ Teri Tingey	/ 12/10/13
Name (print)	Z#	Signature	Date

Working Copy / Information Only (circle one)
Initials / Date: _____ / _____

LA-UR-14-23780

REVISION HISTORY

Document No./Revision No.	Issue Date	Action	Description
EP-DIV-BEP-20048, Rev. 0	December 9, 2013	New Procedure	This new Division-level building emergency plan supersedes the following facility-level BEPs: • EP-DIV-PLAN-10, Radioassay and Nondestructive Testing Facility Emergency Plan • EP-DIV-PLAN-05, Waste Characterization, Reduction, and Repackaging Facility Building Emergency Plan • EP-DIV-PLAN-01, TA-54 Areas G, H, J, L, and Administrative Area Building Emergency Plan • TA-21-PLAN-00008, TA-21 Emergency Plan • EP-DIV-BEP-0102, TA-54 Buildings 1009 and 1014 Building Emergency Plan EP-AREAG-RM-AOP-0421, Security Incident Notifications, EP-WCRR-RM-AOP-0208, Special Shapes, EP-AREAG-RM-ARP-0302, Evacuation Alarm, EP-RANT-RMC-ARP-0303, Evacuation Alarm, EP-AREAG-RM-EOP-0206, Seismic Event, EP-AREAG-RM-EOP-0207, Vehicle Accident, EP-RANT-RMB-EOP-0207, Vehicle Accident, EP-RANT-RMB-EOP-0208, Seismic Event, EP-RANT-RM-EOP-0206, Injured Person with Contamination, EP-WCRR-RM-EOP-0304, Security Threat, EP-WCRR-RM-EOP-0308, Seismic Event, EP-WCRR-RM-EOP-0309, Injured Person at WCRRF. This procedure also supersedes EP-DIV-AP-20045, EWMO Abnormal Event Notification Process. EP-DIV-AP-20045 requirements were incorporated into EWMO Response procedure and references LANL Site Requirements. Nuclear Environmental Site (NES) are also included in the BEP. No hazardous analysis was required; this is considered and administrative procedure.
EP-DIV-BEP-20048, Rev. 1	December 10, 2013	Minor Revision	Revise procedure to remove the OUO designation in accordance with SAFE-1. This revision does not introduce any new hazards.

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1. PURPOSE

The Environmental and Waste Management Operations (EWMO) Division Building Emergency Plan (BEP) captures the Site Emergency Management and Response program requirements from Los Alamos National Laboratory (LANL) procedure P1201-4, Emergency Procedures and Protective Actions and P315, Conduct of Operations Manual. In addition, the EWMO BEP identifies area-specific response requirements for (1) Technical Area (TA)-50-69 Waste Characterization, Reduction, and Repackaging Facility (WCRRF) complex, (2) TA-54 Area G, H, J, L and TA-54 Administrative areas, (3) TA-54 Radioassay and Nondestructive Testing (RANT) Building 54-38 complex, (4) TA-21, and (5) Nuclear Environmental Sites (NES).

2. SCOPE

The EWMO BEP requirements apply to all personnel, subcontractors, tenants, and visitors entering the TA-54, RANT, WCRRF complex, TA-21, and NES.

Building residents who are assigned and qualified for escorting visitors assume the responsibility for ensuring that visitors possess the appropriate level of area-specific information (e.g., rules, regulations, exits, evacuation routes, assembly/muster areas, area specific alarms, and response procedures) necessary to respond appropriately in the event of an off-normal or emergency situation that may arise. Management has the overall responsibility for personnel accountability during an off-normal/emergency event.

The EWMO Division BEP will be reviewed on an annual basis and updated as necessary for changes that alter the scope of this document, corrections based on internal and audit findings, emergency drill and exercise lessons learned external changes in governing standards and references, and changes to facility operations and associated hazards.

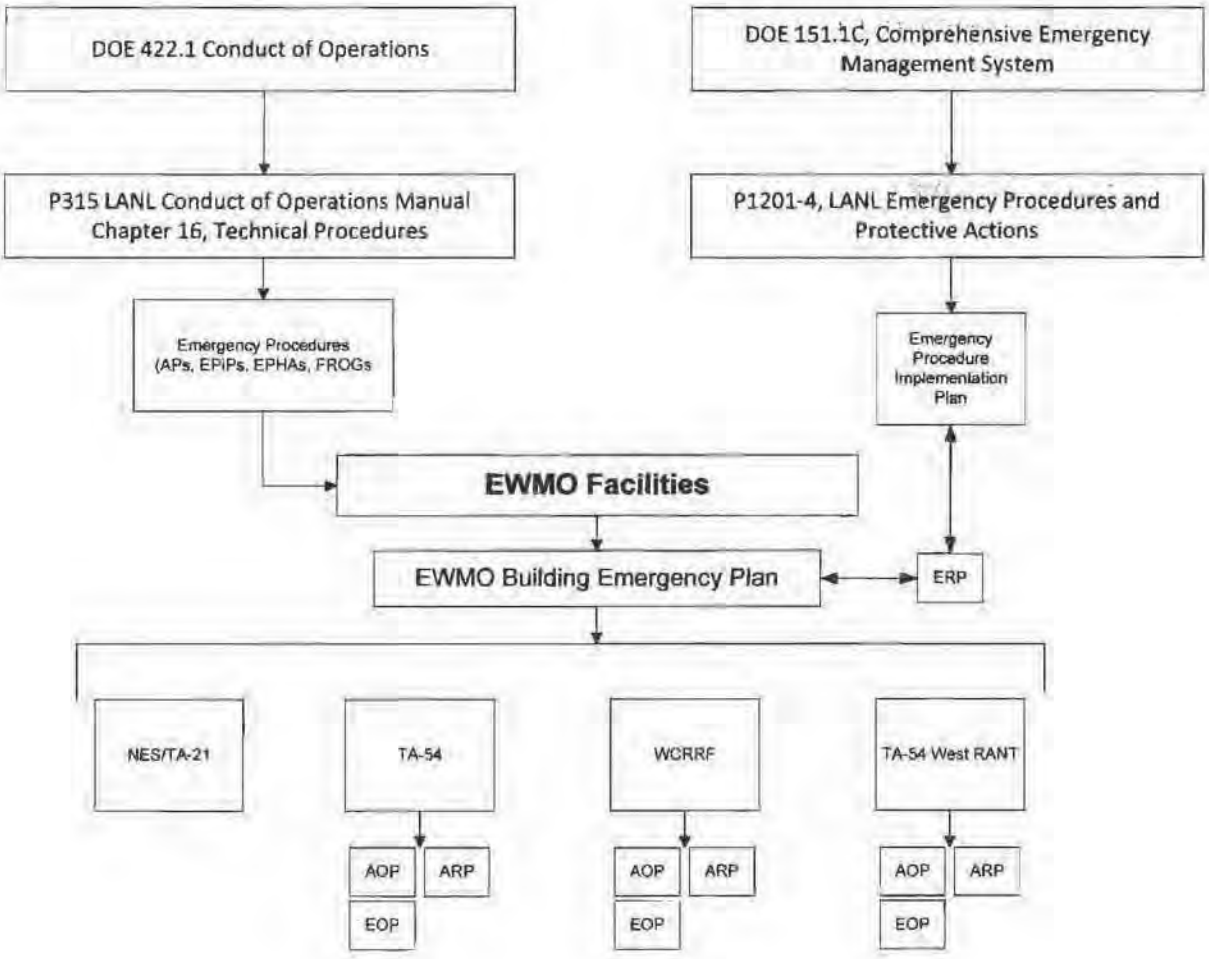
3. OVERVIEW

The EWMO Division BEP plays a key role in the successful implementation of the Site Emergency Management and Response program, Conduct of Operations, and area-specific response procedures for TA-54, WCRRF, RANT, TA-21 and NES. This plan also defines roles and responsibilities that are necessary to ensure that the chain of command is established and to ensure that employees respond correctly and consistently in a safe and timely manner when off-normal/emergency situations arise. Section 5, BEP Requirements, provides the requirements, roles, protective equipment, and standardized responses (i.e., Notification, Off-Normal, and Emergency) for employees working in EWMO facilities. Sections 6 through 10 provide building/area-specific requirements for WCRRF, TA-54, RANT, TA-21 and NES.

3. OVERVIEW (continued)

Figure 1, Emergency Management Process Requirements Flow-down illustrates the requirements derived from Department of Energy to LANL and into the EWMO BEP.

FIGURE 1, EMERGENCY MANAGEMENT PROCESS REQUIREMENTS FLOW-DOWN



4. RESPONSIBILITIES

4.1 First Responder at the Awareness Level

The first responder at the awareness level has the following responsibilities (i.e., first person at the scene of an off-normal/emergency event):

- Stops or suspends work
- Activates the appropriate alarm (i.e., fire, evacuation), as necessary
- Warns others in the immediate area of the off-normal/emergency event
- Secures the incident area to prevent others from entering
- Makes notifications to the Operation Centers, Emergency Operations and Support Center (EOSC) 7-6211, and/or 911 as appropriate

4.2 Shift Operations Manager/Facility Lead (SOM/FL)

NOTE *In EWMO facilities, the Shift Operations Manager (SOM) is the Facility Operations Director (FOD) designee in the field and assumes responsibilities as the Facility Leader (FL). The SOM/FL assumes the role of the FOD in the field. However, an Operations Manager (OM) may also conduct FL duties as long as the OM is trained, qualified, and knowledgeable of the area operations.*

The SOM/FL is the person in charge of the facility during an off-normal/emergency event and/or up until transfer to the Incident Commander (IC).

The SOM/FL has the following responsibilities:

- Coordinates with the Assembly/Muster Area Leader for personnel accountability, condition, and locations
- Ensures that 911 or EOSC 7-6211 has been called as necessary
- Updates the OM/designee of the situation
- Evaluates the event and potential hazards and determines whether additional evacuations are necessary
- Works with support personnel to mitigate the event within the EWMO facility

4.2 Shift Operations Manager/Facility Lead (SOM/FL) (continued)

- Available on-call outside normal working hours including nights, weekends, and holidays when assigned
- Determines appropriate actions for mitigation and notifications during an off-normal event
- Ensures appropriate actions are completed to protect the safety of workers, facility, equipment, records, and the environment
- Authorizes elevation of an off-normal event to an emergency event as necessary
- Makes notifications in accordance with respective response procedure
- Ensures that employees who may need special assistance are identified, and designates personnel to assist these employees
- Ensures accountability of all personnel
- Evaluates the potential hazards and determines the protective actions
- Briefs emergency responders and management personnel during an emergency
- Assists the IC in recovery and reentry efforts
- Transfers command and control to the IC and notifies Operations Center personnel when command and control is transferred

4.3 Incident Commander

Incident Commander is the formal title for the individual who is designated as the person in charge of an emergency response for the Site. This person will be a member of a designated emergency response organization and have completed formal training in emergency management and incident command.

NOTE *The IC will be from one of the formally designated and trained emergency response organizations from the Emergency Operations and Emergency Management (EO-EM), Los Alamos Fire Department (LAFD), SOC, or in unusual cases, from the Federal Bureau of Investigation (FBI) or other Federal agency, and will formally declare that he/she has assumed the IC role.*

- Manages the emergency event until mitigated or transferred back to the SOM/FL
- Authority to call out other response personnel and additional resources
- Assumes the role of IC during an emergency event

4.4 Shift Operations Supervisor

- Assists the SOM/FL to determine appropriate actions for mitigation and notifications during off-normal events
- Serves as a resource for the FL/IC and offsite responders during off-normal/emergency events
- Ensures that actions are initiated to protect the safety of site workers, programmatic equipment, records, and the environment
- Ensures that employees who require special assistance during an emergency are supported

4.5 Operations Center Operator

- Notifies personnel through various communication systems (e.g., E-pagers, public address system, land-line, two-way radio, cell phone, and face to face) on initial off-normal/emergency activities at WCRRF, TA-54, and TA-54 West RANT.
- Notifies adjacent facilities of off-normal/emergency events as applicable
- Facilitates command and control functions under the direction of the SOM/FL until turned over to the IC
- Records and logs initial and ongoing notifications in accordance with this plan
- Acts as a liaison between SOM/FL, IC, and the workers
- Coordinates accounting of personnel at the Assembly/Muster areas
- Assists in directing emergency response personnel and equipment to emergency site/areas
- Monitors the two-way radio base station and the Site Wide Alert Notification System (SWANS) radio
- Maintains a written log of off-normal and/or emergency events in the Operations Center log book
- Ensures that the SWANS radio is operational
- Develops and maintains the Emergency Contact List at the respective Operations Center (Appendices 3, 5, and 8)

4.6 Support Personnel (Environment, Safety, and Health)

The support personnel receive notification from the Operations Center and/or SOM/FL when an off-normal/emergency event arises as necessary.

- Acts a subject matter in their field of expertise (e.g., Industrial Hygiene/Safety) during off-normal/emergency events
- Supports IC or SOM/FL in developing remedial and recovery plans

4.7 Assembly/Muster Area Leader

- Assumes command of Assembly/Muster area
- Collects and gathers information from personnel who were at the incident site
- Liaison between Operations Center and personnel
- Initiates the accountability of personnel
- Makes notification to the respective Operations Center
- Ensures that personnel who may be radiologically contaminated are segregated from the general population
- Delegates tasks as necessary to employees at the Assembly/Muster area during an emergency event
- Directs vehicle traffic on roadways to ensure emergency response vehicles have an open route to the event area as necessary

4.8 Facility Resident

- Notifies Operations Center of off-normal/emergency events
- Notifies EOSC 7-6211 and/or 911 for emergency events
- Responds to off-normal/emergency events in accordance with the requirements of this plan and the facility-specific off-normal/emergency response procedures
- Performs assigned duties from Assembly/Muster Area Leader
- Performs escort responsibilities if assigned

4.9 Visitor

- Responds to alarms and notifications in the event of an off-normal/emergency event
- Stays with their designated escort during off-normal/emergency events

5. BEP REQUIREMENTS

5.1 Site Events

The Laboratory has identified several abnormal/emergency events (e.g., chemical, biological, radiological, fire, security, weather, vehicular accident, and personnel injury) that may affect the general laboratory population, the public, and the environment. These events and their responses are captured in LANL policies and procedures Table 1, General Site Events and References.

NOTE *Unless otherwise recommended or directed by EWMO management, the events listed in Table 2 below provide specific events and the associated reference that contains the response actions.*

TABLE 1, GENERAL SITE EVENTS AND REFERENCES

Bomb threat	P1201-4, LANL Emergency Procedures and Protective Actions
COOP	P1201-4
Fire, Smoke and Explosion	P1201-4
Flood	P1201-4
Hazardous Substance/Chemical Spill	P1201-4
Lightning	P1201-4
Power Outage	P1201-4
Security Concern	P1201-4
Seismic Event (Earthquake)	P1201-4
SIP/Stay Put	P1201-4
Snow and Ice	P1201-4
Suspicious/Unattended Packages	P1201-4
Unexploded Ordnance	P1201-4
Vehicle Accidents	P101-7, Vehicles and Pedestrian Safety
Work Related Injury, Illness	P102-2, Occupational Medicine
Workplace Violence	P724, Workplace Violence

5.2 Facility Specific Procedures

TA-54 and WCRRF Operations Centers maintain controlled copies of the facility-specific response procedures that apply to TA-54, WCRRF, and RANT. Four types of response procedures are used in accordance with P315, Conduct of Operations Manual, Section 16, Technical Procedures.

5.2.1 Abnormal Operating Procedure (AOP)

AOPs provide instructions for responding to events that affect several systems, threaten the safety envelope, or require action to mitigate damage.

5.2.2 Alarm Response Procedure (ARP)

ARPs direct the response of personnel to visible and audible alarms.

5.2.3 Emergency Operating Procedure (EOP)

EOPs provide instructions for responding to events that result in operation outside the safety envelope.

5.2.4 Emergency Response Procedure (ERP)

ERPs provide instructions for responding to an emergency in progress. ERPs include steps or reference other procedures that define the response to additional casualties that could result from the initial event.

5.3 Response Actions

EWMO has developed the following three worker response actions.

5.3.1 Notification Response

The notification response is a notification by the worker of an upset condition. Notification response does not require immediately exiting or evacuating. Once the worker has completed the notification response steps, the SOM/FL and/or support team will provide guidance and protective measures for the worker via the applicable Operations Center.

The notification response action is as follows;

1. **MAKE** Notifications (i.e., Operations Center).
2. **WARN** others.
3. **WAIT** for directions and guidance from the Operations Center and FL/IC.

5.3.1 Notification Response (continued)

The following events have been categorized as requiring a Notification Response:

TA-54 Area G	RANT	WCRRF
• Loss of Electronic Badge Reader • 231 Permacon HVAC LOW Cell D/P • 375 Permacon HVAC LOW Cell D/P • Fire Department Manning Less than 50 Percent	• Loss of Electronic Badge Reader • Fire Department Manning Less than 50 Percent	• Loss of Electronic Badge Reader • Fire Department Manning Less than 50 Percent • WCRRF Loss of Confinement Ventilation System (CVS) • WCRRF Glovebox Fire Suppression Inadvertent Initiation • WCRRF WCG High Pressure Alarms • WCRRF Confinement Ventilation System (CVS) Low Flow Alarms • WCRRF Confinement Ventilation System (CVS) Room 102 High Pressure Alarms • WCRRF CVS HEPA Filter Alarms • WCRRF Confinement Ventilation System (CVS) GBE High Pressure Alarms • WCRRF TE/TI-001 and 002 Low Temperature Alarms • WCRRF Confinement Ventilation System HVA Low Flow Alarm

5.3.2 Off-Normal Response

An off-normal response is an action taken by the worker in a timely manner to ensure they back away from the immediate area (e.g., out of harm's way) until the event can be evaluated and appropriate actions taken to mitigate the situation to prevent it from elevating to an emergency.

The off-normal response steps are:

1. **SUSPEND** work.
2. **WARN** others.
3. **ISOLATE** the immediate area.
4. **MOVE-AWAY** upwind from the area of concern
5. **MAKE** Notifications (e.g., Operations Center and SOS).

Once the worker has performed the off-normal response steps listed above, there are no further actions taken by the worker to mitigate the incident at this time. The SOM/FL and the support team will provide guidance and protective measures to the workers via the applicable Operations Center.

The following list below provides events that have been categorized as response procedures requiring an off-normal response:

TA-54 Area G	RANT	WCRRF
• Discovery of an Airborne, Liquid or Solid Material Release or Spill • Unplanned Loss of Electrical Power • Waste Container • Questionable Integrity • CSLA Non-Compliance	• Discovery of an Airborne, Liquid or Solid Material Release or Spill • Unplanned Loss of Electrical Power • Waste Container • Questionable Integrity • CSLA Non-Compliance	• Discovery of an Airborne, Liquid or Solid Material Release or Spill • Loss of Glovebox Integrity • Unplanned Loss of Electrical Power • Waste Container • Questionable Integrity • CSLA Non-Compliance

5.3.3 Emergency Response

Emergency response actions taken by the operator in the event of an emergency to ensure personnel safety and prompt notification to management and/or Emergency Management. There are no actions taken by the worker to attempt to mitigate the event. Once the worker has performed the emergency response steps listed below, the EOSC, 911, SOM/FL, and the support team will provide guidance and protective measures to the workers via the applicable Operations Center.

The emergency response activities are as follows:

1. **SUSPEND** work.
2. **WARN** others.
3. **ISOLATE** immediate area.
4. **EVACUATE** to an upwind Assembly/Muster area from the incident.
5. **MAKE** Notifications (e.g., SOS, OC, EOSC, 911).

TA-54 Area G	RANT	WCRRF
• EWMO Area Emergency Response	• EWMO Area Emergency Response	• EWMO Area Emergency Response

5.4 Operations Center Response Protocol

Upon entering the abnormal or emergency response procedure (i.e., AOP, EOP, or ERP) the SOM will designate roles and responsibilities (record keeping, log keeping, phones, communications systems) to members of the Operations Center as necessary. The SOM's primary duty during an off-normal/emergency event is to act as the facility leader and overall controller of activities and operations in order to maintain attention to the incident. The response procedure is used to document all event activities (e.g. times, dates, actions) and is a quality record. The OCO logbook is the official logbook that requires documenting the entry into, and exit from, the response procedure and other important non-incident specific information. The SOS and SOM are not required to keep logs during the incident. When a facility enters an ARP, the Operations Center will be notified, but other activities at the facilities will continue normal operations, including the Operations Center, unless deemed otherwise by the SOM.

5.5 Responsibilities Assembly/Muster Areas

Assembly/Muster areas are designated areas for workers and visitors to gather in the event of an emergency or as directed by the SOM/FL.

The Assembly/Muster areas are identified by a large yellow metal box and an orange and white striped wind sock on a pole. Assembly/Muster areas maps for WCRRF, TA-54, RANT, and TA-21 are illustrated in the appendices of this procedure. Assembling/Mustering to a secondary location after initial evacuation if necessary is directed by the Operations Center/SOM/FL and/or the IC.

NOTE *Assembly/Muster area equipment and supplies are inspected weekly in accordance with EP-DIV-DOP-0102, EWMO RCRA Inspections.*

Assembly/Muster areas contain at a minimum the following equipment and supplies for use during off-normal/emergency events:

- A clipboard with roll-call checklists and two-way radio instructions (shown in Appendix 2)
- A copy of the Division Building Emergency Plan
- Assembly/Muster area lead vest (blue)
- Assembly/Muster Area Leader Checklist (instructions for Assembly/Muster Area Leader)
- First aid kit
- Grease pens and pencils
- Instruction card and "Gone to Assembly/Muster area #" card
- Two-way radio
- Wind sock
- Orange vest (for personnel performing traffic control)

The first person to arrive at the Assembly/Muster area during an emergency who is knowledgeable and willing to perform the duties assigned, acts as the Assembly/Muster Area Leader. A checklist is available at each Assembly/Muster area that provides actions to be performed by the Assembly/Muster Area Leader.

5.6 Accountability

Each worker has the primary responsibility to report to the Assembly/Muster Area Leader for accountability.

In EWMO organizations, there are three methods for obtaining personnel accountability during an off-normal/emergency event:

- Badge reader
- Sweep process
- Sign-in sheets at Assembly/Muster areas

The electronic badge reader system records and tracks personnel who enter and exit TA-54 Area G, TA-54 Area L, RANT, and WCRRF. If a situation arises where personnel accountability is required, the applicable Operations Center can generate a personnel accountability report from the badge reader system which provides a list of personnel currently logged into a specific area (e.g., TA-54 G, L, RANT, and WCRRF).

The sweep process is used primarily in administration areas and other areas that do not possess an electronic accountability system. When personnel are required to evacuate, each person will perform a visual sweep and verbal communications (e.g., is anyone here? the area is being evacuated) for personnel in the exit route out of the building. The last person to egress the facility will provide personnel accountability information to the Assembly/Muster Area Leader. Once employees assemble at the Assembly/Muster areas, they will complete a sign-in sheet/roster to document their location.

In all three methods, personnel not accounted for will be communicated to the FL/IC.

5.7 Protective Actions

5.7.1 Shelter-In-Place (SIP)

SIP means to make a shelter where workers are currently located. It is a method to protect occupants until help arrives or otherwise directed by Operations Center and FL. This type of sheltering is for hazardous material events (chemical, biological, radiological). Taking cover in any building will provide some shelter, and is safer than staying outside and potentially receiving a greater exposure to the hazard. Personnel are instructed to remain inside and follow instructions from the SOM/FL or IC. SIP is a temporary protective action and is short-term (1 to 3 hours) until the hazardous situation has passed, and the "All Clear" has been announced. The SOM/FL or IC will make the decision to SIP. Notifications will be communicated via one or more of the following: Public Address system, two-way radio, e-pagers, cell phones, and/or face to face.

General guidelines to SIP include:

- If a SIP kit is not available: assign workers to shut all windows (if any), doors, and assemble in a location away from windows and doors (hallway) for SIP
- Turn building thermostats off to stop outside airflow into building
- Conduct accountability and report results to respective Operations Center/FL/SOM
- Remain in shelter location until the Operations Center/FL/SOM informs personnel it is safe and the sheltering order has been lifted

5.7.2 Stay-Put

The type of sheltering utilized most often by the LANL population is Stay-Put sheltering. Stay-Put sheltering is the protective action used during non-hazardous material events (terrorism event, inclement weather, wild fire). This protective action calls for personnel to move or remain indoors due to an event that may place personnel in harms way outside. Examples of these events are wild land fire, a terrorism event, or inclement weather. The SOM/FL or IC will make the decision to Stay-Put.

Recommended actions to Stay-Put include:

- Stay inside
- Notify building personnel and visitors of the protective action and information about the event (if provided)
- Contact the applicable Operations Center and provide personnel status and accountability

5.7.3 Lightning

If lightning is sighted, employees **SHALL** use the 30/30 rule:

- Seek shelter if lightning is within 6 miles (flash to bang count is 30)
- Move away from any metal objects and grounding system components
- Do not remain upright in an open area or seek shelter near tall, upright objects (trees), take cover in a vehicle or building
- Shelter for at least 30 minutes after the last lightning strike within 6 miles

5.8 Chain of Command Process

The chain of command is the process that identifies positions, roles, and responsibilities for those individuals who are designated and authorized as the person-in-charge during an off-normal/emergency event.

The FL (e.g., SOM, OM) directs the initial command and control during an Off-normal/emergency event. The SOM/FL is a person who possesses the experience and knowledge associated with the area to lead the facility management and workers in an off-normal/emergency response and/or until relieved by the Site IC. An IC will be a designated Emergency Management person who responds as the individual authorized by the institution with the authority and responsibility for command and control at the incident scene.

When the responsibility for command and control is transferred to the IC, the SOM/FL remains available to the IC for area-specific technical support and assistance. A formal transfer of duty from the SOM/FL to the IC is required in a timely manner. Transferring command and control back to the SOM/FL is also a formal process. The level of formality is based upon the severity level of the event.

EWMO utilizes the Operations Center model at WCRRF and TA-54 as part of the EWMO organizational structure which acts as a liaison between LTP management, Facility Lead, IC, Emergency Operations and Emergency Management (EO-EM), and the workers. The TA-54 and WCRRF Operations Centers are staffed during normal operations. The notification process for off-normal hours is performed through the EWMO on-call list and Emergency Operations and Support Center (EOSC) 7-6211.

5.8 Chain of Command Process (continued)

Figure 2, Chain of Command Model

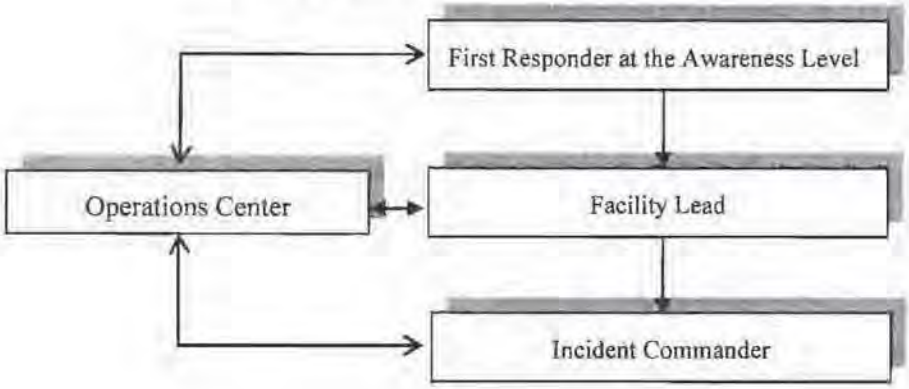
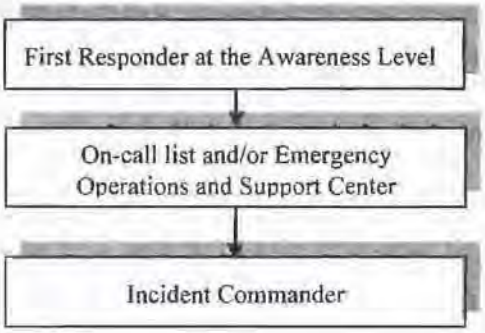


Figure 3, Chain of Command Model Off-Hours



5.9 EWMO Communication Equipment and Warning Systems

EWMO maintains a variety of communication equipment and warning systems to effectively communicate with personnel and emergency responders when off-normal/emergency situations arise.

Cell Phones – Cell phones may be used for notifying the applicable Operations Center, EOSC 7-6211, and 911. Cell phones may also be set-up to receive emergency text messages the same as E-Pagers. If cell phones are used to contact 911, callers must communicate their location and the location of the event. Cell phones are a primary means of communication during an off-normal/emergency event.

Conventional Telephones – Conventional telephones may be used to notify the Operations Center, EOSC, and 911 in the event of an off-normal/emergency event.

5.9 EWMO Communication Equipment and Warning Systems (continued)

Continuous Air Monitor (CAM) – CAMs are used in areas that require continuous air monitoring for radiological airborne contamination. If radiological airborne contamination reaches the pre-determined level, the CAM will produce an audible and visual alarm warning personnel that radiological airborne contamination is present thus requiring personnel not wearing respiratory protection to exit the area and follow the instructions of a supporting Radiological Control Technician (RCT).

E-Pagers – E-pagers are electronic devices set-up to receive text messages from a variety of sources (e.g., LANL phone book, LAN line, EOSC) for the purposes of communicating general information to employees. E-Pagers are limited to 140 characters. E-pagers can also be set-up to receive broadcast emergency messages from Operations Center and LANL.

Evacuation Alarm – The evacuation alarm provides an audible alarm that can be heard throughout the area to alert workers to evacuate to the nearest upwind Assembly/Muster areas. An evacuation alarm system is available at TA-54 Area G, L, and the Administrative area, and an additional independent system for the RANT complex. The evacuation alarm can be activated from several locations as illustrated on Appendix 7, TA-54 Area G Evacuation Alarm Button Locations, and Appendix 10, RANT Evacuation Alarm Button Locations. Any worker who determines an emergency situation that endangers all workers in the area can activate the evacuation alarm. The evacuation alarm is a local alarm, and is not connected to Central Alarm Systems (CAS).

Fire Alarms – Fire alarm systems and warning devices are engineered for facilities and a structure's specific needs (e.g., sprinkler head, heat sensors, and manual pull station). Fire alarms emit an audible long whooping tone that warns personnel in the immediate area to evacuate to the nearest upwind Assembly/Muster area and the alarm transmits and signals to CAS. See Sections 6, 7, and 8 for area-specific fire system information.

Conventional Phones – Land lines can be used for communicating off-normal and emergency information to the Operations Center, EOSC, and 911.

PA System – Public address systems are installed in the TA-54 and RANT facilities to provide a means for broadcasting audio communication to employees for off-normal/emergency events. Use of the PA for non-emergency announcements SHALL require approval from the Operations Center and the SOM.

5.9 EWMO Communication Equipment and Warning Systems (continued)

Two-Way Radios –Two-way radios are another method to communicate between Assembly/Muster areas, SOS, Operations Center, SOM/FL and EOSC. Each Assembly/Muster area is equipped with a two-way radio.

Site Wide Area Notification System (SWANS) Radio – The SWANS Radio is a LANL-wide emergency radio system designed primarily as a back-up communication system in the event normal communication systems are diminished or unavailable. SWANS radios are monitored in the Operations Center. Instructions for proper testing and operation are listed in Appendix 2, Site Wide Area Notification System (SWANS).

Wind Sock – Wind socks are placed strategically placed throughout LANL site to provide a visual means for employees to determine the wind direction. There are two different colors schemes. Wind socks that are solid orange are placed throughout the site in areas that are populated with workers that would require a reference point to determine wind direction. Wind socks that are orange with white strips denote the location of an Assembly/Muster area. Wind socks are especially important when an abnormal/emergency event occurs which requires employees to quickly determine wind direction for the purposes of staying upwind from the event to prevent unnecessary exposure to potential hazardous materials.

5.10 Support Personnel

Support personnel are subject matter experts (SMEs) in their field who assist the SOM/FL or IC during an off-normal/emergency event as necessary.

The following personnel groups may support the FL/IC in an off-normal/emergency event:

- Industrial Safety and Hygiene
- Radiological Protection

Additional organizations that may provide assistance:

- Criticality Safety Officer
- Criticality Safety Engineer
- Emergency Management
- Engineering
- Environmental
- Hazardous Waste
- Maintenance
- On-Site Transportation
- Operations Manager
- Security
- Utilities
- Waste Coordinator

5.11 Emergency Access Control

During an emergency, saving life **SHALL** take precedence. Emergency personnel **SHALL** be allowed to enter the area without delay. Personnel **SHALL** not leave the incident area unless directed to do so by the IC.

5.12 Adjacent Facilities

Off-normal/emergency events have the potential to impact adjacent facilities (e.g., response vehicles, road closures). Notification to adjacent facilities will normally be accomplished by the Operations Center, SOM/FL and/or the EOSC.

5.13 EWMO Abnormal Event Notification Process

The first communication is defined as Initial Notification. During an off-normal/emergency event, the initial notification from the first responder (awareness) to the respective Operations Center and/or 911 initiates the process. The Operations Center will in turn notify the Shift Operations Manager.

The SOM/FL is responsible for notifying the Operations Manager who in turn will at a minimum notify the FOD, ES&H Manager, and the Project Manager as necessary.

Communications up the chain of command are required in accordance with P322-3 and with directorate-level reporting requirements as described in SOP-5228, ADEP Reporting Requirements for Abnormal Events.

5.14 Recovery Plan

The recovery plan is a process to determine actions required to return the facility/area to normal operations. The Recovery Manager will develop the requirements for resuming normal operations. A graded approach to the level of formality should be applied based upon the type of event/incident and hazards involved; extent of damage to facility, equipment, and environment; cause of the emergency/event; and actions required to prevent a re-occurrence. For an off-normal event, the SOM/FL has the authorization to return operations to normal. If the event is considered an emergency event, reentry and return to normal operation **SHALL** be at the discretion of the IC.

5.14 Recovery Plan (continued)

If the Duty Emergency Manager has categorized the emergency as an Operational Emergency, reentry and return to normal operations will be at the discretion of the Emergency Director at the EOSC. The FOD will generally be appointed as the Recovery Manager for returning the facility to normal operations.

When an emergency is over, then the IC will declare that the emergency has ended and direct that the "All Clear" be announced.

- Only the IC may declare an emergency is over
- Each Assembly/Muster area may be released individually
- Some Assembly/Muster areas may be released prior to others if the hazards are localized
- Assembly/Muster area **SHALL** be released only if the release will not endanger personnel or present problems for mitigating the situation

Each event will be evaluated independently for reentry and return to normal operation. Under no circumstances are personnel authorized to reenter the affected area, in an emergency unless given the "All Clear" by the IC.

An off-normal/emergency event **SHALL** not be considered over when an alarm is silenced or acknowledged.

6. WCRRF SPECIFIC REQUIREMENTS

The WCRRF Operations Center is the access control point for entry to WCRRF Building TA-50-69 and WCRRF 50-69 yard.

Assembly/Muster Areas
The Assembly/Muster areas are illustrated on Appendix 4, WCRRF Assembly/Muster Area Locations.

Fire Alarms – WCRRF Building TA-50-69 is equipped with automatic fire suppression and manual pull stations to notify personnel of a fire. The automatic and manual stations are connected to the Digital Alarm Communication System (DACS) which in turn will communicate the alarm with the Central Alarm Station (CAS). There is one DACS panel for Building TA-50-69: Fire Alarm Control Panel DACS 1522 (-1).

Fire alarm manual pull stations are distinctive red metal boxes mounted on walls inside Building TA-50-69. In the event of a fire or explosion, personnel should activate the manual fire alarm pull stations and call 911 and the WCRRF Operations Center at 665-2797, or the Maintenance on Call (MOC) pager 500-6965 (after hours). When an automatic or manual fire manual pull station is activated at WCRRF, the LAFD is automatically notified of the location. The WCRRF Operations Center will notify personnel of the situation using one or more of the communication systems (Public address, two-way radio, e-pagers, cell phones, and/or face to face).

Additional requirements when an off-normal or emergency event occurs:

- If wearing a respirator, do not attempt to remove the respirator until given direction by a RCT.
- If working with classified or sensitive material, and the area is established as a Temporary Limited Area, and if safe to do so, cover up the material prior to exiting the facility, and inform the Assembly/Muster Area Lead and Supervisor of the situation.
- When working in a facility/structure that is designed with a Confinement Ventilation System (e.g., TA-50-69) for the purpose of maintaining a negative differential pressure, employees **SHALL** ensure that one set of personnel airlocks remains closed upon exiting
- If working in a radiological controlled area during an off-normal event, follow the instructions of an RCT.
- During an emergency event, all personnel who may be potentially contaminated should not commingle with other personnel at the Assembly/Muster area prior to being surveyed by an RCT.

7. TA-54 SPECIFIC REQUIREMENTS

TA-54 consists of the TA-54 Administrative Area, and Areas G, H, J, and L. RANT complex is known as TA-54 West RANT and is described in Section 8, RANT Specific Requirements.

The TA-54 Operations Center is the access point for Area G is located at the entrance of the TA-54 Area G Controlled Area TA-54-315, Room 105). The Operations Center is staffed during day shift (0700) to 1730 hours). The Operations Center may be staffed to support after-hour activities as determined by management. The TA-54 Operations Center maintains a phone number for regular business activities at extension 665-2735. When notifying the TA-54 Operations Center of an abnormal/emergency event the following number **665-1288 SHALL** be used. The Operations Center will ensure this phone number receives priority over all other calls.

TA-54 maintains a database of the hazardous constituents contained within the waste at TA-54 Area G. The database is accessible from the Waste Services group and the Information Management group. Emergency Planning and Preparedness maintains Building Run Sheets that contain limited information on hazardous material inventories for the FL/IC and emergency responders.

The fire alarms are zoned into five areas, which operate independently.

TABLE 2, DACS IN TA-54

Zone 1, Fire Alarm Control Panel DACS 6148(-1) (located in 54-48)	Structures 54-48, 54-229, 54-230, 54-231, 54-232, 54-289
Zone 2, Fire Alarm Control Panel DACS 6146(-1) (located in 54-412)	Structure 54-412
Zone 3, Fire Alarm Control Panel DACS 6149(-1) (located in 54-11)	Structures 54-2, 54-11, 54-33, 54-49, 54-153, 54-224, 54-273, 54-283, 54-287, 54-302, 54-321, 54-322, 54-323, 54-375, 54-491, 54-1027, 54-1028, 54-1030, 54-1041,
Zone 4, Fire Alarm Control Panel DACS 6147(-1) (located in 54-51)	Structures 215 (Area L), Admin. Bldgs: 54-22, 54-37, 54-51, 54-60, 54-64, 54-244, 54-245, 54-246, 54-247, 54-290, 54-434, 54-1050,
Zone 5, Fire Alarm Control Panel DACS 6144 (-1), Structure 54-38	Structures 54-38

7. TA-54 SPECIFIC REQUIREMENTS (continued)

Building 54-532 and 54-533 do not have fire alarms. Areas J and H do not possess automated fire alarms systems.

Additional TA-54 requirements during an off-normal or emergency event

- If wearing a respirator, do not attempt to remove the respirator until given direction by the RCT.
- The location of the safe zone may vary depending on whether the event is inside or outside the facility.
- If working in a radiological controlled area during an off-normal event, follow the instructions of an RCT.
- During an emergency event, all personnel who may be potentially contaminated should not commingle with other personnel at the Assembly/Muster area prior to being surveyed by a RCT.
- If working with classified or sensitive material, and the area is established as a Temporary Limited Area, and if safe to do so, cover up the material prior to exiting the facility, and/or inform the Assembly/Muster Area Lead of the situation.
- When working in a facility/structure that is designed as a contamination control enclosure (e.g., TA-54-412 Tent, TA-54-231 PermaCon, and TA-54-375 PermaCon), employees **SHALL** ensure that all doors to the contamination control enclosure remain closed upon exiting.

TA-54 is divided into eight response zones that correspond to locations where the fire alarm was initiated or activated (see Appendix 6). Emergency response zones were developed because of the size of the work areas at TA-54, thus allowing the worker to exit to the nearest upwind Assembly/Muster Area and to provide pertinent information to the TA-54 Operations Center for the zone in which the alarm was activated.

Area G Controlled Area Domes Buildings Structures	Zones I – IV
Area G Operations Center	Zone IV
Main Administrative Area	Zone V
Area L Storage Yard	Zone V
Building 54-532 and 54-533	Zone VI
Area between Area J and Building 54-533	Zone VI
Area J and Area H	Zone VII
Radioassay and Nondestructive Testing Facility (RANT)	Zone VIII

Other Alarms – TA-54 Area G maintains additional alarms (such as Tritium, O2, low flow) in certain areas that warn personnel in the immediate vicinity.

8. RANT SPECIFIC REQUIREMENTS

RANT is equipped with an Evacuation Alarm system that may be activated from several strategic locations in the RANT facility for the purpose of alerting all employees to evacuate to the nearest upwind Assembly/Muster area (see Appendix 9, RANT Assembly/Muster Area Locations). This alarm is not connected to the CAS.

Additional requirements at RANT during an off-normal or emergency event:

- Workers in a facility/structure that is designed with ventilation (e.g., TA-54-38) for the purpose of personnel comfort (heating, cooling) **SHALL** ensure that exterior doors of the facility are closed upon exiting during an off-normal event.
- Alarms are considered actual unless notified by TA-54 Operations Center or Facility Lead.
- Personnel who are trained and qualified to use fire extinguishers may attempt to mitigate small incipient fires.
- If working in a radiological controlled area during an off-normal event, follow the instructions of an RCT.
- During an emergency event, all personnel who may be potentially contaminated should not commingle with other personnel at the Assembly/Muster area prior to being surveyed by an RCT.

Fire Alarm System – RANT Building TA-54-38 is equipped with automatic fire suppression and manual pull stations in the event a fire develops. The automatic and manual stations are connected to Digital Alarm Communication System (DACS) which in turn will communicate the alarm with Central Alarm Station (CAS). There is one DACS panel for Bldg. TA-54-38: Fire Alarm Control Panel DACS 6144 (-1).

Fire alarm manual pull stations are distinctive red metal boxes mounted about 4 feet above the ground on walls inside Building TA-54-38. In the event of a fire or explosion, personnel should activate the manual fire alarm pull stations and notify 911 and call either the TA-54 Operations Center at **665-1288**, or the Maintenance on Call (MOC) pager **500-6965** (after hours). The TA-54 Operations Center maintains a phone number for regular business activities at extension **665-2735**. When an automatic or manual pull station is activated at RANT, the LAFD is automatically notified of the location. The TA-54 Operations Center will notify personnel of the situation using one or more communication systems (Public address, two-way radio, e-pagers, cell phones, and/or face to face).

9. TA-21 SPECIFIC REQUIREMENTS

TA-21 is a secured and locked area. Access and work activities are controlled through the TA-64 Operations Center. Any work conducted at TA-21 will be performed under an approved Integrated Work Document (IWD). The IWD at a minimum **SHALL** identify the following requirements for personnel entering and/or conducting work activities at TA-21:

- Assembly/Muster station locations
- Process for accountability of personnel in an abnormal/emergency event
- Type of communications systems (e.g., two-way radio, cell phones)

The following types of activities are conducted at TA-21 under an approved IWD

- Maintenance of lights on water towers
- PMIs
- Stormwater/Pollution Prevention
- Vegetation control
- Water/Air Quality activities

10. NES SPECIFIC REQUIREMENTS

Any work conducted at Nuclear Environmental Sites will be under an approved Integrated Work Document (IWD). The IWD at a minimum **SHALL** identify the following requirements for personnel entering and/or conducting work activities at NES:

- Assembly/Muster station locations
- Process for accountability of personnel in an abnormal/emergency event
- Type of communications systems (e.g., two-way radio, cell phones)

11. TRAINING

Workers will be trained to the information in this BEP as determined by analysis to be commensurate with their job, access, and duty requirements.

12. RECORD PROCESSING

None

13. REFERENCES

EP-DIV-DOP-0102, EWMO RCRA Inspections

P101-7, Vehicles and Pedestrian Safety

P102-2, Occupational Injury and Illness reporting and Investigation

P201-3, Reporting Known and Potential Incidents of Security Concern

P315, Conduct of Operations Manual

P322-3, Performance Improvement for Abnormal Events

P724, Workplace Violence

P1201-4, LANL Emergency Procedures and Protective Actions

SOP-5228, ADEP Reporting Requirements for Abnormal Events

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DEFINITIONS AND ACRONYMS

Definitions

Assembly Muster Station – A designated rallying point away from the work area equipped with communication equipment and first aid supplies. Personnel evacuate to the upwind Assembly/Muster areas in response to emergency situations.

Chain of Command – The chain of command is the formal process of establishing authority to manage an off-normal or emergency event.

Controlled Area – Any area to which access is controlled in order to limit access of the general public to radiation and radioactive materials. A Controlled Area is an area in which elevated radiation and/or contamination levels may exist as a consequence of routine or non-routine site operations.

Emergency Management & Response – A Laboratory organization tasked with directing and coordinating response actions to emergencies throughout the Laboratory.

Emergency Management Group – A Laboratory organization tasked with directing and coordinating response actions to emergencies throughout the Laboratory.

Emergency Operations and Support Center – LANL's Emergency Operations Center (EOC) runs the 24/7 Emergency Operations Support Center staffed by communications specialists and on-call emergency managers, LANL personnel can call the Center for assistance with or information about all non-life-threatening situations that involve off-normal or unusual circumstances.

Facility Leader – The FL is the TA-54 Facility person in charge of emergency operations until transferred to the incoming IC.

First Responder at the Awareness Level – The first person to become aware of an abnormal/emergency event.

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DEFINITIONS AND ACRONYMS

Incident Commander – A trained and qualified emergency professional from emergency management, SOC Los Alamos (the Laboratory's protective force), Los Alamos County Fire Department, Los Alamos County Police Department, or other federal authority having jurisdiction that takes command and control of the event.

Stay-Put – The type of sheltering utilized most often by the LANL population is stay-put sheltering. Stay-put sheltering is the protective action used during non-hazardous material events. This protective action calls for personnel to move or remain indoors due to an event that puts personnel in harm's way outside. The SOM/FL or IC will make the decision to Stay-Put.

Shelter-in-Place – A protective action taken by personnel to isolate themselves from a hazard.

Spill – An intentional or unintentional release of oil, PCBs, liquid hazardous substances, or liquid radioactive substances to the environment that is not permitted under Laboratory, state, or federal permits.

APPENDIX 1
Page 3 of 3

DEFINITIONS AND ACRONYMS

Technical Area 54 – Technical Area 54 is comprised of process and administrative support areas. Contained in TA-54 are the following Area G, H, J, L, 54 Administrative areas, and RANT complex.

Visitor – Any individual, including Laboratory employees or subcontractors, who requires access to RANT but does not have authorized access to the specific area he/she wishes to enter.

Acronyms

A/MAL	Assembly/Muster Area Lead
BEP	Building Emergency Plan
CAM	Continuous Air Monitor
CAS	Central Alarm Station
EO-EM	Emergency Operations and Emergency Management
EOSC	Emergency Operations and Support Center
EWMO	Environmental Waste Management Organization
FL	Facility Leader
FOD	Facility Operations Director
IC	Incident Commander
IS&H	Industrial Safety and Hygiene
LAFD	Los Alamos Fire Department
LAPD	Los Alamos Police Department
LTP	LANL TRU Programs
NES	Nuclear Environmental Sites
OCO	Operations Center Operator
OM	Operations Manager
PA	Public Address
RANT	Radioassay and Nondestructive Testing Facility
RCT	Radiological Control Technician
SIP	Shelter in Place
SP	Stay-Put
SOM	Shift Operations Manager
SWANS	Site Wide Alert Notification System
TA	Technical Area
WCRRF	Waste Characterization, Reduction, and Repackaging Facility

APPENDIX 2
Page 1 of 2

SITE WIDE AREA NOTIFICATION SYSTEM (SWANS)

Radio Instructions

The Site Wide Area Notification System (SWANS) Radio is a LANL-wide emergency radio system for the purpose of back-up communications, in the event normal communications protocols are diminished or not available. Emergency Operations and Emergency Management (EO-EM) monitors the SWANS frequency during normal working hours. The Central Alarm Station (CAS) monitors the frequency continuously.

WARNING

Do not use the SWANS Radio instead of calling 911. Always call 911 first if needed.

To Contact Emergency Operations and Support Center

[1] **TURN** up the volume.
[2] **DEPRESS** the Push-To-Talk button.
[3] **SPEAK** after the solid tone ends.
[4] **SAY**, "EOSC, EOSC, this is [*your name*] at TA-__, Building____."
[5] **LET GO** of the Push-To-Talk button to hear response.
[6] **IF** evacuation to an Assembly/Muster area is necessary,
THEN the Operations Center will take the SWANS radio.

Daily Monitoring with the SWANS Radio (Operations Center)

[1] **LEAVE** radio turned on and sitting in charger and on Channel 1.
[2] **ENSURE** the volume is turned up enough to hear radio traffic.
[3] **IF** you receive an alert tone (4 beeps, pause, 4 beeps, continuously)
THEN:
  [A] **PRESS** the Push-To-Talk button to stop the alert tone.
  [B] **TURN** the volume up.
  [C] **FOLLOW** the directions that are given on the radio.
  [D] **RELAY** message as applicable.
  [E] **IF** your building or organization is addressed directly,
  THEN respond immediately.
[4] **IF** you return to the office and hear an alert tone,
THEN:
  [A] **PRESS** the Push-To-Talk button to stop the alert tone.
  [B] **CONTACT** EOSC by radio or phone (7-6211).
  [C] **INFORM** EO-EM the alert tone was sounding on your radio, and they will relay the alert tone message.

APPENDIX 2
Page 2 of 2

Radio Testing Instructions

Use of the Orange Panic Button

If the orange panic button located on the top of the radio is pushed, EOSC will try to call you on the radio. If there is no response, EOSC will try to call you on the phone. If there is still no response, the duty Emergency Manager will respond to your location.

Testing and Maintenance

[1] **PERFORM** a radio check once a week by calling EOSC and saying, "TA---____Facility to EOSC, radio check"

[2] **CALL** EOSC at 7-6211 if you have any problems with the radio. (A warbling tone may indicate the battery is failing)

[3] **IF** you are getting excessive static or poor reception,
THEN notify EOSC so a test can be run.

WARNING

Use the orange panic button for extreme emergency only.

Two-Way Radio Instructions

[1] **TURN** the radio on.

[2] **SWITCH** the radio to Channel 1.

[3] **PRESS** the button on the side of the radio to transmit.

[4] **ESTABLISH** contact with the Operations Center. Speak slowly and clearly.

[5] **IF** you do not receive an immediate response,
THEN remain calm and **REPEAT** steps [3] and [4].

[6] **WHEN** contact is established,
THEN transmit your name and location AND **WAIT** for the Operations Center to ask for additional information.

[7] **UPON** request from the Operations Center,
THEN transmit the names and condition of personnel at your location. Only relevant and essential information should be given.

APPENDIX 3
Page 1 of 1

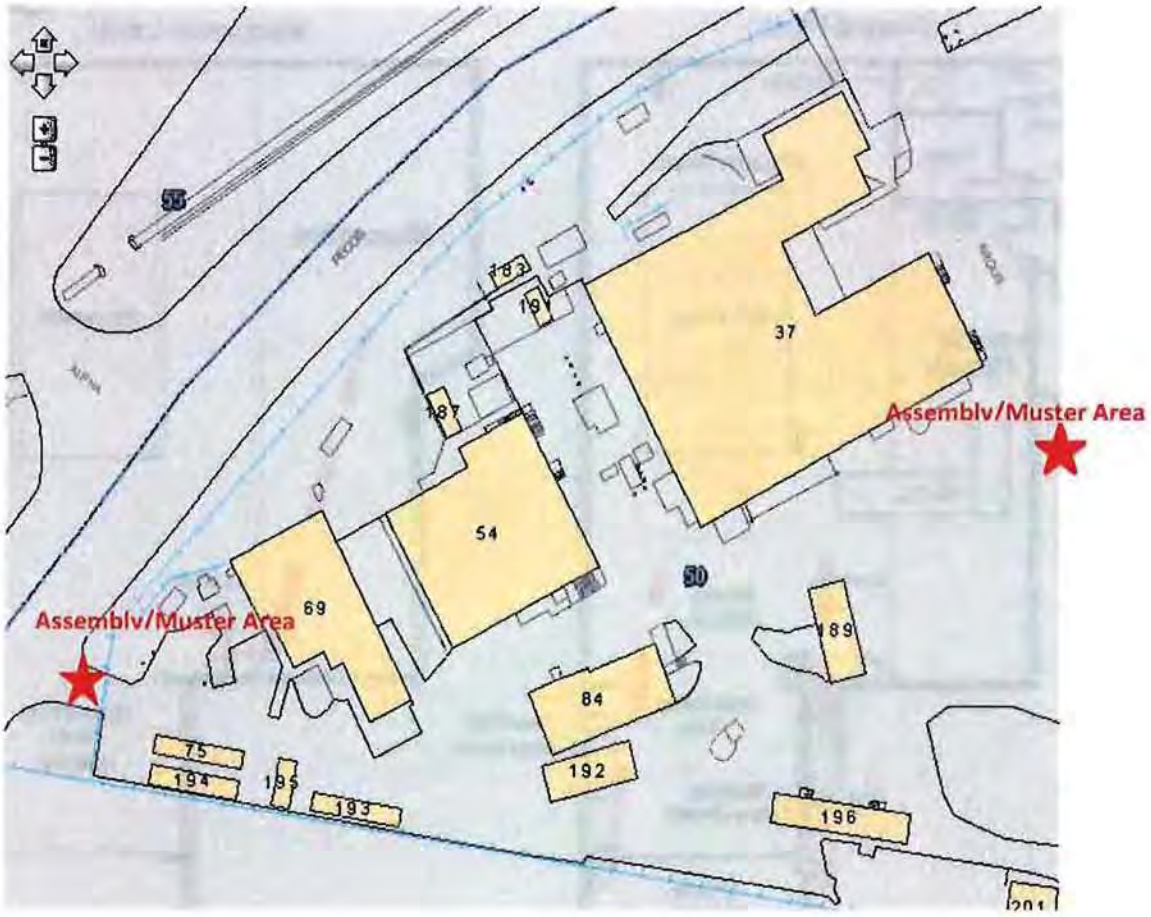
WCRRF TA-50-69 EMERGENCY CONTACT LIST

Organizations
Emergency Operations Support Services 7-6211
Engineering
Environmental
EWMO FOD
Fire/Ambulance
Fire Protection Engineer
Industrial Safety/Hygiene
Maintenance Manager
On-call list
Occupational Medicine Nurse's Station
Operations Manager
Radiation Protection
RP Supervisor
Security
Shift Operations Manager
Site Services Subcontractor (EnergySolutions)
Transportation
Utilities
Waste Coordinator
*Surrounding facilities contacts

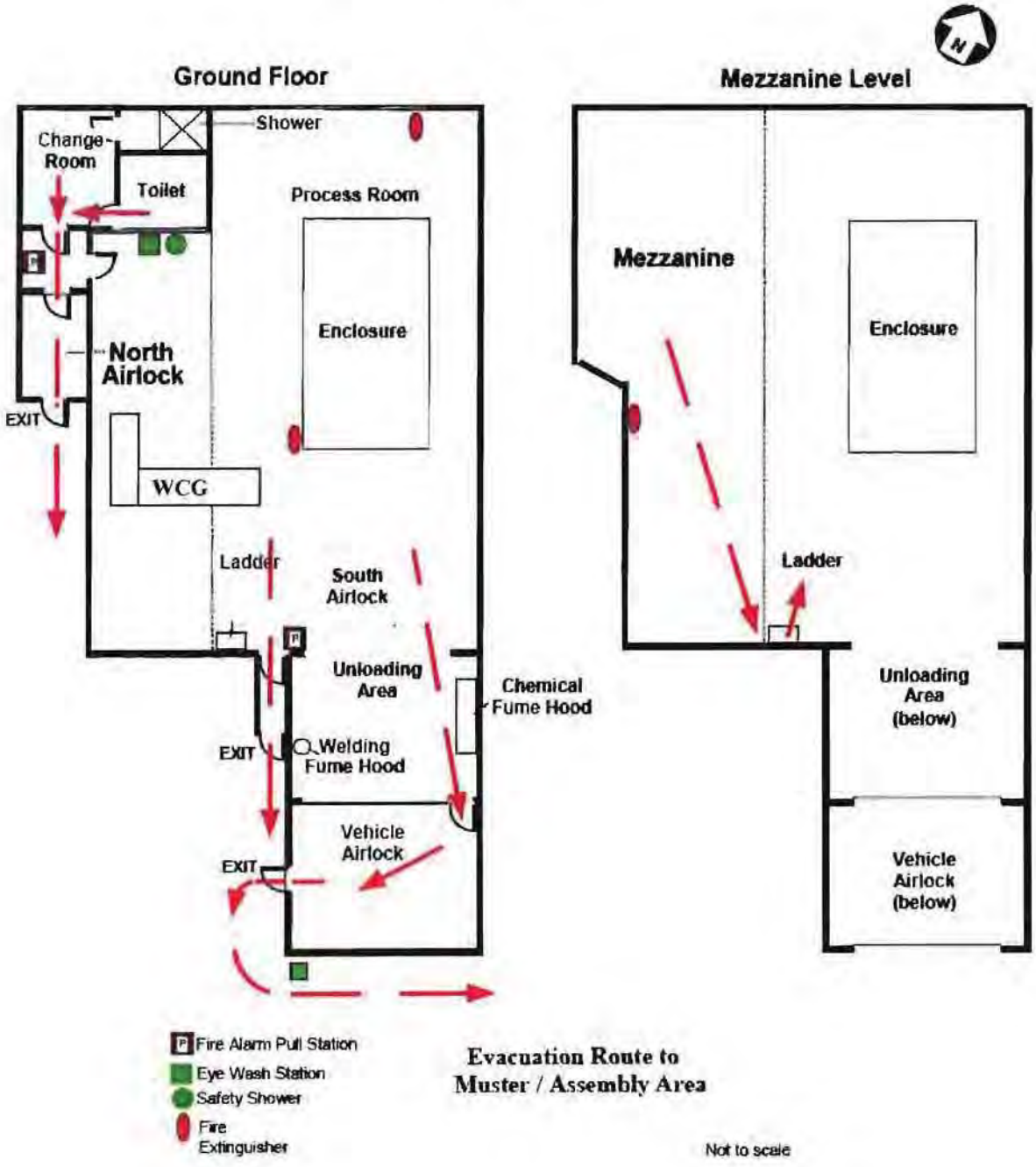
* Identify surrounding facilities for performing notifications of an off-normal/emergency event

APPENDIX 4
Page 1 of 2

WCRRF ASSEMBLY/MUSTER AREA LOCATIONS



APPENDIX 4
Page 2 of 2



APPENDIX 5
Page 1 of 2

TA-54 AND RANT EMERGENCY CONTACT LIST

Organizations
Emergency Operations Support Services 7-6211
Engineering
Environmental
EWMO FOD
Fire Protection Engineer
Fire/Ambulance
Industrial Safety/Hygiene
Maintenance Manager
On-call list
Occupational Medicine Nurse's Station
Operations Manager
Radiation Protection
RP Supervisor
Security
Shift Operations Manager
Shift Operations Supervisor
Transportation
Utilities
Waste Coordinator
LTP-SOS
HMLW
Site Services Contractor
Operations Center SOS
*Surrounding facilities contacts

* Identify surrounding facilities for performing notifications of an off-normal/emergency event

APPENDIX 5
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TA-54 AND RANT EMERGENCY CONTACT LIST

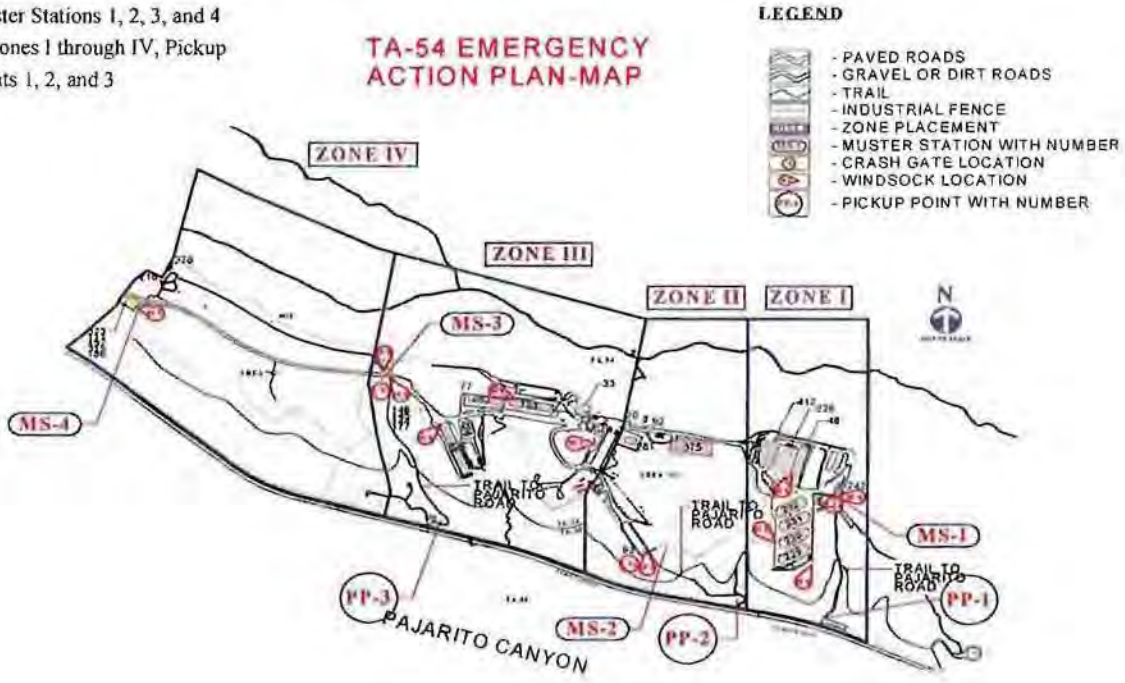
Organizations
Emergency Operations Support Services 7-6211
Engineering
Environmental
EWMO FOD
Fire/Ambulance
Fire Protection Engineer
Industrial Safety/Hygiene
Maintenance Manager
On-call list
Occupational Medicine Nurse's Station
Operations Manager
Radiation Protection
RP Supervisor
Security
Shift Operations Manager
Shift Operations Supervisor
Transportation
Utilities
Waste Coordinator
*Surrounding facilities contacts

* Identify surrounding facilities for performing notifications of an off-normal/emergency event

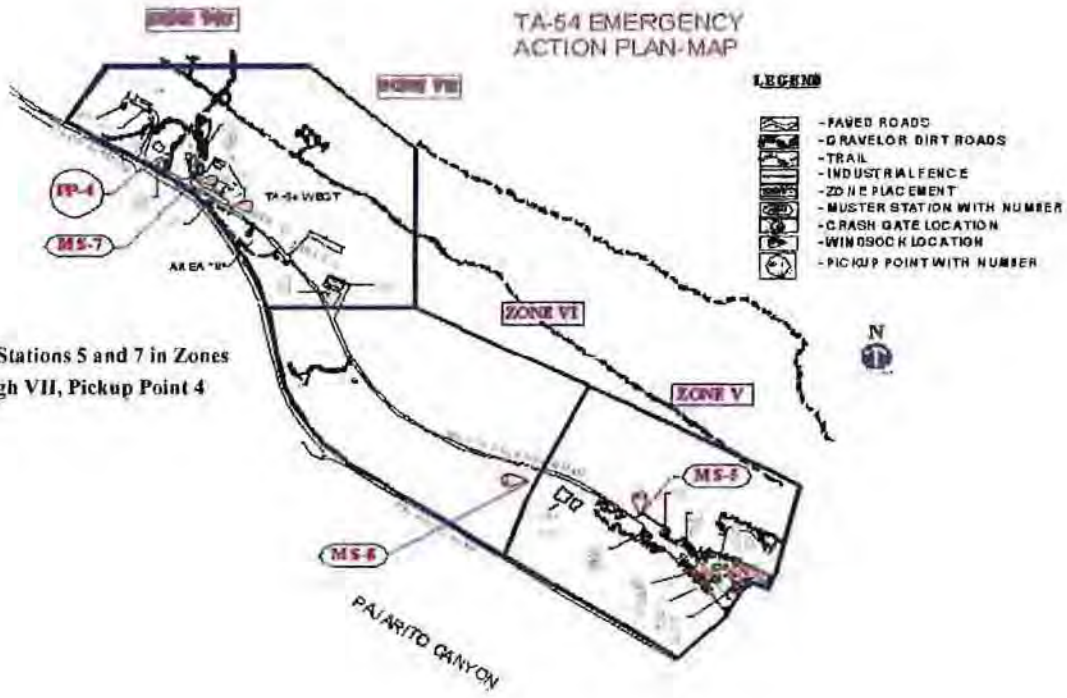
APPENDIX 6
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TA-54 ZONE BORDERS, PICKUP POINTS, AND ASSEMBLY/MUSTER AREA LOCATIONS

Muster Stations 1, 2, 3, and 4 in Zones I through IV, Pickup Points 1, 2, and 3



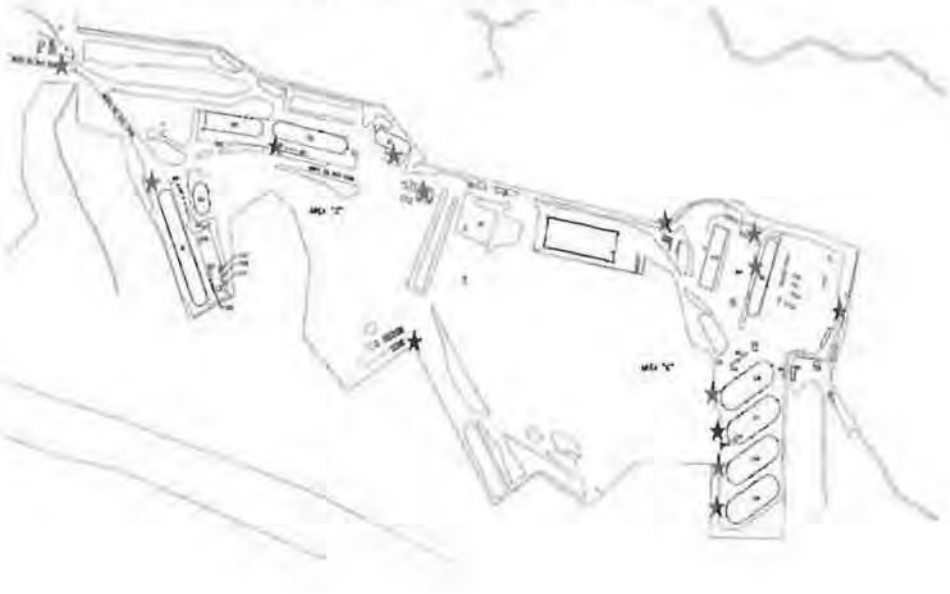
APPENDIX 6
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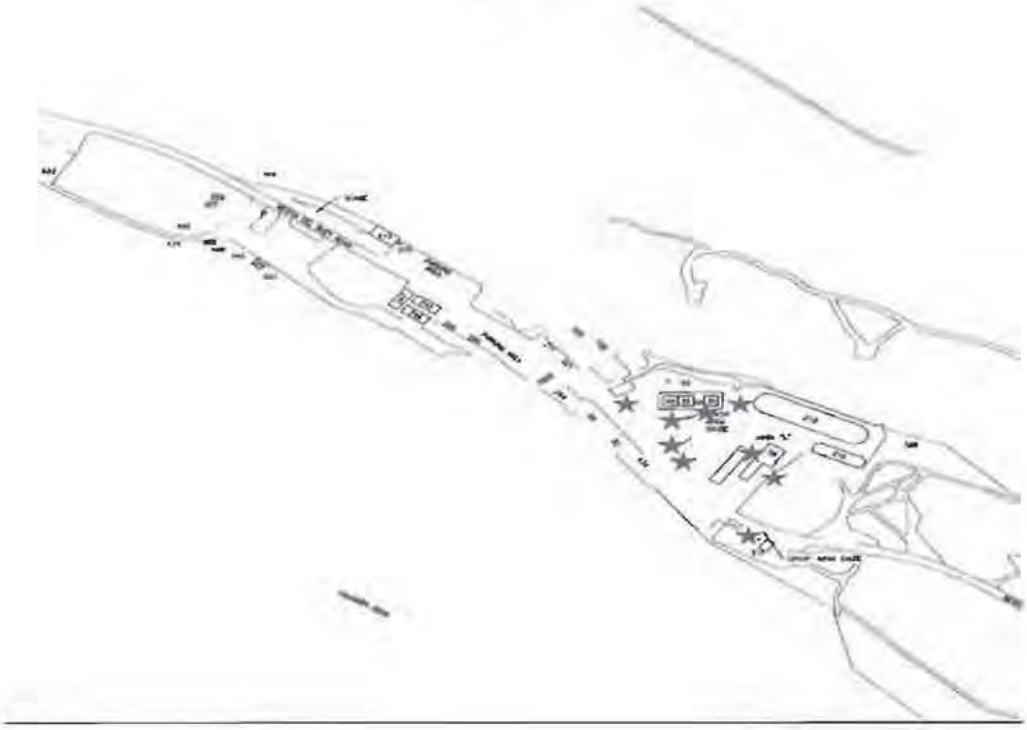
Muster Stations 5 and 7 in Zones V through VII, Pickup Point 4

APPENDIX 7
Page 1 of 2

TA-54 AREA G EVACUATION ALARM BUTTON LOCATIONS

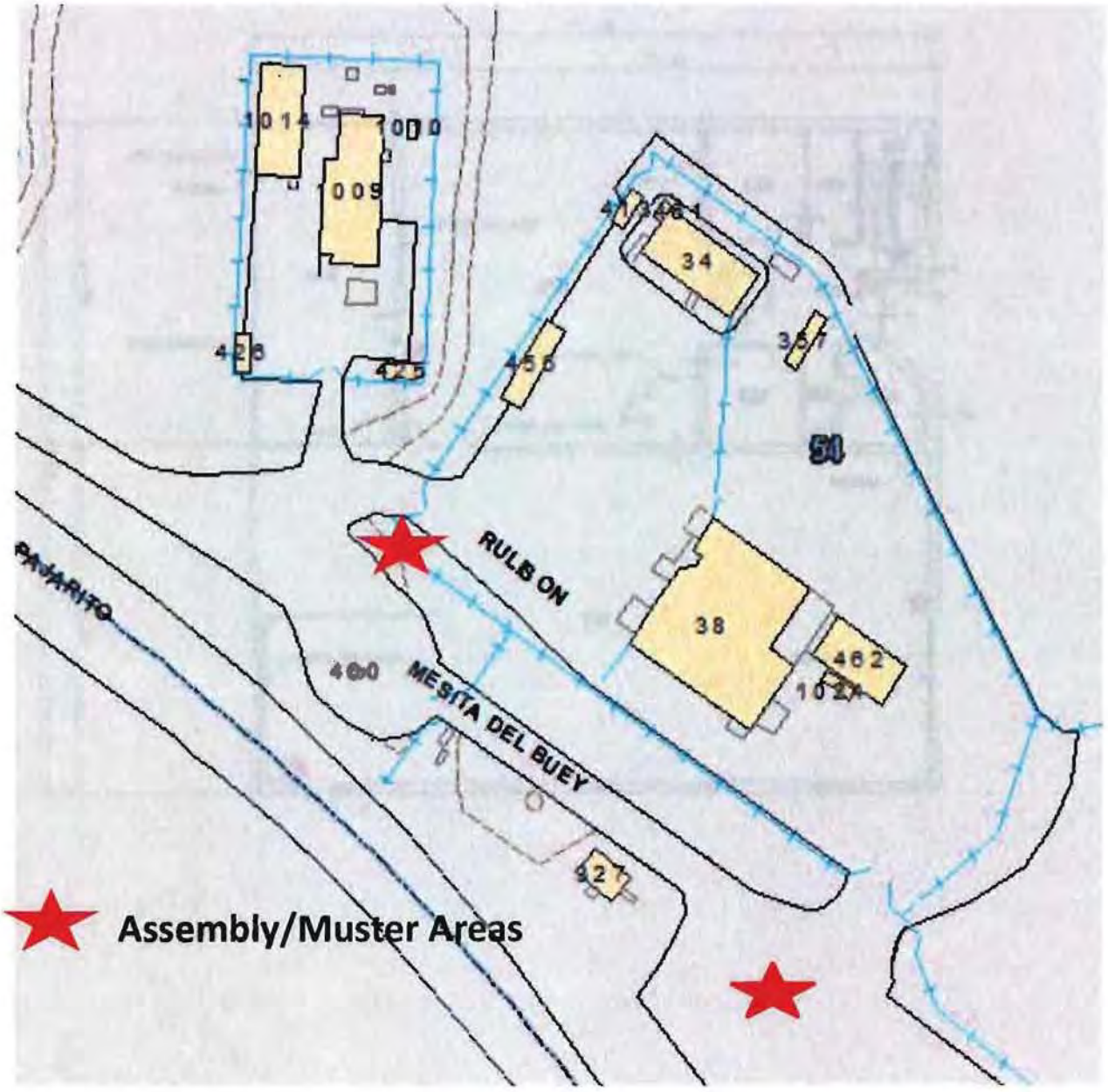


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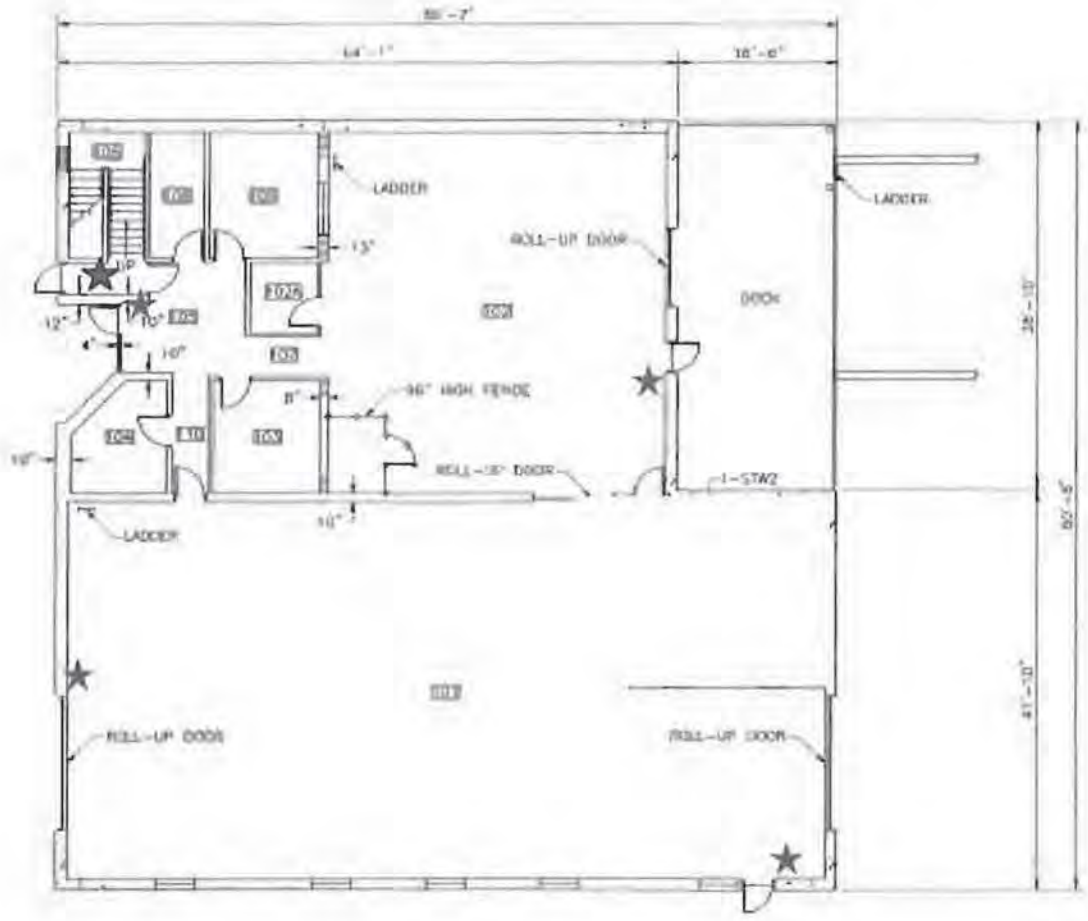
APPENDIX 8
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RANT ASSEMBLY/MUSTER AREA LOCATIONS



APPENDIX 9
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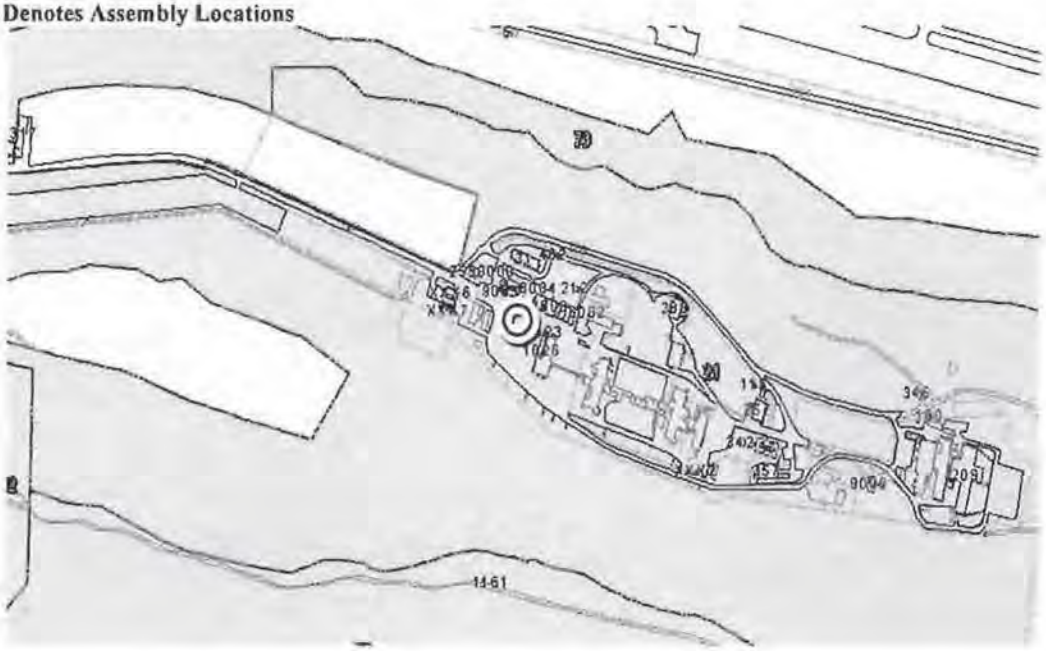
RANT EVACUATION ALARM BUTTON LOCATIONS



APPENDIX 10
Page 1 of 1

TA-21 ASSEMBLY AREA LOCATIONS

- Denotes Assembly Locations



Attachment 7

EWMO Area Emergency Response

Effective Date: 12/09/13

The Responsible Manager has determined that the following organizations' review/concurrence is required for the initial document, and for major revisions a same type and level review is required. Review documentation is contained in the Document History File:

Emergency Operations
Engineering
IH&S
Operations Managers
Quality Assurance
Radiation Protection
Shift Operations Managers

Responsible Manager, EWMO Facility Operations Director

Steve M. Henry	/ 219172	/ /s/ Andy Baumer for	/ 12/04/13
Name (print)	Z#	Signature	Date

Classification Review: ☐ N/A ☒ Unclassified ☐ UCNI ☐ Classified _____

Art Crawford	/ 080070	/ /s/ Art Crawford	/ 12/05/13
Name (print)	Z#	Signature	Date

Working Copy / Information Only (circle one)
Initials / Date: _____ / _____

LA-UR-14-23782

1.0 ENTRY CONDITIONS

- Request is made for Emergency Response Personnel support
- Visual observation of a Fire, smoke
- Audible fire alarm
- Manual fire pull station activated
- Serious personnel injury (job related)
- Utility (water, gas, electricity) outages or leaks (water, fuel, sewer, oil) with significant impact to the facility or the environment
- Situations where the likely potential for involvement of more than one emergency response elements

2.0 IMMEDIATE RESPONSE ACTIONS

√	Time/Date	#	ACTIONS
Operations Center			
		2.1	**ENSURE** personnel have completed the Emergency Response in accordance with EWMO-DIV-BEP-20048, Building Emergency Plan, and **OBTAIN** incident information from the caller. (e.g., location, inside/outside building/structure). Narrative/Comments:
		2.2	**NOTIFY** personnel of incident. (e.g., Public address, 2-way radio, E-Pagers, cell phones, and face to face)
		2.3	**NOTIFY** the Shift Operations Manager/Facility Lead (SOM/FL). Name:_____
NOTE			*The following steps may be performed out of sequence.*
		2.4	**ENSURE** that Emergency Operations and Support Center (7-6211), Fire Department, and/or 911 was notified.

2.0 IMMEDIATE RESPONSE ACTIONS (continued)

√	Time/Date	#	ACTIONS
		2.5	**PERFORM** accountability of the personnel in affected area.
		2.6	**DISPATCH** a Nuclear Operator/Waste Handler to meet the Emergency Response vehicles and **OPEN** access gates if safe to do so.
		2.7	**NOTIFY** the support personnel to assist Shift Operations Manager. (e.g., Environmental, Safety and Health)
Shift Operations Manager/Facility Lead			
NOTE			*When the Operations Manager is not physically present and/or on shift, the SOM will conduct the minimum notifications up the chain of command (e.g., FOD, ES&H Manager, and Project Manager).*
		2.8	**NOTIFY** the applicable Operations Manager of the event, and **REQUEST** the Operations Manager to conduct the minimum notifications (e.g., FOD, ES&H Manager and Project Manager).
		2.9	**BRIEF** support personnel and the emergency responders upon arrival to incident site.
		2.10	**CONDUCT** formal transfer of command and control to the Incident Commander (IC).
		2.11	**ENSURE** EWMO support team is available to assist IC as necessary.

3.0 SUBSEQUENT ACTIONS

√	Time/Date	#	ACTIONS
Shift Operations Manager/Facility Lead			
		3.1	**ENSURE** a formal transfer of command and control from IC is performed once the emergency has been downgraded.
Operations Center			
		3.2	**IF** actions were developed after transfer from IC, **THEN IMPLEMENT** actions to return area/operations to normal. Actions:
		3.3	**PROCESS** the procedure as a quality record in accordance with EP-DIR-AP-10003, Records Management Procedure For ADEP Employees.

Narrative/Comments:

Completed By:

Printed Name	Signature	Z#	Date/Time

Attachment 8

EP-DIV-RM-AOP-20201, R.0

Discovery of an Airborne, Liquid, and/or Solid Material Release or Spill

Effective Date: 12/9/2013

The Responsible Manager has determined that the following organizations' review/concurrence is required for the initial document, and for major revisions a same type and level review is required. Review documentation is contained in the Document History File:

Engineering
IH&S
Operations Managers
Quality Assurance
Radiation Protection
Shift Operations Managers

Responsible Manager, EWMO Facility Operations Director

Steve M. Henry	/ 219172	/ /s/ Andy Baumer 234651 for SMH	/ 12/3/13
Name (print)	Z#	Signature	Date

Classification Review: ☐ N/A ☒ Unclassified ☐ UCNI ☐ Classified _____

Teri Tingey	/ 200975	/ /s/ Teri Tingey	/ 12/3/13
Name (print)	Z#	Signature	Date

Working Copy / Information Only (circle one)
Initials / Date: _____ / _____

LA-UR-14-23781

1.0 ENTRY CONDITIONS

- Discovery of airborne, liquid, and/or solid material release
- Uncontrolled release of hazardous and/or radioactive material into the environment
- Hazardous material release or spill in an area that does not possess controls to mitigate the consequences
- Strong chemical odor (e.g., acid, ammonia, liquefied petroleum, gasoline)

2.0 IMMEDIATE RESPONSE ACTIONS

√	Time/Date	#	ACTIONS
Operations Center			
		2.1	**ENSURE** personnel have completed the Off-Normal Response in accordance with EWMO-DIV-BEP-20048, Building Emergency Plan and **OBTAIN** incident information from the caller (e.g., location, odor, gas, liquid, amount, inside/outside building/structure). Narrative/Comments:
		2.2	**NOTIFY** personnel of incident. (e.g. Public address, 2-way radio, E-Pagers, cell phones, and face to face)
		2.3	**NOTIFY** the Shift Operations Manager/Facility Lead (SOM/FL). Name:_____
	NOTE *The following steps may be performed out of sequence.*		
		2.4	**NOTIFY** the support personnel to assist Shift Operations Manager. (e.g., Environmental, Safety, and Health)

2.0 IMMEDIATE RESPONSE ACTIONS (continued)

√	Time/Date	#	ACTIONS
Shift Operations Manager/Facility Lead			
	NOTE		*When the Operations Manager is not physically present and/or on shift, the SOM will conduct the minimum notifications up the chain of command (e.g., FOD, ES&H Manager, and Project Manager).*
		2.5	**NOTIFY** the applicable Operations Manager of the event, and **REQUEST** the Operations Manager to conduct the minimum notifications (e.g., FOD, ES&H Manager and Project Manager).
		2.6	**CONDUCT** information gathering, such as the following applicable items: • Container number and contents • Inside/outside facility structure • Location and amount • Spills or release • Temporary Limited Area • Weather conditions
		2.7	**DETERMINE** and **EVALUATE** the incident to develop actions as applicable.
		2.8	**IF** Emergency Response Personnel are required, **THEN GO** to EP-DIV-RM-ERP-20200, EWMO Area Emergency Response and **EXIT** this procedure as necessary.

3.0 SUBSEQUENT ACTIONS

Operations Center			
		3.1	**IF** actions were developed, **THEN IMPLEMENT** actions to return area/operations to normal. Actions:
		3.2	**PROCESS** the procedure as a quality record in accordance with EP-DIR-AP-10003, Records Management Procedure For ADEP Employees.

Narrative/Comments:

Completed By:

Printed Name / Signature / Z# / Date/Time

Attachment 9

Waste Container Questionable Integrity

Effective Date: 12/9/2013

The Responsible Manager has determined that the following organizations' review/concurrence is required for the initial document, and for major revisions a same type and level review is required. Review documentation is contained in the Document History File:

Engineering
IH&S
Operations Managers
Quality Assurance
Radiation Protection
Shift Operations Managers

Responsible Manager, EWMO Facility Operations Director

Steve M. Henry	/ 219172	/ /s/ Andy Baumer 234651 for SMH	/ 12/3/13
Name (print)	Z#	Signature	Date

Classification Review: ☐ N/A ☒ Unclassified ☐ UCNI ☐ Classified _____

Teri Tingey	/ 200975	/ /s/ Teri Tingey	/ 12/3/13
Name (print)	Z#	Signature	Date

Working Copy / Information Only (circle one)
Initials / Date: _____ / _____

LA-UR-14-23782

1.0 ENTRY CONDITIONS

- Visual indication of a fallen/dropped waste container
- Visual inspection of a waste container indicates an unanticipated loss of waste container integrity (e.g., missing or broken filter, puncture, corrosion, missing drum locking ring, external contamination
- Visual indication of a bulging waste drum
- Visual indication of a bulging inner waste drum

2.0 IMMEDIATE RESPONSE ACTIONS

√	Time/Date	#	ACTIONS
Operations Center			
		2.1	**ENSURE** personnel have completed the Off-Normal Response in accordance with EWMO-DIV-BEP-20048, Building Emergency Plan and **OBTAIN** incident information from the caller (e.g., location, position, container information, visual damage to exterior of container, leaking, personnel injury, inside/outside building/structure). Narrative/Comments:
		2.2	**NOTIFY** personnel of incident. (e.g., Public address, 2-way radio, E-Pagers, cell phones, and face to face)
		2.3	**NOTIFY** the Shift Operations Manager/Facility Lead (SOM/FL). Name:_____

2.0 IMMEDIATE RESPONSE ACTIONS (continued)

√	Time/Date	#	ACTIONS
	NOTE		*The following steps may be performed out of sequence.*
		2.4	**NOTIFY** the support personnel to assist Shift Operations Manager. (e.g., Environmental, Safety and Health, Engineering, Waste Coordinator, and Security)
Shift Operations Manager/Facility Lead			
	NOTE		*When the Operations Manager is not physically present and/or on shift, the SOM will conduct the minimum notifications up the chain of command (e.g., FOD, ES&H Manager, and Project Manager).*
		2.5	**NOTIFY** the applicable Operations Manager of the event, and **REQUEST** the Operations Manager to conduct the minimum notifications (e.g., FOD, ES&H Manager and Project Manager).
		2.6	**CONDUCT** information gathering, such as the following applicable items: • Container number and contents • Spills/release • Temporary Limited Area • Weather conditions
		2.7	**DETERMINE** and **EVALUATE** the incident to develop actions in accordance with the applicable compliance documents (e.g., Safety Basis, RCRA, Radiation Protection).
		2.8	**IF** Emergency Response Personnel are required, **THEN GO** to EP-DIV-RM-ERP-20200, EWMO Area Emergency Response and **EXIT** this procedure as necessary.

3.0 SUBSEQUENT ACTIONS (continued)

√	Time/Date	#	ACTIONS
Operations Center			
		3.1	**IF** actions were developed, **THEN IMPLEMENT** actions to return area/operations to normal. Actions:
		3.2	**PROCESS** the procedure as a quality record in accordance with EP-DIR-AP-10003, Records Management Procedure For ADEP Employees.

Narrative/Comments:

Completed By:

Printed Name	/ Signature	/ Z#	/ Date/Time

Attachment 10

STANDING ORDER

1. Standing Order Number: EWMO-AREAG-SO-1247, R.2

2. Standing Order Type: (check one) ☐ **Division** ☒ **Facility**

3. Applicable Facilities: TA-54 Area G

4. Standing Order Title: TA-54 Area G Domes TA-54-231 and TA-54-375 PermaCon Access Restrictions

5. Distribution List: (By Functional Title): TA-54 Timely Order Book and Environmental Programs (EP) Document Control

6. Approval:

Gail Welsh	/s/ Gail Welsh	10/15/14
Print name	Signature	Date

(Approval Authority for division-level standing orders is the FOD, for facility-level, the OM or designee.)

Standing Order Effective Date: 10/15/14

Convert this Standing Order to a procedure? ☐ Yes, by _____ (Date) ☒ No

7. Purpose:

This standing order restricts access to the PermaCons in Domes TA-54-231 and TA-54-375 to prevent workers from coming into unnecessary contact with the waste containers and establishes restrictions for the entry into the TA-54-375 PermaCon [e.g., personal protective equipment (PPE) and waste container temperature].

Background: Monitoring requirements of LA-UR-14-23820, LANL Nitrate Salt-Bearing Waste Container Isolation Plan, (i.e., Isolation Plan) is accomplished by the performance of EWMO-AREAG-FO-DOP-1246, Nitrate Salt-Bearing TRU Waste Container Monitoring. The required monitoring performed includes hourly visual inspection and daily temperature measurements of all waste containers within the TA-54-231 and TA-54-375 PermaCon. Additionally, hourly temperature measurements are obtained for waste containers within the TA-54-375 PermaCon that have attached thermocouples, using computer located inside of the TA-54-375 PermaCon Control Room. Daily head-space gas sampling is performed for containers 68685 and LASB50522. Biweekly head space gas sampling is also performed for five additional waste containers.

The following personnel are affected by this standing order: EWMO Operations Manager, Shift Operations Managers, Nuclear Operators, Radiological Control Technicians, and Operations Center Operators.

8. Actions and Duration:

8.1 Requirement

Shift Operations Manager (SOM) approval is required to access the PermaCons in Domes TA-54-231 and TA-54-375, except for inspections performed in accordance with EWMO-AREAG-FO-DOP-1246.

The PermaCons in Domes TA-54-231 and TA-54-375 **SHALL** be posted on the outside of each access point instructing personnel to obtain SOM approval before entering the PermaCon, unless they are performing EWMO-AREAG-FO-DOP-1246.

8.1 Requirement (continued)

Additional Dome TA-54-375 PermaCon access requirements:

- Entry into any cell requires Level I PPE (coveralls, booties, hood, and gloves) and Air Purifying Respirators with a dual GMC-P100 cartridge, in addition to the applicable Radiological Work Permit.
- Before entry the temperature of Standard Waste Box (SWB) 68685 **SHALL** be verified to be is less than or equal to 10 °F above ambient using the computer in the TA-54-375 PermaCon Control Room.

8.2 Action(s) to be taken

8.2.1 TA-54-231 PermaCon Entry

[1] **OBTAIN** SOM approval for entry except to perform EWMO-AREAG-FO-DOP-1246 inspections.

8.2.2 TA-54-375 PermaCon Entry

[1] **OBTAIN** SOM approval for entry except to perform EWMO-AREAG-FO-DOP-1246 inspections.

NOTE *The following action is performed using the computer located inside of the TA-54-375 PermaCon Control Room and receiving input from SWB 68685 using three thermocouples (T1 – SWB top, T2 – SWB side, and T3 – ambient).*

[2] **DETERMINE** whether the T1 (SWB top thermocouple) and T2 (SWB side thermocouple) indicated temperatures are less than or equal to 10 °F above the T3 (ambient thermocouple) indicated temperature.

[3] **IF** either the T1 or T2 indicated temperature is greater than 10 °F above than the T3 (ambient) temperature,
THEN STOP activities associated with the entry into the TA-54-375 PermaCon and **NOTIFY** the TA-54 Operations Center of the discrepancy.

[4] **IF** both the T1 and T2 indicated temperatures satisfy either of the following:

- Less than the T3 (ambient temperature
- Less than or equal to 10 °F above the T3 (ambient) temperature,

THEN OBTAIN and **DON** level I PPE and Air Purifying Respirator with a dual GMC-P100 cartridge for the TA-54-375 PermaCon entry.

8.2.3 EWMO-AREAG-FO-DOP-1246 Inspections

Hourly visual inspections will be conducted from outside of the PermaCon through the windows into the cells and hourly temperature measurements will be obtained from using the TA-54-375 PermaCon control Room computer. Daily head-space gas sampling will be conducted as required by the Isolation Plan. Temperature measurements of the exterior of the waste containers and visual inspection of the waste containers by personnel within the PermaCon will also be performed daily.

8.3 Duration

This standing order will remain in effect until cancelled or superseded.

9. Unreviewed Safety Question (USQ) Review:

USQ process complete? ☒ Yes ☐ N/A

USQ No. (if applicable): AREAG-14-441-C

If "N/A" is checked, then justify below:

USQ Qualified Evaluator (QEV)

Lawrence Garcia	/s/ Lawrence Garcia	10/14/14
Print name	Signature	Date

10. Derivative Classifier Review:

This document was reviewed to ensure proper classification and is classified as:

☒ Unclassified ☐ Unclassified Controlled Nuclear Information (UCNI)

☐ Official Use Only (OUO) ☐ Classified

NOTE: If this document is OUO, UCNI, and/or classified, add the appropriate markings, distribution limitation statement, and guidance data block(s).

Derivative Classifier (DC)

Art Crawford	/s/ Art Crawford	10/15/14
Print name	Signature	Date

11. Standing Order Cancellation:

Choose one of the following: ☐ USQ complete ☐ N/A

USQ No. (if applicable): _____

Responsible Manager (FOD for division-level standing orders, OM or designee for facility-level)

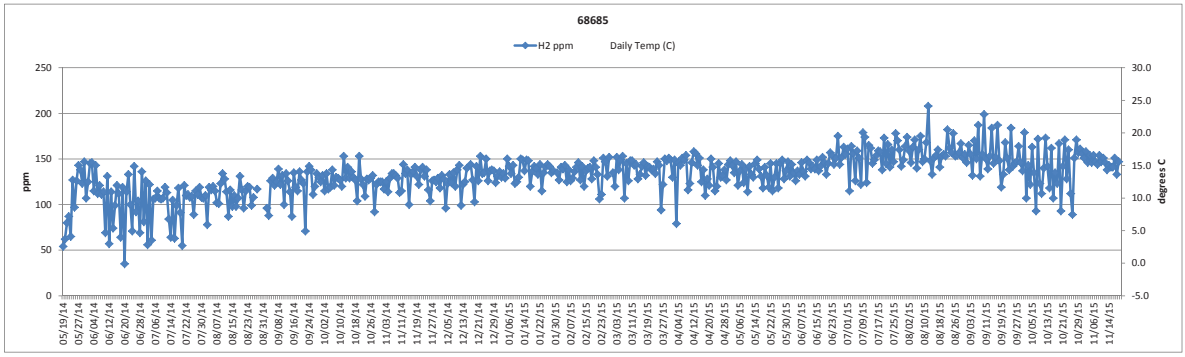
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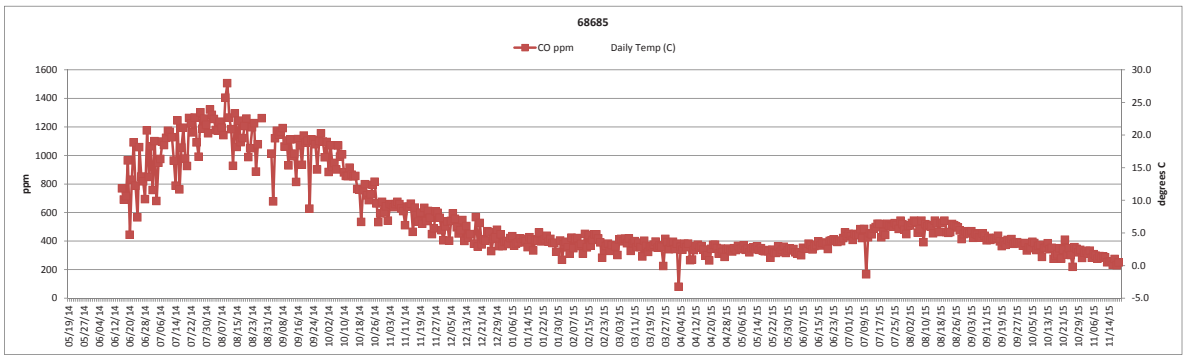
(Attach Attachment 2, Timely Order Reviewer Signoff Sheet, to document reviews of this standing order.)

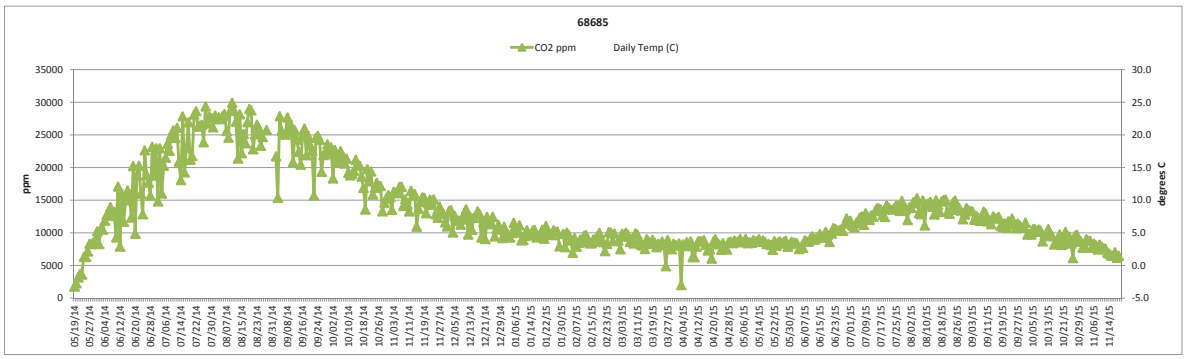
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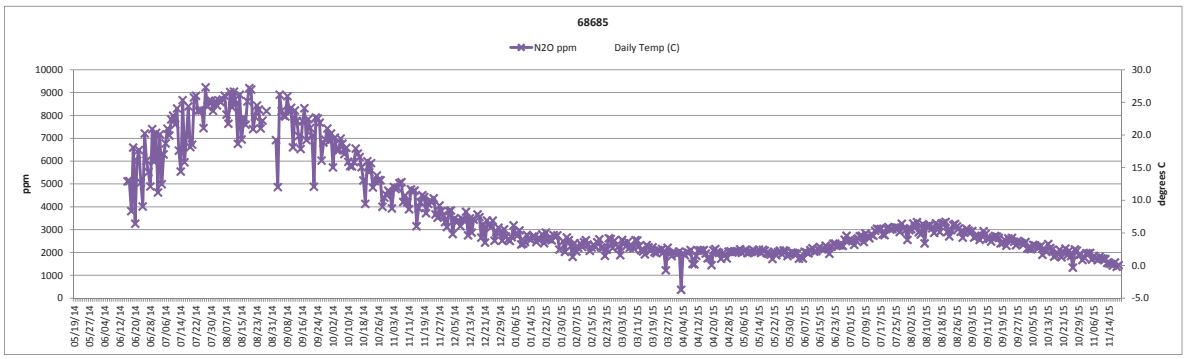
Attachment 11

Remediated Nitrate Salt Container Headspace Gas and Temperature

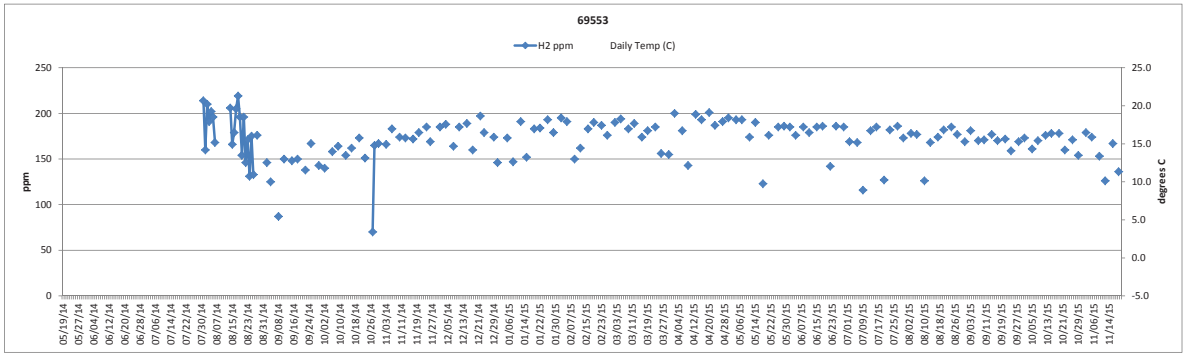


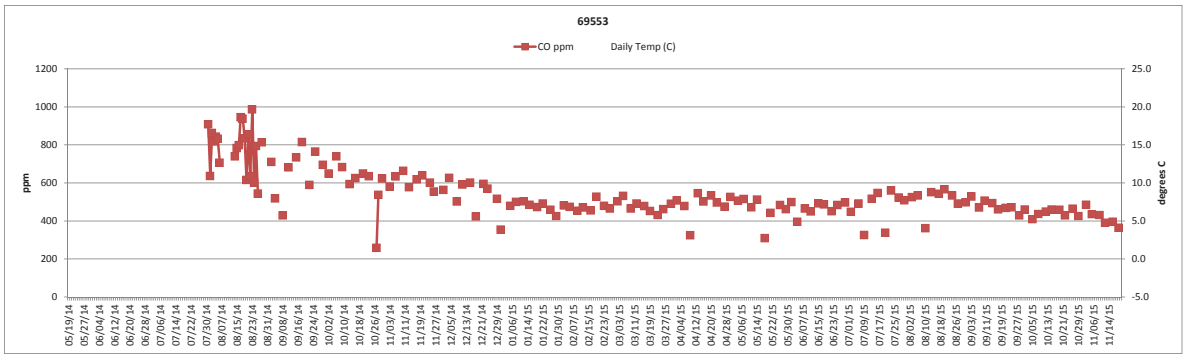


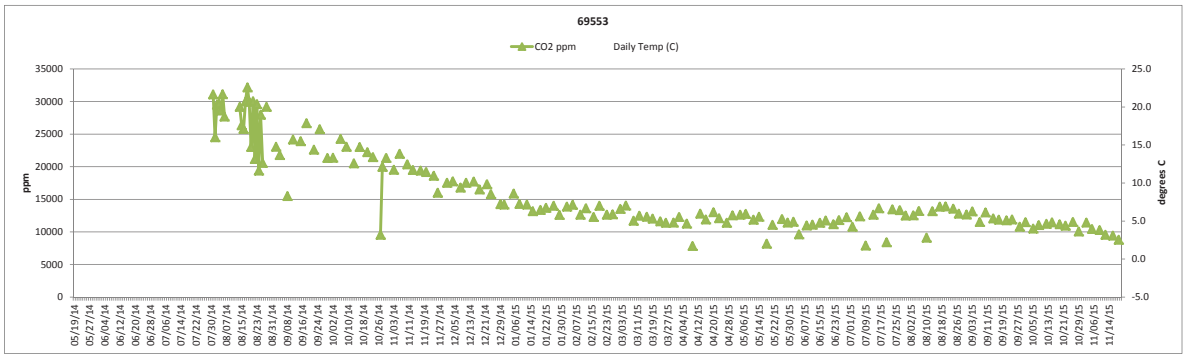


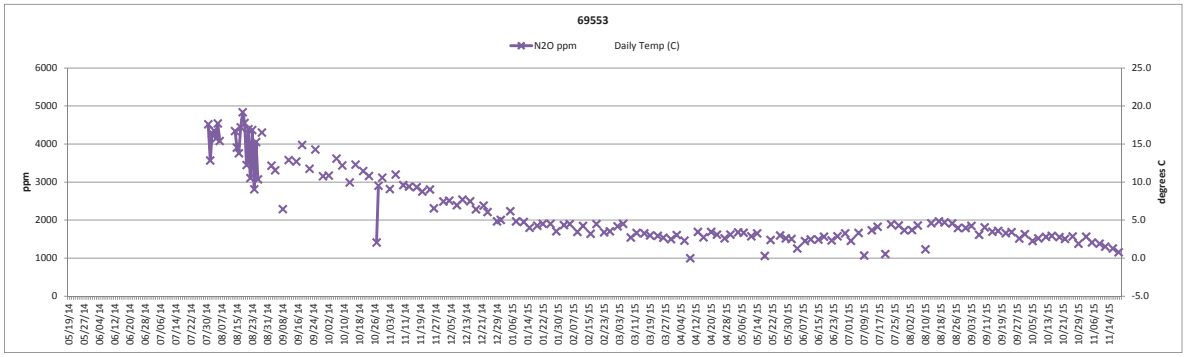


Remediated Nitrate Salt Container Headspace Gas and Temperature

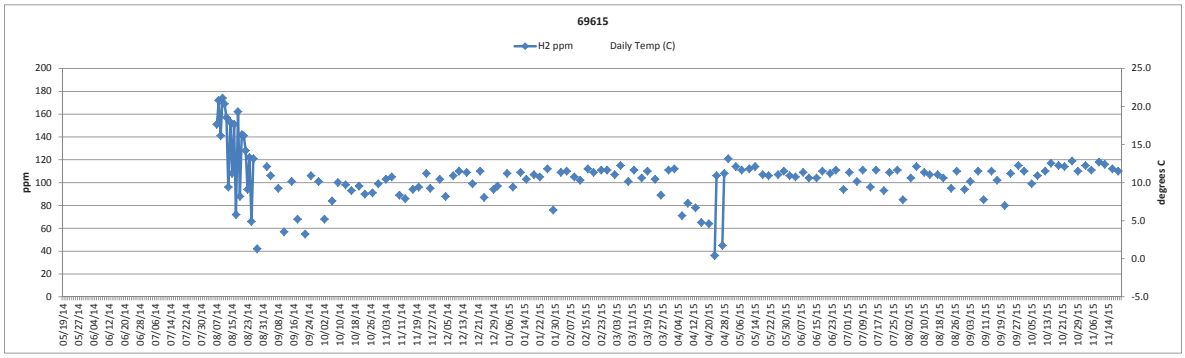


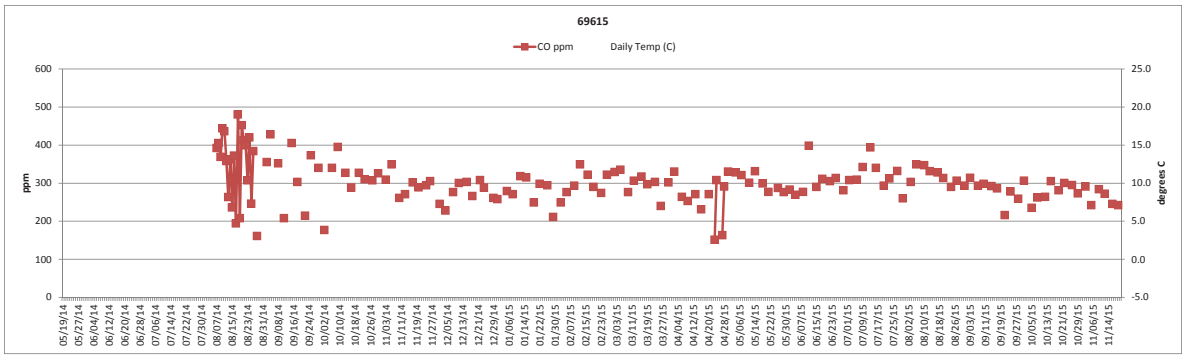


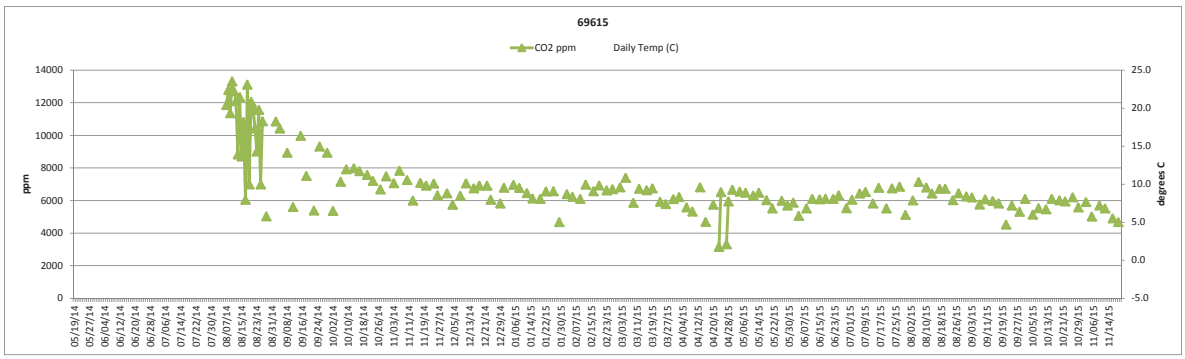


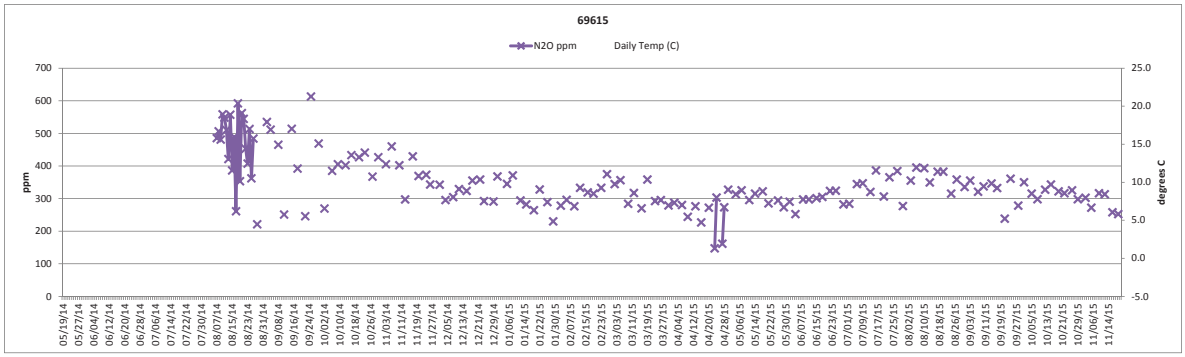


Remediated Nitrate Salt Container Headspace Gas and Temperature

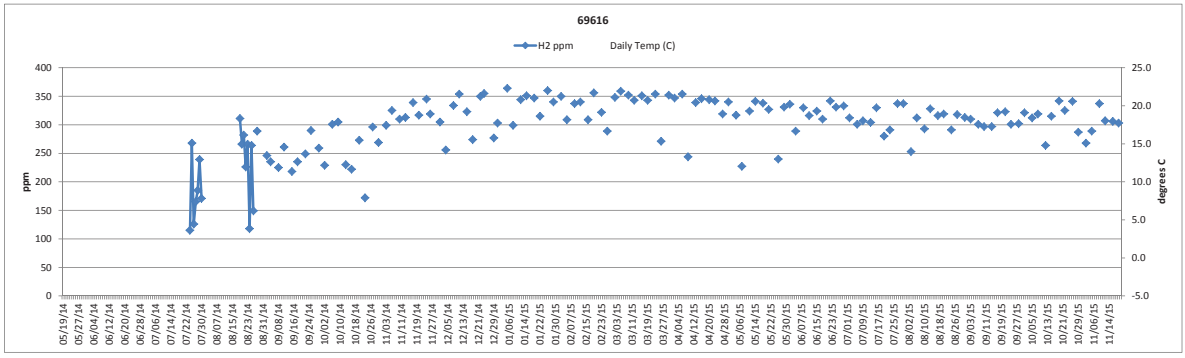


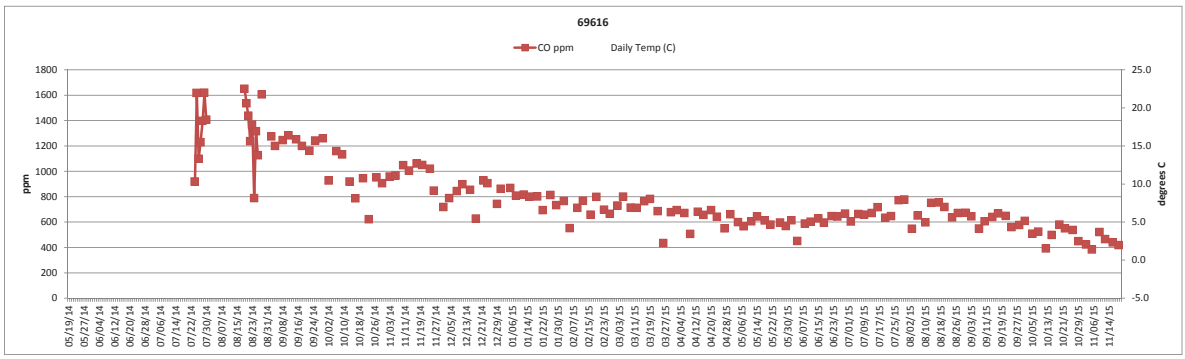


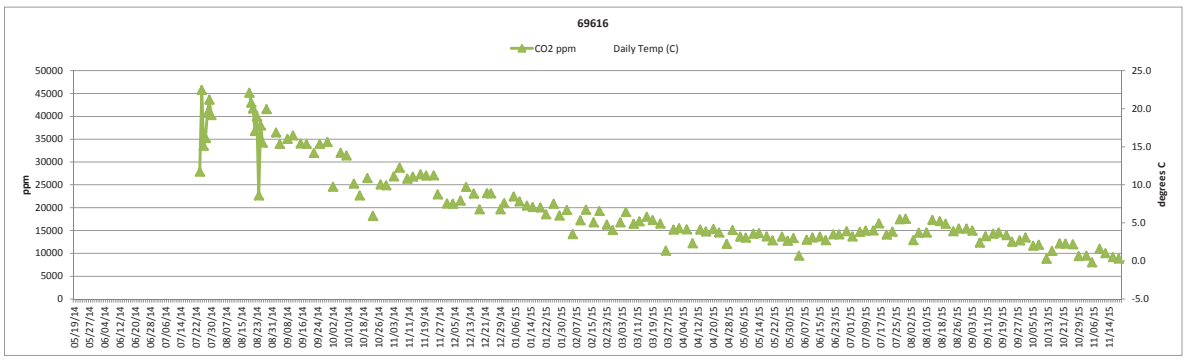


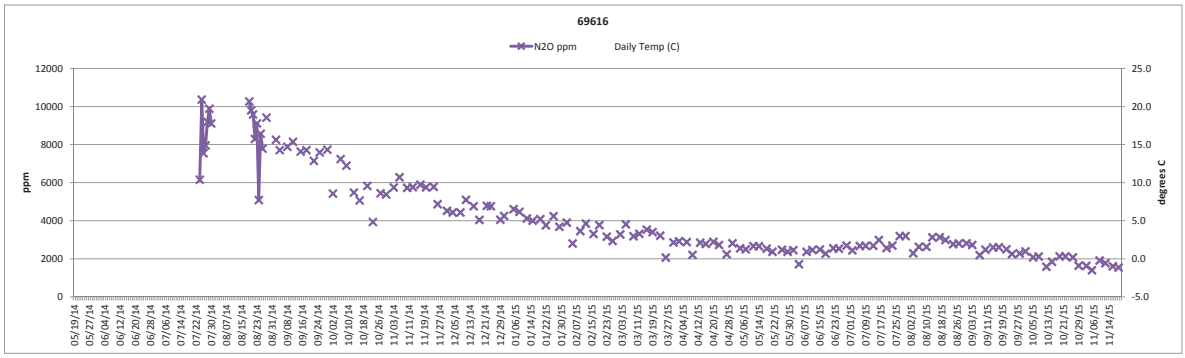


Remediated Nitrate Salt Container Headspace Gas and Temperature

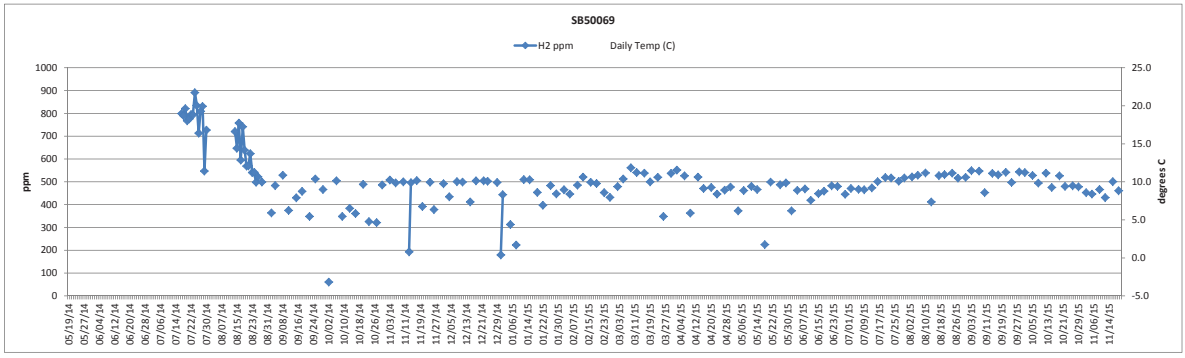


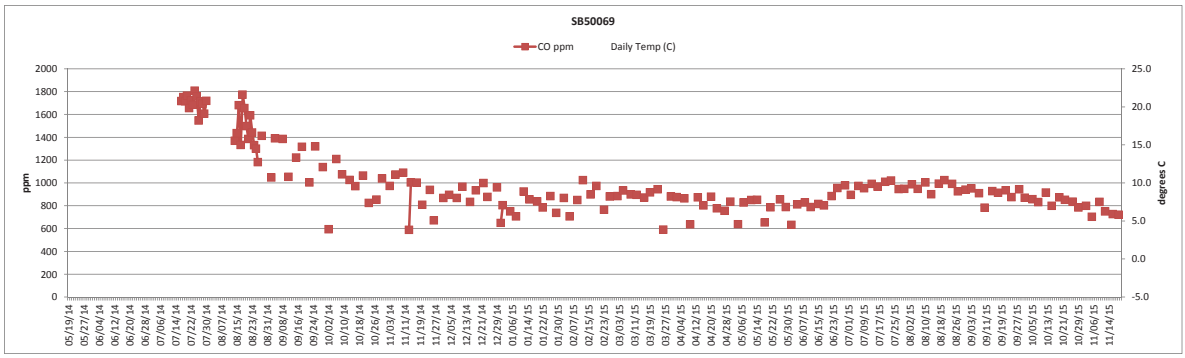


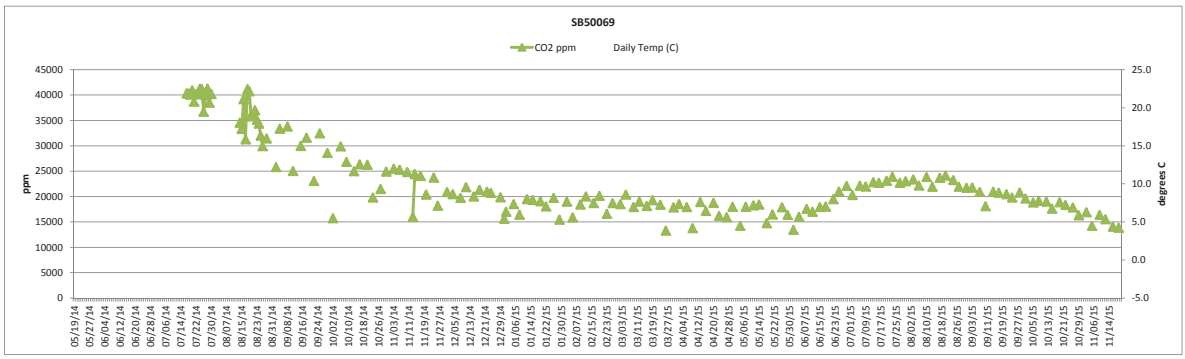


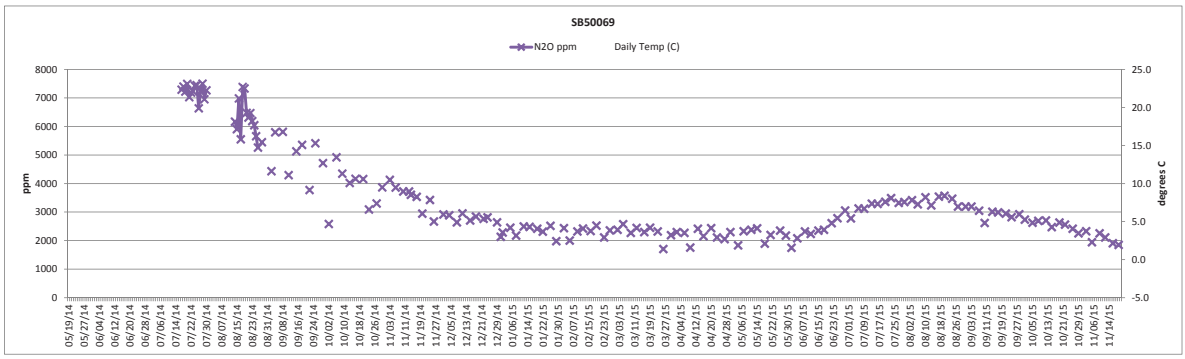


Remediated Nitrate Salt Container Headspace Gas and Temperature

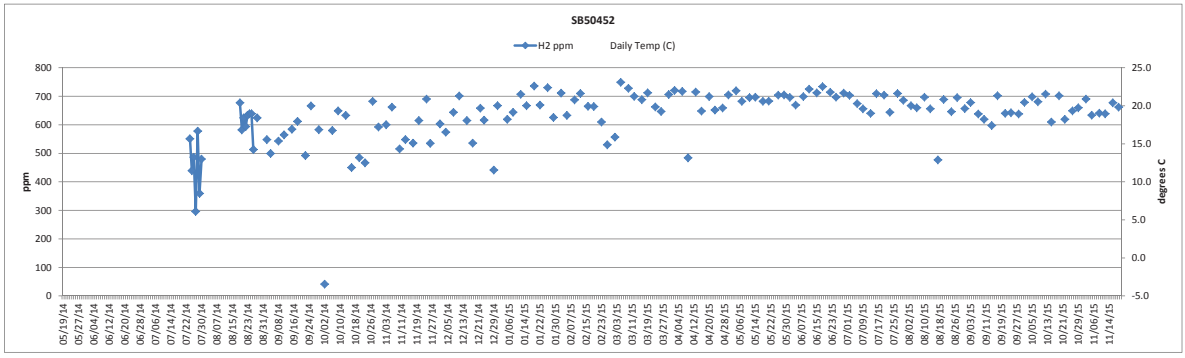


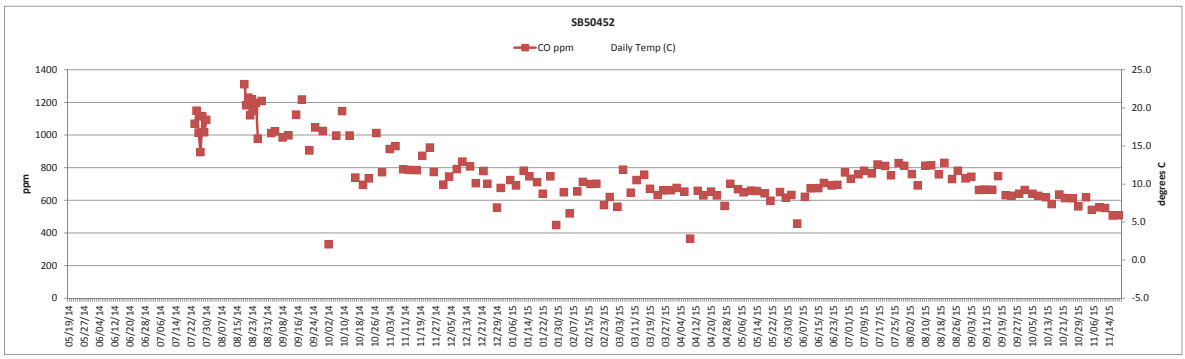


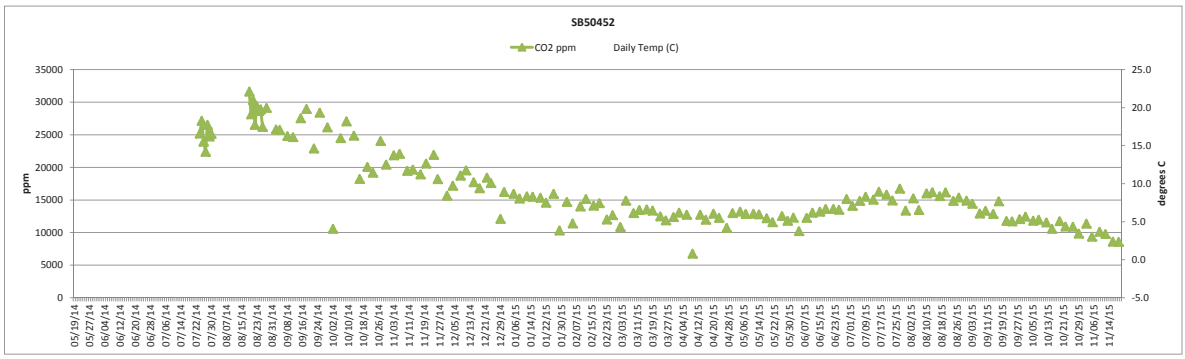


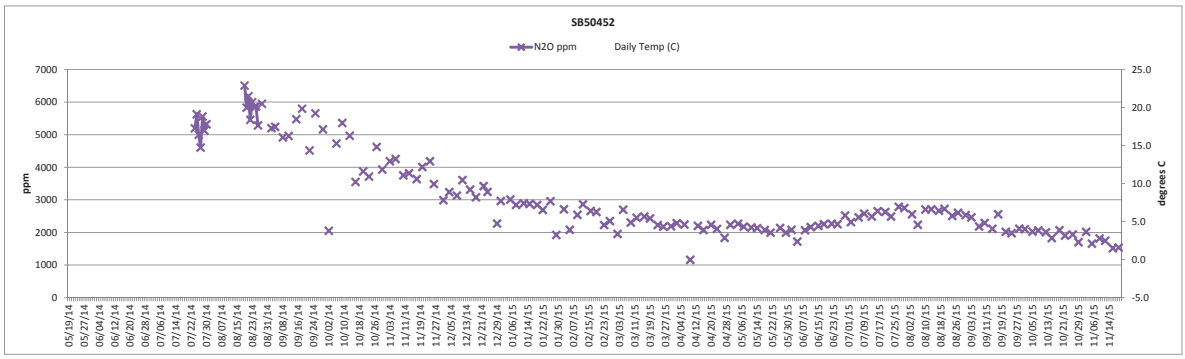


Remediated Nitrate Salt Container Headspace Gas and Temperature

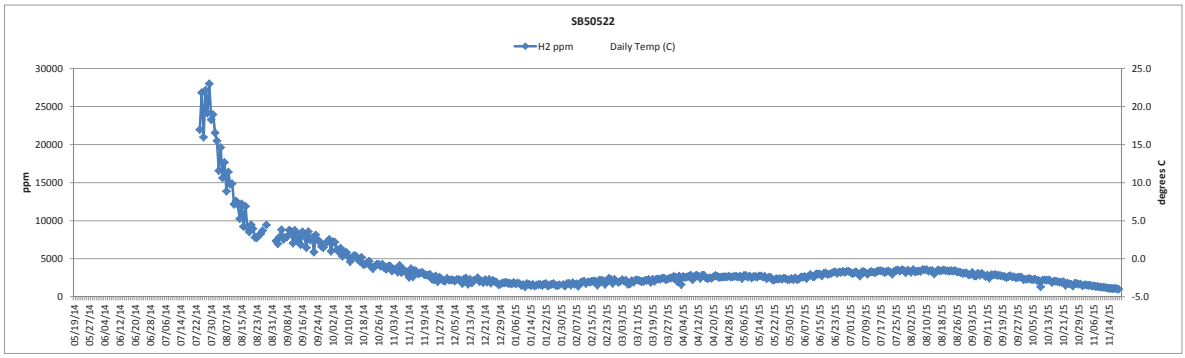


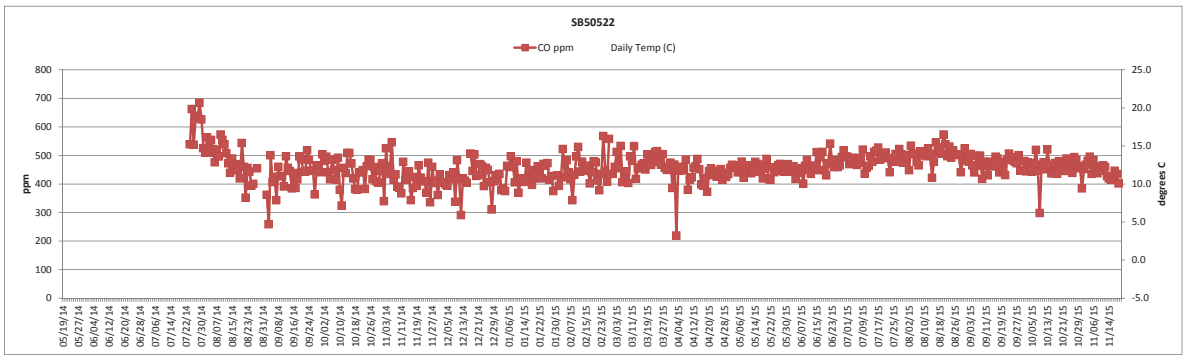


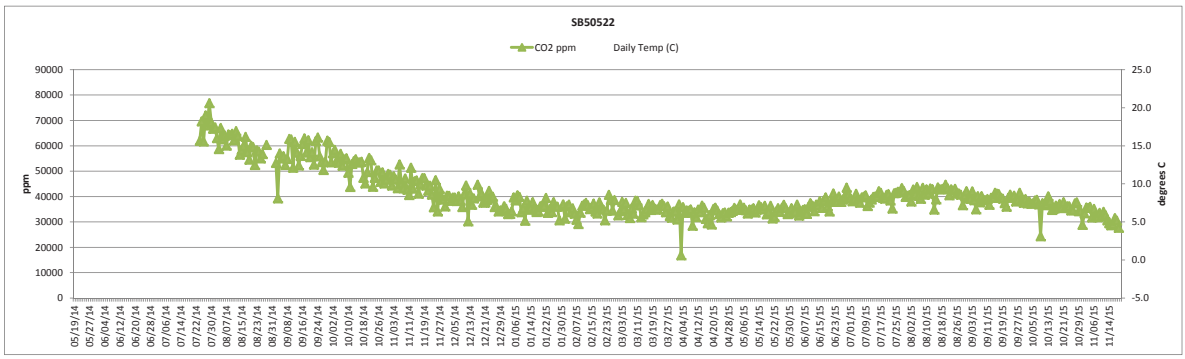


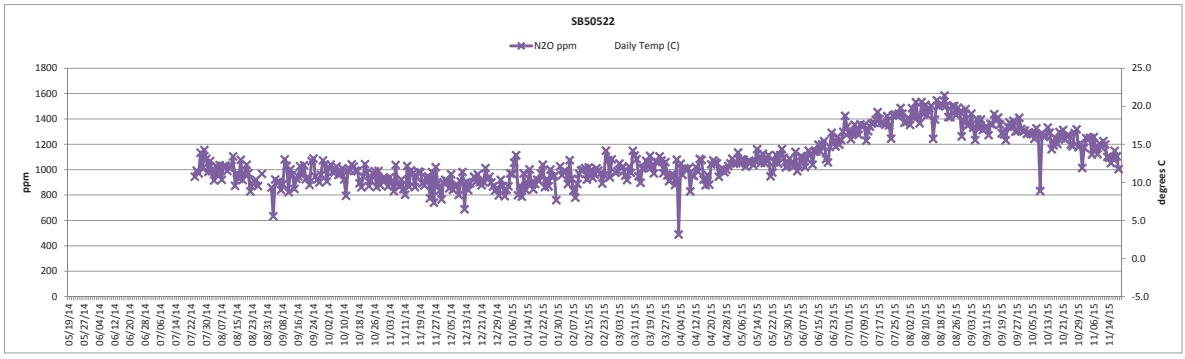


Remediated Nitrate Salt Container Headspace Gas and Temperature









Attachment 12

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Title: Interpretation of Headspace Gas Observations In Remediated Nitrate Salt Waste Containers Stored at Los Alamos National Laboratory

Author(s): Robinson, Bruce Alan
Leibman, Christopher Patrick

Intended for: Report

Issued: 2015-04-14 (Draft)

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Interpretation of Headspace Gas Observations in Remediated Nitrate Salt Waste Containers Stored at Los Alamos National Laboratory

Bruce A. Robinson

Christopher P. Leibman

April 10, 2015

Executive Summary

This study supports the case for the use of gas concentration measurements of the Standard Waste Box (SWB) headspace as an interpretive tool for discerning the type and rate of gas-generating reactions within the Remediated Nitrate Salt (RNS) waste drums in storage at Los Alamos National Laboratory (LANL). Model results imply that the measurements could provide an early warning for the occurrence of heat-generating chemical and biological reactions in the drums, enabling actions to be taken before self-heating at low temperatures triggers a runaway exothermic reaction at higher temperatures. The study conclusions are summarized below.

1. The headspace gas concentrations are consistent with a description consisting of the combination of a radiolysis mechanism for hydrogen gas generation and low-level, temperature-dependent chemical reactions such as oxidation for the generation of other gases such as carbon dioxide and nitrous oxide. Many of the SWBs have low levels of reaction product gases, whereas a subset exhibit higher concentrations indicative of somewhat higher levels of reactivity. The ratios of gases within the drum for the SWBs with the highest gas concentrations exhibited a similar characteristic signature, but with variability from drum to drum.

2. A simple mathematical and numerical model of the headspace gas behavior provides a plausible description of the long-term variations of concentrations of gases such as carbon dioxide and nitrous oxide in the SWB headspace. The model balances a gas generation source term from reactions in the RNS drum with mixing from the outside atmospheric air due to ventilation of the SWB. Excellent fits to the concentration data for Drum 68685 (a sibling to the drum that breached in WIPP) were obtained throughout the entire time period since the RNS drum was placed within the SWB in May of 2014. Figure ES-1 below shows this result.

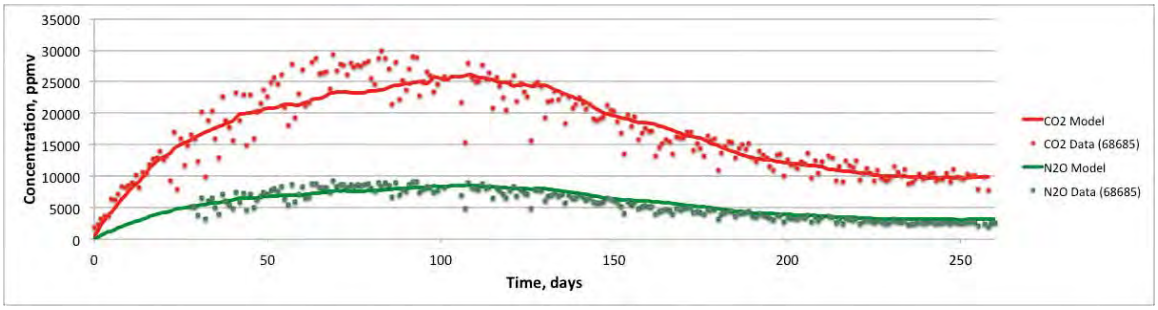


Figure ES-1 Simulation results compared to data for carbon dioxide and nitrous oxide concentrations for Drum 68685.

3. The model results for Drum 68685 suggest a low level of chemical reaction within the RNS waste drum. Gas generation rates due to reaction are predicted

to be a minute fraction of the ventilation rates into and out of the SWB, and calculated heat generation rates for a reasonable postulated reaction (oxidation of Swheat, which appears to have the correct stoichiometry based on the simultaneous fit to the carbon dioxide and nitrous oxide data) are also very low, nominally 1 W or less for the drum. If other reactions are occurring, these could also generate heat, but if they also generate carbon dioxide, this should have been reflected in the form of higher concentrations. Therefore, the level of carbon dioxide in the drums appears to provide a bound on the level of reactivity and heat generation; this bound is very low from a thermal perspective. Investigations should focus on the potential for reactions not involving the generation of carbon dioxide to attempt to identify other important reactions not reflected in the headspace gas data.

4. The reaction rates exhibit a significant temperature dependence, which explains the higher concentrations of carbon dioxide and other gases in the SWB headspace in the summertime compared to the winter. A model reaction exhibiting an Arrhenius temperature dependence was employed in the model. Calibrations to the data led to values of 15-20 kcal/mol for the activation energy. This range is well within the 10-30 kcal/mol range suggested by Clark and Funk (2015) for such reactions. The low level of reactivity also implies that at these rates, reactants will not be depleted for many years, and that the pattern of higher concentrations under the summertime temperature conditions will repeat itself this summer in a predictable manner. This prediction constitutes a blind test of the validity of the model.

5. Uncertainties in the model have been evaluated to estimate how tightly the model bounds parameters like heat generation rates, given the lack of perfect information on temperatures, available gas volumes inside the SWB and internal drums, and ventilation rates. Reaction and heat generation rates are unlikely to be more than about a factor of two higher than the rates cited above that were derived from the data fit. Other parameter combinations that would lead to higher rates produce simulations that begin to deviate significantly from the observed data.

6. The model could be applied to the data from other SWBs containing the LANL RNS wastes, but this study focused principally on Drum 68685. It is likely that different reaction rates and ventilation rates would be required to simulate other drums, which points to the uniqueness of each drum as a separate system. Notably, all seven of the drums being subjected to daily headspace gas sampling appear to have characteristic behavior similar to that of 68685: higher concentrations of carbon dioxide and other headspace gases than the other drums, and temperature dependence of the concentrations.

7. The drums are currently under temperature control within the Permacon, but there have also been efforts to study the possibility of enhancing the ability to keep the drums cooler throughout the year, including in the summer months.

Simulations were performed to examine the effect of these actions on reaction rates. As expected, the model predicts reaction rates and gas concentrations in the SWB headspace to be lower for lower temperatures. As a defense-in-depth measure, temperature control seems prudent. However, recalling that even under the current level of temperature control, gas generation rates are low, it is unlikely that this additional curtailing of the concentrations represents a meaningful additional factor of safety over an already safe storage condition. Moreover, if cooling is achieved by placing the drums in a refrigerator, ventilation conditions will also be affected, which would likely result in added uncertainty in the interpretation of concentration values, and thus added complexity to the technical arguments supporting the efficacy of the cooling measures taken.

8. Scenarios developed to examine the response of SWB headspace gases to abrupt changes in reactivity suggest that concentrations are a very sensitive means for observing such changes. In a simulation postulating a rise in temperature within an RNS waste drum of 1 ^{o}C per day (presumed to be undetected by measurements on the outside of the SWB), the model suggests that within about five days, the headspace gases would deviate enough from their current state to provide a high likelihood that this off-normal condition would be detected. This is illustrated in Figure ES-2 below. Even if one assumes conservatively that this time is 10 days, the RNS waste temperature would still be well below the temperature specified by Clark and Funk (2015) and SRNL (2015) as the onset temperature for runaway exothermic reactions for this waste. Further work should be performed to solidify this conclusion by considering issues of detectability of deviations, given that the data are not perfectly smooth, and to make sure that additional drums beyond the seven receiving daily sampling are monitored more frequently for purposes of detecting incipient chemical reactions that might be the precursor of thermal runaway conditions.

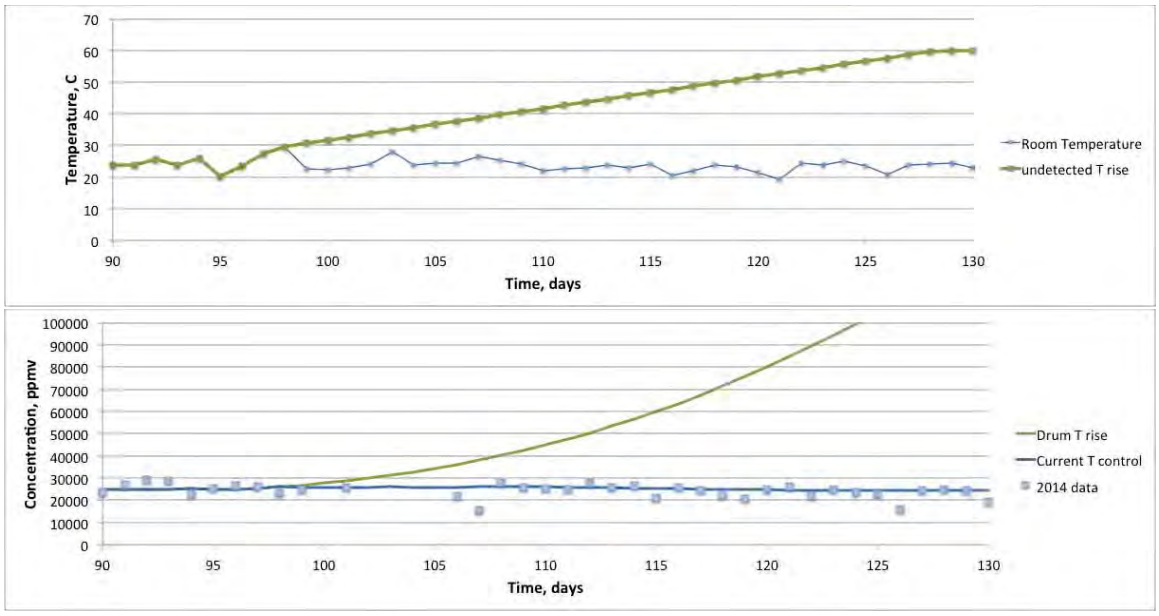


Figure ES-2 Simulation of hypothetical scenario in which the RNS waste drum experiences an undetected temperature rise due to low-level chemical or biological reaction. Top figure: Postulated RNS waste drum temperature profile. Self-heating begins at day 98, when it deviates from the temperature in the room. Bottom: Simulated carbon dioxide concentrations. The green curve is the simulated response to self-heating within the RNS drum. The simulation tracks the baseline scenario until the postulated change, after which concentrations climb rapidly. The 2014 concentration data and the model under a scenario of the current temperature control ("Current T control") is superimposed to show the level of data scatter expected when using these data to detect off-normal conditions.

1 Introduction

On February 14, 2014, a release of radioactivity occurred at the Waste Isolation Pilot Plant (WIPP), resulting in distribution via airborne transport of radioactivity within the repository and to the surrounding environment in the vicinity of the facility. When definitive photographic evidence became available (May 15, 2014) that the breached drum was indeed an RNS waste drum processed at LANL (Drum 68660), LANL implemented additional precautions and controls, including overpacking of the 55-gallon RNS waste drums into Standard Waste Boxes (SWBs)[1] and storage in a Permacon at TA-54, Area G, in Dome 375, as well as moving all unremediated nitrate salt (UNS) containers[2] to a Permacon at TA-54, Area G, in Dome 231. RNS waste drums similar to those at LANL had previously been shipped to WIPP (422 drums, emplaced in the WIPP underground), and to the low level radioactive waste facility in Andrews, Texas managed by Waste Control Specialists, LLC (WCS) (109 drums, subsequently placed in shallow underground storage). Both WIPP and WCS subsequently have also taken precautions to protect workers, the public, and the environment.

Drums at LANL continue to be managed and monitoring results are reported to the New Mexico Environment Department (NMED) under the LANL Nitrate Salt Bearing Waste Container Isolation Plan (Isolation Plan: LANL, 2014). Drums are currently stored under HEPA filtration and the temperature controls provided by the buildings, with active fire suppression systems. Monitoring of the drums consists of hourly visual inspections, daily temperature measurements of the SWBs containing the RNS waste drums, and periodic sampling and analysis of the headspace gases within these SWBs.

The LANL Chemical Diagnostics and Engineering Group (C-CDE) began characterizing headspace gases in LANL SWBs containing RNS waste on May 8, 2014. Results of this monitoring campaign are described in detail in Leibman et al. (2015). Gas samples of TRU drum headspace were analyzed for Volatile Organic Compounds (VOCs) by Gas Chromatography/Mass Spectrometry (GC-MS) and for permanent gases using GC with a Thermal Conductivity Detector (GC-TCD). Permanent gases are those that remain gaseous at standard temperature and pressure and include helium, hydrogen, oxygen, nitrogen, methane, carbon monoxide, carbon dioxide, and nitrous oxide. This initial characterization was conducted to determine if causal factors which could lead to drum failure could be quickly identified to prevent recurrence. Of immediate concern was the potential to produce explosive or flammable concentrations of gas from unanticipated chemical

[1] *Upon completion of this process on May 18, 2014, there were 57 RNS waste containers at LANL, overpacked into a total of 55 SWBs.*

[2] *At the time that LANL suspended further processing of UNS waste on May 2, 2014, there were a total of 27 UNS waste drums that had not yet been processed. The move of these drums to Dome 375 was completed on June 3, 2014.*

reaction of the nitrate salt waste with organic absorbent. These initial analyses and other monitoring did not suggest that runaway chemical reactions were occurring in any of the remediated or un-remediated nitrate salt waste drums. Since these initial characterization activities, headspace gas analysis has continued to see what trends in individual gas concentrations or relative concentrations were observed, and to gain further insight into potential mechanisms that could have contributed to the breach of drum 68660 in the WIPP repository.

With the collection of a significant quantity of headspace gas and temperature data for the RNS waste drums, it is reasonable to suspect that additional insights into the nature of chemical reactivity within the drums can be derived from a modeling and analysis activity. These insights could play a key role in LANL's ongoing efforts to confirm the safety of the RNS waste in its current storage configuration. Such studies, as well as the recently published studies of the WIPP radiation release event (Clark and Funk, 2015; SRNL, 2015), could also inform future directions for management and ultimate treatment of the waste. Finally, it is anticipated that the Accident Investigation Board (AIB) report will issue findings related to the reactive chemistry occurring within the RNS waste drums that will need to be answered. The models and interpretations developed herein also satisfy this need.

The remainder of this report is organized as follows. First, a description of the configuration of the waste is presented along with a presentation and qualitative interpretation of the headspace gas data. These descriptions emphasize those aspects that influence the development of a mathematical model of headspace gas behavior. Then, a conceptual and numerical model of the system is developed, including assumptions and simplifications required to result in a tractable mathematical model. Then, headspace gas modeling results are presented for the SWB containing Drum 68685, a LANL RNS waste container (a sibling of Drum 68660 that breached in the WIPP underground) for which daily headspace gas measurements are available. Finally, the implications of the results to the management of RNS waste at LANL are discussed by using the model to examine the various scenarios for cooling the waste, as well as various scenarios for detecting off-normal conditions should the RNS waste drums exhibit increased reactivity in the future.

2 Headspace Gas Monitoring for RNS Waste

The RNS waste at Los Alamos has undergone monitoring of the headspace gases on a regular basis since the time it was determined that a Los Alamos waste drum had breached at WIPP. This section summarizes the configuration of the waste drums and presents a high-level overview of the data collected.

2.1 Configuration of RNS Waste Stored at Los Alamos

There are currently 57 RNS waste containers at LANL, overpacked into a total of 55 SWBs. Figure 2-1 provides a diagram and physical dimensions of a SWB for a configuration containing four 55-gallon drums. For most of the RNS waste containers at Los Alamos, including Drum 68685, the SWB overpack contains one 55-gallon drum containing RNS waste, and three additional drums that are either empty dunnage drums or which contain non-nitrate salt TRU waste. The SWBs are fitted with filtered vents to allow gases generated within the container to vent to the atmosphere. This is a standard precaution built into such a system to prevent the buildup of flammable gases within the container.

The headspace gases monitored in the LANL RNS waste drums are obtained from the headspace of the SWB overpack containing the 55-gallon RNS waste drum. Thus, SWB headspace gas concentrations are measurements of the gases contained within the space outside of the 55-gallon drums but within the SWB. Gas concentrations are impacted by gas generation within the 55-gallon RNS waste drum and by communication with the outside air through the SWB and drum filter vents. Venting of the SWB provides a mechanism for mixing of the headspace gases with outside air, as well as the escape of gases from the SWB. As the pressure conditions within the room change due to barometric or room ventilation changes, the gas flow may be either into or out of the SWB. When the SWB is “exhaling,” gases are released at the concentrations present within the SWB headspace. When the SWB is “inhaling,” the SWB is supplied with atmospheric air.

The volume available for gas mixing is uncertain due to the lack of perfect knowledge on the volume of waste within the internal drums. However, gas transfer between the SWB headspace and the 55-gallon dunnage drums should be relatively rapid in most cases because either the lid of dunnage drum is removed or the lid is on but the bung is removed.

These factors are important to the mathematical model of the system developed in the next section.



Standard Waste Box

Table 1 – SWB Weights

Component	Weight (pounds)		
	Maximum Gross	Nominal Tare	Net Content
SWB	4,000	640	3360

Table 2 – SWB Dimensions

Dimension	Approximate Measurement (Inches)	
	Inside	Outside
Height	36 9/16	36 7/8
Length	68 ¾	71
Width	52	54 ½

Source: http://www.wipp.energy.gov/library/cpp/cpp/standard%20waste%20box%20%28swb%29.htm

Figure 2-1 Diagram and physical dimensions of a Standard Waste Box (SWB)

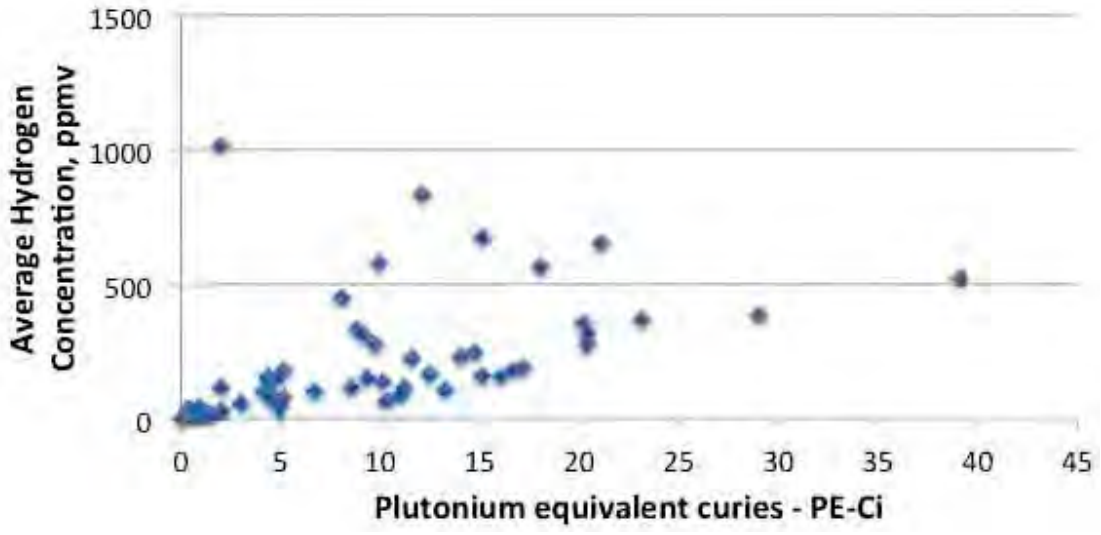
2.2 Summary of Headspace Gas Data

Leibman et al. (2015) report on the sample collection and gas concentration analysis methods for the headspace gases in the RNS waste drums at Los Alamos. This section describes some of the key results from this monitoring campaign, setting the stage for the modeling effort that follows in the remainder of this report. Data up to February 3, 2015 are used in all plots and analyses; results will be updated as needed to reflect the most recent measurements.

Measurements of permanent gases, including helium, hydrogen, oxygen, nitrogen, methane, carbon monoxide, carbon dioxide, and nitrous oxide, have been conducted at least monthly, and for several drums, as frequently as daily, for the 55 SWBs containing the 57 RNS waste drums. The principle purpose of

these measurements is to monitor for flammable gases such as hydrogen and to detect any chemical reactivity such as oxidation reactions that may be occurring in the drums.

The data support the conclusion that the predominant source of hydrogen is radiolysis of the drum contents as a result of decay of the radioactive transuranic elements in the waste. Figure 2-2 is a correlation of the average hydrogen concentration versus the activity in the drum for the 55 SWBs. Such a correlation is not expected to be perfect because of variability between drums such as venting characteristics of individual drums, inaccuracies in the activity measurement and the heterogeneity of drum contents. Nonetheless, a correlation does exist, suggesting a radiolysis mechanism. Also, as illustrated in Figure 2-3 for Drum 68685, the hydrogen concentration is generally constant with time, in contrast to trends for other gases such as carbon dioxide that suggest a temperature-dependent behavior (see below). Both of these observations support radiolysis as the controlling the mechanism for hydrogen generation.



Note: Two drums, SB50522 and SB02198, are not included because their average hydrogen concentration levels exceed the maximum on the plot (5953 ppmv and 2640 ppmv, respectively). Each of these drums has exhibited a steady decline in hydrogen concentration since monitoring since began, and future monitoring will track the concentration to detect future trends.

Figure 2-2 Correlation of hydrogen concentration in headspace gas versus the drum activity for the 55 SWBs containing RNS waste.

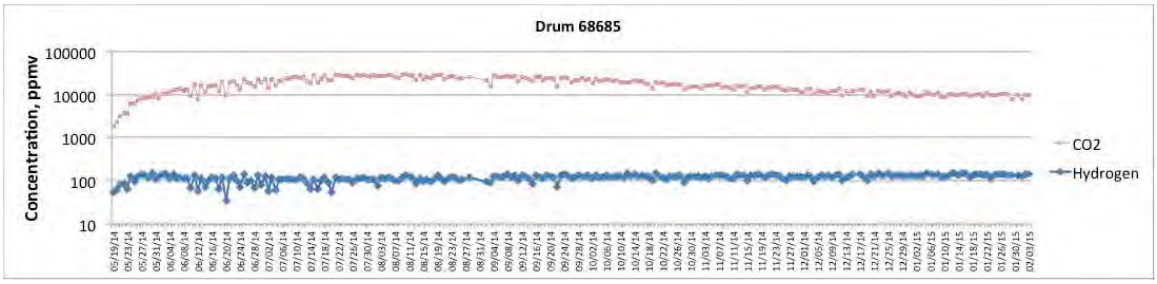


Figure 2-3 Trends of concentration for carbon dioxide and hydrogen gases in Drum 68685.

Leibman et al. (2015) found that the ratios of gases within the drum for the SWBs with the highest gas concentrations exhibited a similar characteristic signature, but with variability from drum to drum. This statement is supported by the average ratios of gases for the seven containers with the most extensive monitoring history (Figure 2-4). In addition to these averages, the ratios exhibit varying degrees of time dependence (Figure 2-5), which may be due to temperature dependence of multiple chemical reactions. For example, for Drum 68685, the carbon dioxide/nitrous oxide ratio ranges from about 3:1 at the beginning of monitoring to about 4:1 after 260 days; at the other extreme, these ratios for SWB 50522 are about 65:1 initially, and drop to about 35:1 after 260 days. Multiple chemical reactions that perhaps exhibit different temperature dependence would be required to quantitatively explain this behavior. The carbon dioxide/nitrous oxide ratio of approximately 3:1 in Drum 68685 is used to postulate a simplified description of the chemical reactivity in that drum later in this report. However, it is important to recognize that different chemical reactions contribute to gas generation and some variability should be expected across the drum population.

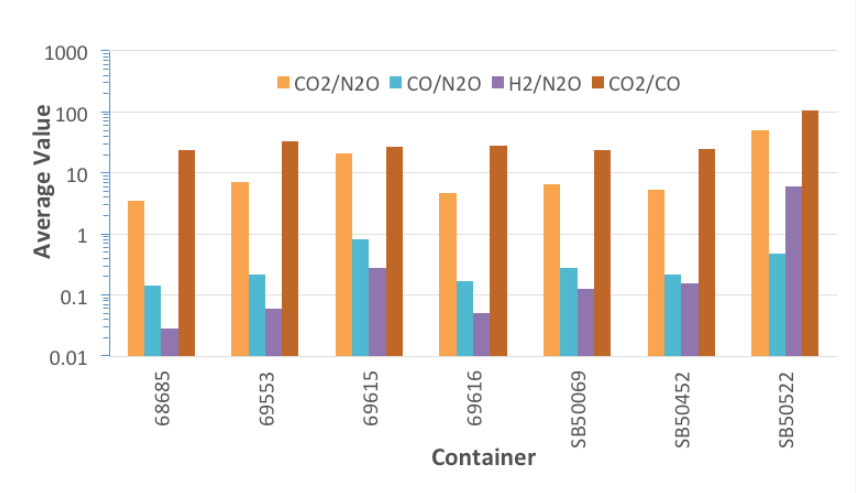


Figure 2-4 Average gas concentration ratios in the headspace of SWBs containing RNS waste. Reproduced from Leibman et al. (2015). These seven drums exhibit the highest concentrations of the 55 SWBs in storage.

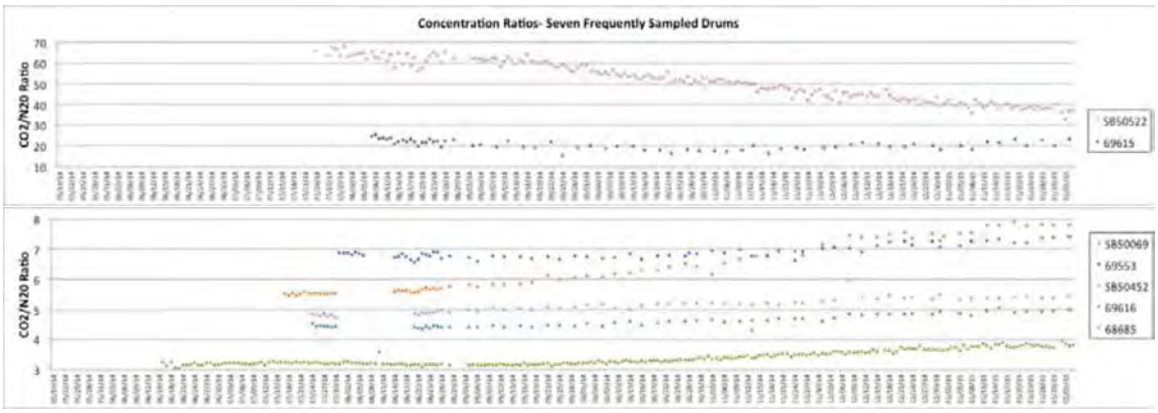


Figure 2-5 Time-varying ratio of carbon dioxide/nitrous oxide concentration for the most frequently monitored SWBs containing RNS waste. Top panel: two drums with the highest ratios; Bottom panel: five drums with the lower ratios.

Figure 2-6 shows the carbon dioxide concentration-time histories of the seven most frequently sampled drums. All drums with high concentrations exhibit the same characteristic decline in concentration, explained in the model developed later as temperature-dependent reaction kinetics in the RNS waste drum, modulated by mixing with atmospheric air due to ventilation of the SWB.

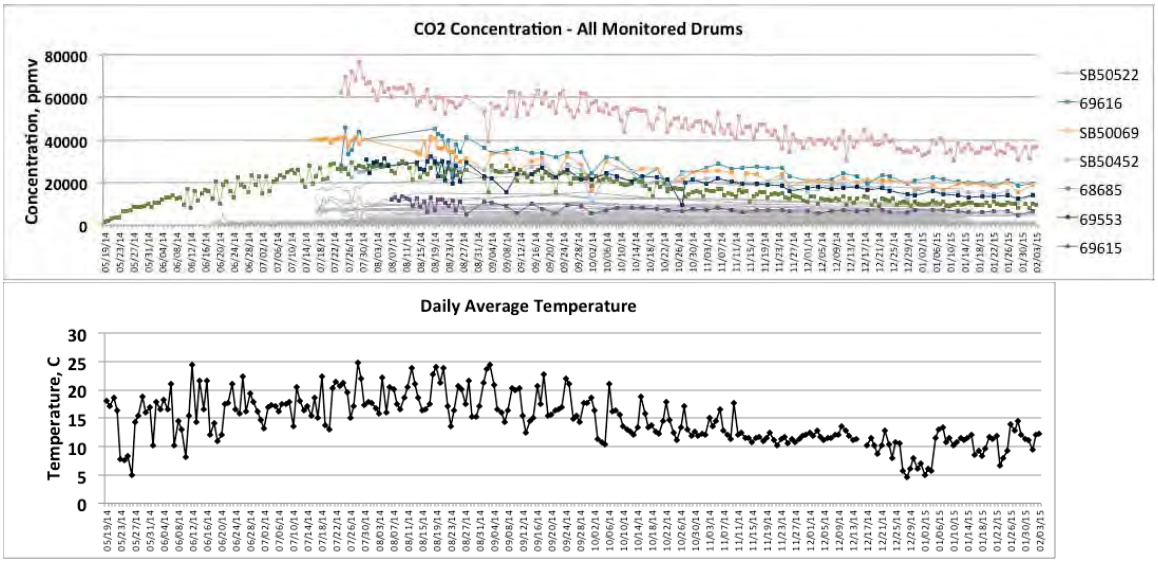


Figure 2-6 Carbon dioxide concentration-time and temperature-time histories of the seven most frequently sampled drums. Gray lines are curves plotted for the remaining 48 SWBs. Top panel: concentrations; Bottom panel: daily average temperatures for the cell containing Drum 68685.

In contrast to the seven drums with highest carbon dioxide concentrations, many drums have much lower concentrations, for example with maximum carbon dioxide concentrations less than 10,000 ppmv. These are depicted in Figure 2-6 as thin gray curves at lower concentrations. Many of these drums

exhibit either flat concentration profiles with time, or steadily increasing values, but at much lower levels than the frequently sampled drums highlighted in Figure 2-6. The average concentrations of carbon dioxide, nitrous oxide, and hydrogen for all drums are represented in Figure 2-7, and Table 2-1 indicates the groupings of containers into separate bins of similar carbon dioxide concentrations. The selection of the bin for a given SWB was performed manually, choosing the bin based on the overall concentration of the majority of the measurements for that drum, rather than using a maximum or average value. The overall statistics are presented at the bottom of the table. Based on a qualitative criterion that carbon dioxide concentrations >10000 ppmv in the SWB headspace meet the definition of a "reactive" waste drum, 11 drums fit into this category, including all seven of the most frequently sampled drums, as well as four others: Drums 69183, 69630, 69645, and 94068. However, note that there is some reactivity in most of the drums, and that the term "reactive" must be placed into context through an assessment of the level of gas generation. The model developed in the remainder of this report provides that context.

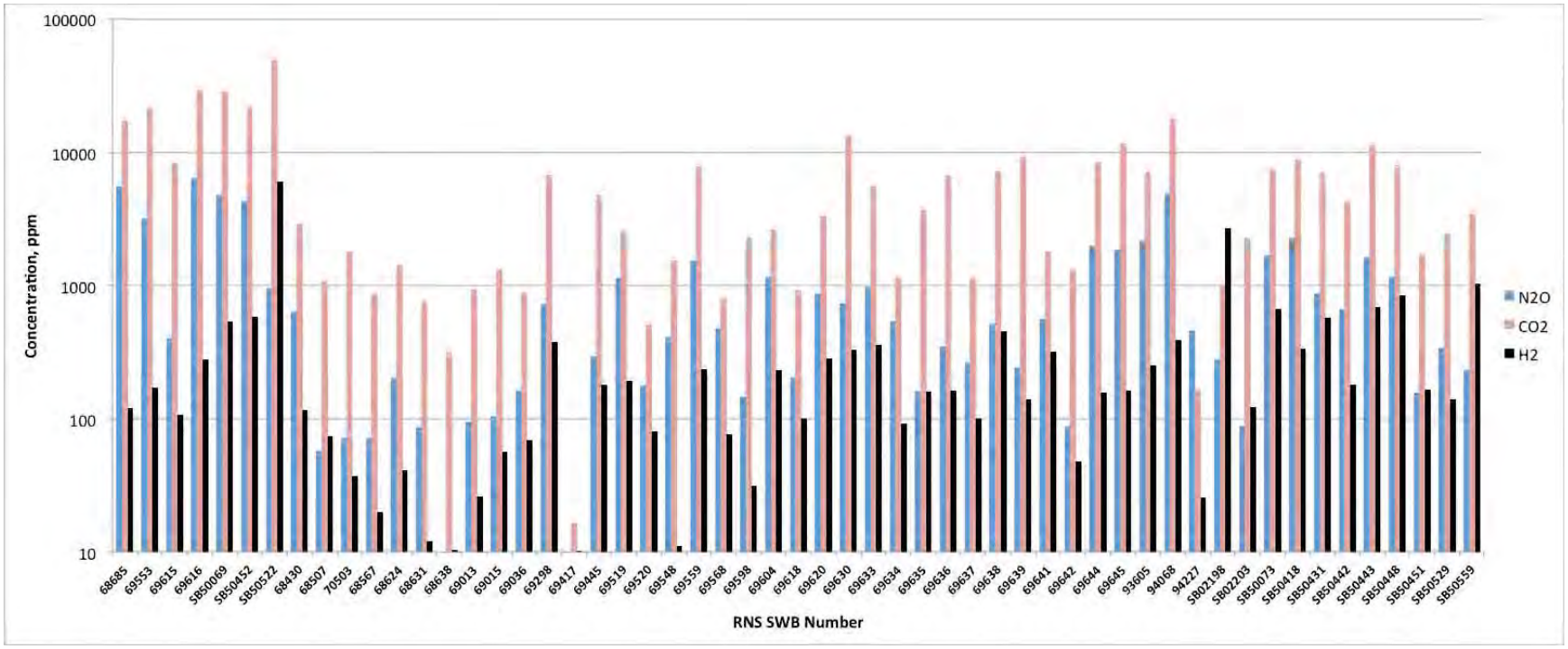


Figure 2-7 Average concentrations of gases in each of the 55 SWBs containing RNS waste

Table 2-1 Carbon dioxide concentrations within the 55 SWBs containing RNS waste drums

			Carbon Dioxide Concentration (ppmv)					
RNS Drum ID	**Parent Drum ID**	**SWB ID***	**<1000**	**1000-2000**	**2000-5000**	**5000-7500**	**7500-10000**	**>10000**
68408	S842463	SB02198		✔				
68430	S833846				✔			
68507	S853279			✔				
68540	S842181	70503		✔				
68553	S842181	70503						
68567	S816837		✔					
68624	S824184			✔				
68631	S825810		✔					
68638	S825810		✔					
68648	S855139	SB50442			✔			
68665	S853492	SB50529			✔			
68685	S855793							✔
69013	S870213			✔				
69015	S851418			✔				
69036	S873554		✔					
69076	S852530	SB50452						✔
69079	S901114	SB50073					✔	
69183	S870478	SB50443						✔
69208	S851772	SB50069						✔
69280	S841251	SB50431					✔	

			Carbon Dioxide Concentration (ppmv)					
RNS Drum ID	Parent Drum ID	SWB ID*	<1000	1000-2000	2000-5000	5000-7500	7500-10000	>10000
69298	S841251						✔	
69361	S892963	SB50451		✔				
69417	S822876		✔					
69445	S823229					✔		
69490	S892963	SB50522						✔
69491	S891387	SB50448					✔	
69519	S816768				✔			
69520	S813471			✔				
69548	S851416			✔				
69553	S841627							✔
69559	S832148						✔	
69568	S825664		✔					
69595	S852588	SB50418					✔	
69598	S793450				✔			
69604	S816768				✔			
69615	S843673							✔
69616	S841627							✔
69618	S818412			✔				
69620	S816768				✔			
69630	S843672							✔
69633	S851418					✔		
69634	S851416			✔				

			Carbon Dioxide Concentration (ppmv)					
RNS Drum ID	**Parent Drum ID**	**SWB ID***	**<1000**	**1000-2000**	**2000-5000**	**5000-7500**	**7500-10000**	**>10000**
69635	S851418				✔			
69636	S843672					✔		
69637	S813471				✔			
69638	S822679						✔	
69639	S843673						✔	
69641	S813471					✔		
69642	S818412				✔			
69644	S793450						✔	
69645	S822679							✔
92459	S910171	SB50559			✔			
92472	S910171	SB50559						
92669	S823187	SB02203			✔			
93605	S824541						✔	
94068	S851852							✔
94227	S813475		✔					
Color Legend		**Total**	**7**	**11**	**12**	**4**	**10**	**11**
Frequently sampled drums	Two RNS drums in an SWB							

* If SWB ID is blank, the SWB is referred to by its RNS drum ID

3 Model Development

This section presents a conceptual and numerical model of the transient behavior of gases within the SWB headspace for containers hosting the 55-gallon RNS waste drums. The subsections below include the conceptual model with accompanying assumptions and simplifications, followed by the mathematical model developed to simulate the headspace gas concentrations.

3.1 Conceptual Model

In principle, a fully realistic depiction of the concentrations of headspace gases within the SWB would consider the transient processes of ventilation flows into and out of the SWB, temperature and spatially dependent reaction and gas generation within the 55-gallon drum, expulsion of those gases into the SWB headspace, and gas flow and mixing above and between the drums inside the SWB. Given the complexity of those processes and the lack of input data to inform such a model, an idealized model approximating the key processes is a more practical approach. The following simplifications and assumptions are made for the conceptual model developed herein.

Gases within the headspace of the SWB are perfectly mixed. The ventilation of the drum should result in gas circulation and mixing, and molecular diffusion of gases within the open space should be rapid, leading to homogenization of gas concentrations. Mole fractions of generated gases such as CO_2 do not exceed a few percent, so gravitational accumulation of gases heavier than air at the bottom of the SWB should be minimal. An implication of this assumption is that there is a single, time-varying value of concentration within the headspace, and that the sampling campaign provides a measurement of that concentration-time history.

Average gas flow rates are in balance at any point in time. In other words, the inflows equal the outflows. Here we make a distinction between the short-term transients of induced inflow and outflow via ventilation, versus the long-term average flows that we desire to represent in the model. From the perspective of a representation of the long-term behavior of the system, the inflow is the time-averaged flow rate into the SWB during periods when it is inhaling. The rate of gas generation from reactions occurring within the RNS waste drum is another "inflow" into the SWB headspace. Likewise, outflows are the time-averaged flow rates while the SWB is exhaling. Because the gas pressure in the SWB is approximately atmospheric (at the local conditions where the drums are stored), there is no net accumulation of gas within the headspace in the long term. This assumption stipulates that an averaged representation of the inflow and outflow (controlled by cyclic changes in barometric pressure, temperature variability, and transients in room airflow) that ignores the short-term "on/off" nature of

ventilation flows is sufficient for a model of the long-term mass balance of gases within the SWB.

Chemical reactions within the RNS waste drum generate gases that feed the SWB headspace; these reactions follow an Arrhenius temperature dependence. While there may be multiple reactions, as implied by the analysis of headspace gas data presented earlier, this model assumes that a single reaction with Arrhenius temperature dependence is the sole source of permanent gases such as CO_2 and N_2O that are observed. This is a simplification made out of necessity, given the inherent complexity of the RNS mixtures and lack of detailed information on the reactions. However, it is acknowledged that if multiple reactions occur, there may be shifts in the dominant stoichiometry as a function of temperature.

Temperatures measured in the room where the SWB is stored are an appropriate input for calculating the reaction rates within the RNS waste drum. Temperature is controlled within the Permacon in which the RNS waste is stored, but the system is not kept at a uniform temperature: generally, temperatures are somewhat higher in the summer and cooler in the winter. Figure 3-1 shows the daily temperatures measured in the cell in which the SWB containing Drum 68685 is stored. Two forms of the data are presented: the daily average temperature averages the diurnal temperature swings from day to night, whereas the daily maximum temperature simply records the maximum temperature of that day. In addition to the seasonal variability, there are higher-frequency diurnal variations in temperature. From separate experiments conducted at Los Alamos to understand the rates of heat transfer within the drum, we know that the characteristic response time of a drum in this configuration is of the order of a few days. Therefore, diurnal fluctuations should be damped, such that the drum experiences a bulk temperature that can be well represented by the daily average or daily maximum temperature. Conversely, the drum response time is short compared to the long storage periods that the model is designed to simulate. Therefore, the assumption that room temperatures track the measured temperatures in the vicinity of the drums is an appropriate approximation. Finally, this assumption also requires that heat generation rates due to reaction within the RNS drum are too small to impact the bulk average temperature within the drum. In the model analysis, this assumption is tested *ex post facto* by estimating the heat generation rates that would accompany the reactions in the drum to determine if they would be sufficient to provide significant warming of the contents.

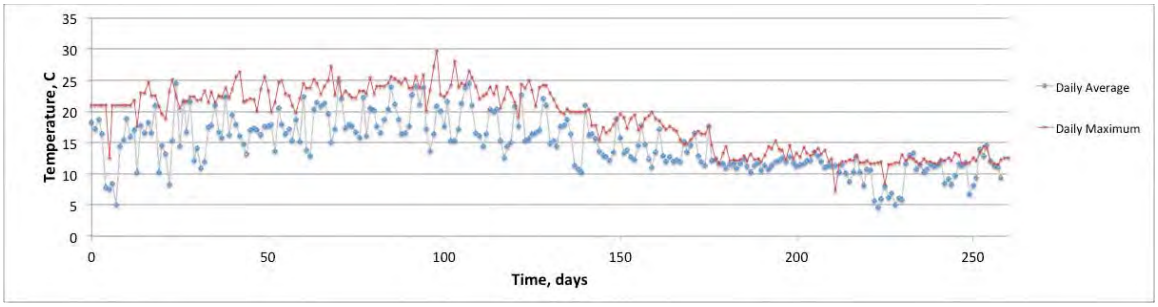


Figure 3-1 Measured temperatures within the cell containing the SWB of Drum 68685.

3.2 Mathematical Model

Given the assumptions outlined above, a mass balance in the SWB headspace for a gas constituent such as CO_2 or N_2O generated from the RNS waste can be described as follows:

$$V_{HSG}\frac{dC}{dt} = -Q_{out}C + Q_{in}C_{in} + \chi(T) \quad (1)$$

where

$$\chi(T) = Ae^{-E_a/RT} \quad (2)$$

In these equations, C is the concentration of a particular gas in the headspace (mol/L); t is time (s); T is temperature (K); C_{in} is the atmospheric concentration of the gas (mol/L); V_{HSG} is the volume of the headspace gas within the SWB (L); $\chi(T)$ is the rate of generation of the component (e.g. carbon dioxide or nitrous oxide) being simulated (mol/s); E_a is the activation energy of the reaction within the RNS waste drum (kcal/mol); R is the universal gas constant (1.987e-3 kcal/mol-K); A is a lumped term with units of mol/s containing the pre-exponential factor and a scaling factor that establishes the actual molar generation rate of the gas within the RNS waste drum; Q_{in} is the long-term average gas flow rate into the system due to SWB inhalation (L/s); and Q_{out} is the long-term average gas flow rate out of the system due to SWB exhalation (L/s). Due to gas generation within the RNS drum, Q_{in} and Q_{out} are not equal to one another, but are related through the following expression:

$$Q_{out} = Q_{in} + Q_{gen} \quad (3)$$

where Q_{gen} is the volumetric generation rate of all gases due to reactions within the RNS drum, and is calculated from the following expression:

$$Q_{gen} = \frac{\chi(T)RT}{P_{HSG}X_g} \quad (4)$$

In this equation, the universal gas constant is 0.08206 L-atm/mol-K, P_{HSG} is the pressure in the headspace, assumed to be 0.7849 atm, the mean atmospheric pressure that the elevation of Los Alamos, New Mexico, where the drums are stored, and X_g is the fraction of the total gas generated from reaction that is the constituent being modeled. In other words, if, for example, carbon dioxide is being simulated in the model, other gases will be generated along with it, and are accounted for by this fraction, which is obtained from the stoichiometry of the reaction presumed to be occurring within the RNS waste drum that is giving rise to the gas generation.

This mass balance equation is closely related to the continuous stirred tank reactor (CSTR) model that is commonly employed in the field of chemical engineering to describe well-mixed reactors, except that in this case, the inlet and outlet flow rates are not necessarily equal due to the generation of gas due to RNS waste reactions. Equation (1) is solved numerically using a simple Picard integration scheme in the spreadsheet titled *HSG model calculations.xlsx* that accompanies this report. Details of the numerical calculations are presented in that spreadsheet, along with the numerical verification tests performed to ensure that the solutions obtained are accurate. A summary of the verification tests is presented in Appendix 1.

In the presentation of the results in the remainder of this report, the units of the parameters of time and concentration are converted to days and ppmv, respectively, to enable comparison to the available data.

4 Model Results

This section presents model results describing the long-term transient behavior of carbon dioxide and nitrous oxide in the headspace gases. The most complete data set is for Drum 68685, a sibling drum of 68660, which also exhibits some of the highest concentrations of carbon dioxide of any of the RNS drums in storage at LANL.[3] The first subsection presents a detailed set of modeling results for this drum. Then, a more general set of modeling results are presented in the next subsection, to illustrate the characteristic types of headspace gas behavior that are occurring in other drums. Following that, the behavior of headspace gases under different possible cooling scenarios is presented in Section 4.3, and the potential use of these measurements to detect anomalous reactions that would be indicative of initial heating within the RNS waste drum is discussed in Section 4.4.

4.1 Model of Drum 68685

It is necessary to define a chemical reaction involving the evolution of carbon dioxide and nitrous oxide in order to simultaneously simulate the behavior of both gases in the same model. For Drum 68685, we adopt the cellulose oxidation reaction suggested by Leibman et al. (2015):

$$C_6H_{10}O_5 + 6NaNO_3 \rightarrow 3Na_2CO_3 + 3CO_2 + 5\ H_2O + 2\ N_2 + N_2O + O_2$$

This reaction was first postulated when cellulose was considered as a denitrifying reagent for Hanford tank waste prior to waste vitrification (Scheele et al., 2007). While the Swheat kitty litter cannot be simply characterized as $C_6H_{10}O_5$, it serves to illustrate the potential products from oxidation of the Swheat by nitrate salt oxidizer present as a bulk material in the waste stream. In this reaction, the first reactant is an idealized representation of the repeating portion of a cellulose molecule. Although this model reaction is idealized, it allows for a specification of the stoichiometry and the heat of reaction on a per-mole basis. Thus, in this model, one mole of cellulosic material generates seven total moles of permanent gas, of which three moles are carbon dioxide (CO_2) and one mole is nitrous oxide (N_2O). Leibman et al. (2015) describe this model reaction to be exothermic with a heat of reaction of -577.013 kcal/mol. This stoichiometric ratio and heat of reaction are used in the overall simulation of results below.

Other inputs are set as follows:

[3] *While Drum 68685 is a sibling of the drum that breached in WIPP, there are significant differences between the two that preclude the expectation that they will behave identically. For example, Drum 68660 contains a layer of waste from the absorption of free liquid with Swheat, whereas the Swheat used in 68685 was only in the form of Swheat/Salt mixtures.*

The atmospheric concentrations of carbon dioxide and nirous oxide, used as the input concentrations when the SWB is inhaling, are 400 ppm and 0.325 ppm, respectively.[4]

Headspace gas volume V_{HSG}: the total inner volume of the SWB is approximately 1900 L, some of which may or may not be taken up by the presence of the four 55 gallon drums. The drums, each of which are 208 L, are either empty or partially filled with RNS or other waste. Each dunnage drum in the SWB containing Drum 68685 has a lid, but the bung is removed, implying that the headspace gas volume may include the empty volume within the dunnage drums as well as the remainder of the gas volume in the SWB. The other extreme is that gas exchange from the headspace to the dunnage drums is limited, to the point that only the volume within the SWB but outside the 55 gallon drums is available for headspace gases to mix. In the study, we treat this as an uncertainty that is examined with a sensitivity analysis: the main model result is performed with the maximum volume ($V_{HSG} = 1900\ L$); the other extreme is modeled assuming the minimum volume ($V_{HSG} = 1900 - 4 \cdot 208 = 1068\ L$).

The parameters Q_{in}, A, and E_a are adjustable in the model in order to fit the available data. Fitting was performed manually.

The simulated headspace gas concentration results using the daily maximum temperature data and the minimum headspace gas volume are shown in Figure 4-1. The fit to the data is excellent. For this model, the flow rate and reaction parameters have distinctly different influence on the transient behavior. The flow rate (or more precisely, the characteristic turnover time of the headspace gas, V_{HSG}/Q_{in}), controls the initial rate of rise of the concentration values; the turnover time is 22 days for this simulation. The reaction parameters control the ultimate level of the concentration values as well as the difference in the highest concentrations at around 100 days (at the highest temperatures in the summer) versus the lower values at low winter temperatures (from day 230 to the end of the simulation). The stoichiometry of the model reaction controls the relative levels of carbon dioxide and nitrous oxide: the 3:1 stoichiometric ratio of the generated gases is reflected in the data, as observed by Leibman et al. (2015). This numerical model supports that observation, in that the transient behavior of both gases are well represented by the model.

One of the outputs of the model is the gas generation rate due to reaction, which, when combined with the heat of reaction, gives a prediction of the heat generation rate in the RNS waste drum. Predicted gas generation rates are very small, ranging from 4 to 5 cm^3/min during the initial and summer months, declining to about 2 cm^3/min in the winter. This compares to the fitted value for Q_{in} of 60 cm^3/min. An implication of this model is that the rate of gas generation

[4] *From information on atmospheric concentrations of trace gases found at the following Website*: http://www.eea.europa.eu/data-and-maps/daviz/atmospheric-concentration-of-carbon-dioxide-1.

is a small fraction of the ventilation rates into and out of the drum (i.e., $Q_{in} \approx Q_{out}$). Thus, measuring gas generation rates via direct flow rate measurements is likely to be masked by the much greater inlet and outlet ventilation flows. If more vigorous reactions were to occur associated with thermal runaway, the rates of gas generation would be much larger and probably could be measured.

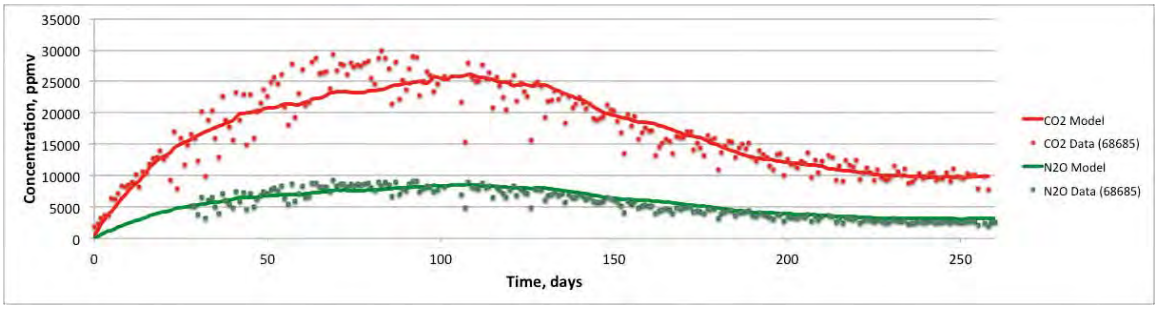


Figure 4-1 Simulation results for carbon dioxide and nitrous oxide concentrations for Drum 68685. Daily maximum temperature record and minimum SWB headspace volume used.

Heat generation rates from this reaction are shown in Figure 4-2. The predicted heat generation rate in the drum is very small, averaging about 0.8 to 1 W during the summer, declining to about 0.3 to 0.4 W under the colder winter storage conditions. This level of heat generation is likely to be easily dissipated through the SWB and into the room. This result supports the conclusion that internal heating in these drums due to this reaction is inconsequential, and confirms the model assumption that the drum temperature is controlled by the temperature of the storage unit, with no substantial heat contribution from internal heating. This also suggests that the assumption of negligible internal heating yields a self-consistent model: the amount of reaction predicted by the model from fitting of the headspace gas concentration data under that assumption is too small to result in internal heating. The caveat to these results is that there could be other reactions occurring that generate heat without gas generation. There should be additional investigation into the possibility of such reactions, and later the possibility of these reactions being detected in the headspace gas measurements is examined.

The prediction of the total amount of carbon dioxide generated over the 260 day simulation period is about 18.6 moles, which would come from the reaction of 18.6/3 = 6.2 moles or 1 kg of Swheat. This is a very small fraction of the total amount of Swheat available for reaction, implying that there are ample quantities of reactants available to supply continued gas generation at these low rates for as long as these drums stay in storage. From this result it follows that the reaction and gas generation rates are likely to track the storage temperature as it rises again in the summer of 2015, as the reactions are unlikely to be limited by the quantity of available reactants for the foreseeable future. This prediction

constitutes a blind test of the validity of the model. Concentrations should track the seasonally dependent temperatures of the storage unit in a predictable way, as long as the drum configuration in storage remains as it is today. Any significant deviations from predictions would be evidence of a change in the reaction characteristics of the drum. Increased gas generation above that predicted in the future would be evidence of other reactions. Deviation from the prevailing trends in gas concentrations may provide a useful indicator to confirm whether incipient reactions, either the ones modeled or additional reactions unlike those observed to date, are occurring. Use of these results to interpret future headspace gas concentrations, including the potential for diagnosing incipient heat-generating reactions, is described in Section 4.4 below.

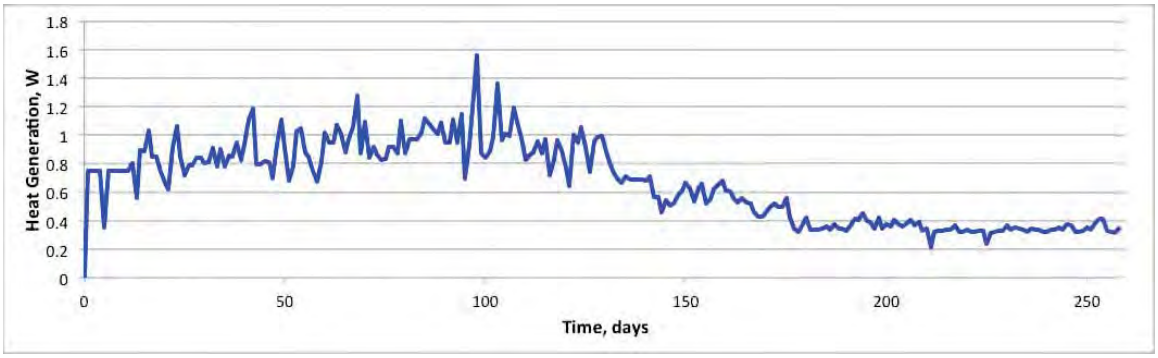


Figure 4-2 Simulation of heat generation assuming the postulated Swheat reaction for Drum 68685.

Some of the parameters in the model are uncertain; for this reason, it is important to establish the uncertainty around the key results just presented. To do this, three additional models were developed. The first model assumes that the minimum gas volume (1068 L) is available in the headspace. For this model, an equally good fit the concentration data is obtained (not shown), with the changes to the other parameters yielding somewhat lower gas generation (14.3 moles of carbon dioxide over the 260 day period, compared to 18.6 moles when the smaller volume is assumed), and lower heat generation (maximum heat output of about 0.6 to 0.8 W compared to the 0.8 to 1 W range for the previous case). The general conclusions that the level of reactivity, attributable to the aforementioned denitrifying reaction, is low and generates minimal heat still hold.

A second sensitivity study used the daily average temperature as the temperature input to the model, and resulted in a similarly good fit to the data. The predicted gas and heat generation rates were marginally larger than the case presented in detail above.

A third model was developed to attempt to establish an upper bound on the gas generation rate (and heat generation rates) and still obtain a reasonable fit to the data. Increasing the pre-exponential factor alone to increase the rate results

in proportionally higher concentrations in the headspace gas. In principle, these concentrations can be made lower again in the model by increasing the inlet flow rate to achieve the proper rate of dilution within the SWB. However, this results in shorter turnover times within the SWB, resulting in an inability to simulate the early-time concentrations: the predicted rate of increase is too fast compared to the data. Figure 4-3 illustrates this effect for an increase in reaction rate by a factor of three, and offsetting this by an increase in ventilation rate (the turnover time is 7.3 days for this simulation). The plateaus are still adequately fit, but the initial rise is too fast. This analysis roughly establishes a cap on how high the reaction rates could be compared to the model developed earlier: the reaction and heat generation rates cannot be more than about a factor of two and still explain the observed concentrations. As with the other sensitivity analyses, this uncertainty does not place into question the fundamental conclusion from the previous result that gas and heat generation rates are very low within the RNS drums in storage at LANL.

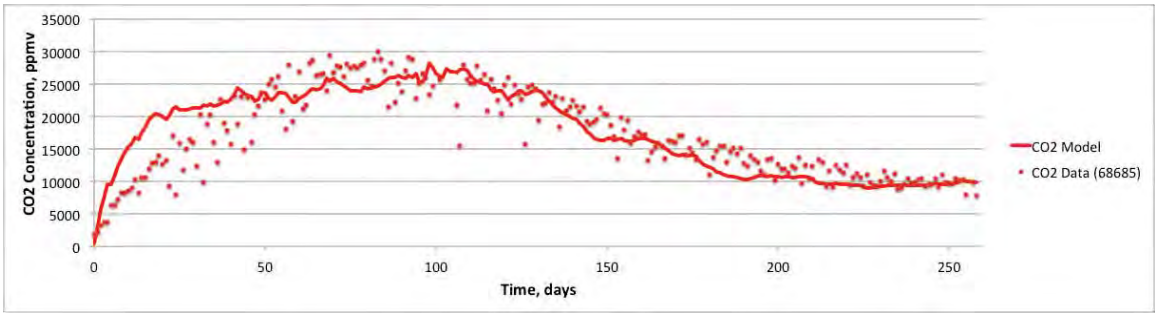


Figure 4-3 Simulation attempting to fit the carbon dioxide concentrations for Drum 68685 with higher reaction rates combined with higher ventilation rates.

As a final consistency check, the activation energy required to fit the data was about 15 kcal/mol for the case presented in detail above, whereas the case in which the daily average temperature was used as input required adjustment of this value to 20 kcal/mol (and compensating for this change by adjusting the pre-exponential term to achieve the fit). The range of 15-20 kcal/mol obtained from this model is within the range proposed by Clark and Funk (2015) of 10-30 kcal/mol as typical of activation energies for reactions of this nature.

An ancillary use of the model is to evaluate the moisture conditions within the drum, including the possibility of drying of the RNS waste contents over time. The RNS waste drums were packaged with significant quantities of water, either as free liquid absorbed with Swheat, or wet nitrate salts mixed with Swheat. Since the Swheat/Salt mixtures have been shown experimentally to be reactive at lower temperatures when they are dried (SRNL, 2015), it is important to understand if significant drying could occur after packaging. For the model result of a time-averaged flow rate due to venting of 60 cm^3/min, and assuming the

inlet air is dry and the exit air is 100% humid,[5] only about 1.6 g/day or 580 g/year (0.58 L/year) would be removed from the drum via evaporation. Therefore, one would not expect the RNS waste to dry significantly in its current storage configuration, either to date or many years into the future.

4.2 Application of the model to other drums

The model results in the previous section provide a self-consistent description of the processes controlling the concentrations of gases in the headspace in SWBs containing RNS waste drums. Although the general conclusion of low gas generation and heat generation rates apply to all drums, Section 2.2 demonstrated that each drum has its own set of unique conditions that will change the details of the transient concentration behavior within SWB headspace. The model developed herein would explain this behavior through a combination of slower kinetics and slower venting rates. A few example calculations with different parameter values are presented in Figure 4-4 to illustrate this point. When only the kinetics are slower (Model 1), the curve retains its same shape but the carbon dioxide concentrations are lower (peaking at about 5000 ppmv compared to close to 30,000 ppmv for Drum 68685). To explain concentrations in SWBs that rise throughout the entire period (which includes both summer and winter temperature conditions) or reach a plateau (Model 3), slower ventilation rates are also required, such that turnover times in the SWB headspace are greater. Model 2 is an intermediate case that shows a plateau and a slight decline towards the end of the simulation. Thus, drum-to-drum variability in reaction rates and ventilation rates explains the different behaviors of the headspace gases observed in the 55 SWBs.

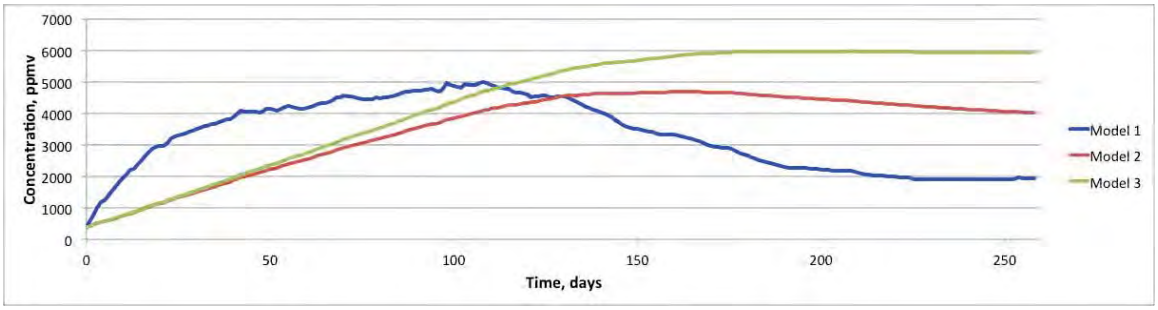


Figure 4-4 Example model results showing different characteristic carbon dioxide concentration behavior depending on the selection of kinetics and flow parameters.

[5] *These are clearly bounding assumptions applied for analysis purposes: 1) the atmospheric air at Los Alamos, New Mexico is relatively dry, but obviously contains some water vapor, and 2) the water vapor content in the SWB headspace may be limited by the fact that the water in the RNS waste is physically separated from the headspace, and is absorbed or present within small pores in the material, and therefore is less accessible for vaporization than if there were free liquid in the SWB itself.*

4.3 Predicted behavior under alternative storage scenarios

Various scenarios are under consideration by LANL to further reduce the rates of reactions occurring within the drums. To examine the impact of different cooling scenarios a modeling analysis was performed in which it is assumed different levels of cooling are achieved. These were compared to the current temperature control capability, which works to provide a limit to the maximum temperature in the Permacon and to provide for worker comfort.

To enable a simple modeling comparison, it is assumed that if additional cooling capability is installed, that it comes on line on May 19, 2015, exactly one year after the first gas sample was collected.[6] For the current temperature control case, it is assumed that the daily maximum temperatures in the Permacon repeat themselves exactly in 2015. Different cooling capabilities would perform differently, but in general, if the cooling is performed in the Permacon, the highest temperatures would be "clipped" at a particular value, whereas temperatures below this set point would be achieved if the environmental conditions at that time of the year allowed this to occur. For modeling purposes, this is represented by the set of temperature profiles in Figure 4-5, with temperatures above the control point clipped at that temperature. Control temperatures of 20, 15, and 10°C were chosen for this analysis.

Projected carbon dioxide concentrations in the headspace of the SWB under these scenarios are shown in Figure 4-6. All scenarios assume that, in contrast to the low initial concentration at the onset of the Isolation Plan, the initial concentration is 20,000 ppmv, a value likely to be experienced in this SWB in May, after a year of storage. As expected, greater degrees of temperature control result in a lowering of the gas generation rate and concentrations in the headspace. As a defense-in-depth measure, temperature control seems prudent. However, recalling that even under the current level of temperature control, gas generation rates are low, it is unlikely that this additional curtailing of the concentrations represents a meaningful additional factor of safety over an already safe storage condition.

[6] *Different assumptions could be implemented, but this one simplifies the development of these cases, while still being sufficient for this analysis.*

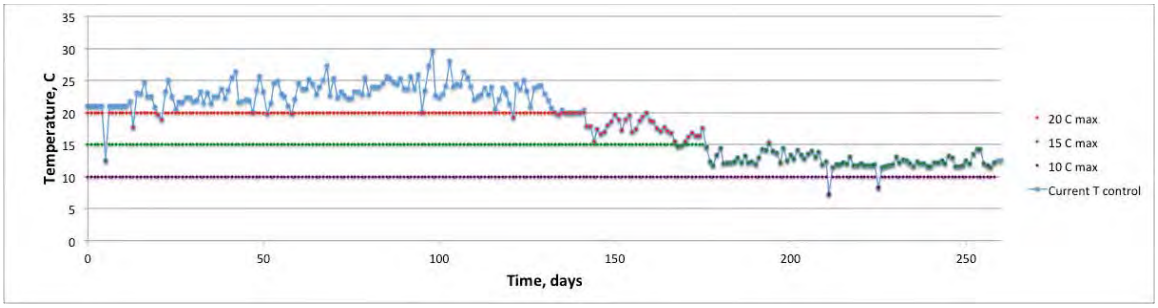


Figure 4-5 Temperature profiles used to examine the impact of different temperature control options on the headspace gas behavior.

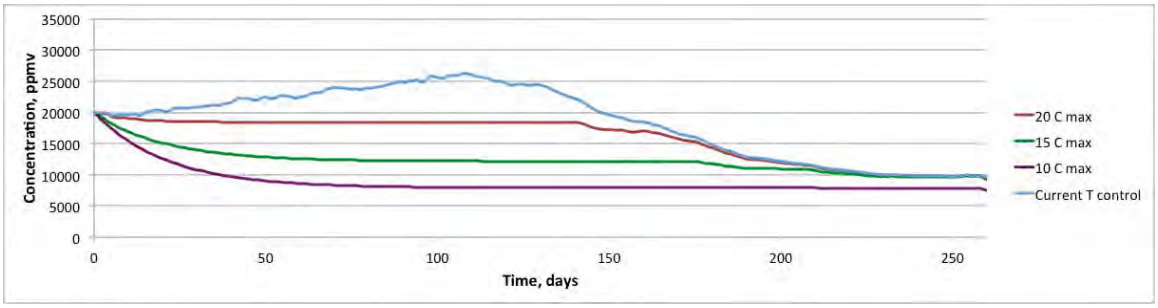


Figure 4-6 Projected carbon dioxide concentrations for the alternative cooling scenarios, compared to the option assuming the current temperature control is applied.

This last statement pre-supposes that there are no additional reactions occurring for which temperature control would be beneficial. For this not to be the case, we would need to postulate an exothermic reaction that does not generate gases, yet is nonetheless occurring now or is triggered at some point in the future. The logic is that if those reactions were occurring and generating significant gases, then they would be detectable in the headspace gas results. The possibility of such reactions should be investigated; in the next subsection, this possibility is explored using the model.

As a final note on temperature control, the lowest temperature set points are likely to require a significant change to the storage configuration of the SWBs, such as placing them in a large refrigerator. This change would not only lower the temperature, but also change the ventilation conditions and thus the inlet and outlet flow rates of the SWB. If the flows during inhalation and exhalation changed significantly, the model presented above would no longer be valid, and the year's worth of information that went into the calibration of the model would need to be regenerated for this revised storage configuration. Lower inhalation and exhalation flow rates would cause the SWB headspace gas concentrations, which presumably will drop in response to the lower temperature, to respond more slowly than before the change. This will likely result in added uncertainty

in the interpretation of concentration values, and thus added complexity to the technical arguments supporting the efficacy of the cooling measures taken.

4.4 Detection of precursors to thermal runaway

An important issue for safe management of the RNS waste is to identify key indicators in data such as SWB headspace gases that would provide early warning of the precursors to thermal runaway reactions. At present, a model of gas-phase mass transport (this study) has not been coupled to a thermal transport model to simulate these processes directly. In lieu of a more sophisticated model, plausible scenarios of low-level heat-generating reactions are constructed to examine the degree to which headspace gases respond to changes in the reactivity conditions. If headspace gas concentrations respond relatively rapidly to abrupt changes inside the RNS waste drum, then the sampling campaign can be used proactively to detect these changes, or in the case of absence of deviations from expected behavior, to confirm a safe storage condition. Two types of perturbations are studied in this section: increased reaction rates from undetected temperature rise in the RNS drum, or clogged filters on the RNS drum leading to pressure rise.

A safety issue of great concern for initiating thermal runaway for this waste is the presence of undetected reactivity and low-level heat generation that gradually accelerate to a point at which heat loss from the drum is outpaced by the heat generation rate due to reaction. At that point, temperatures rise, reaction rates increase exponentially, and eventually thermal runaway occurs. Reactivity studies (Clark and Funk, 2015) have established a temperature of 60 ^{o}C for complex nitrate salt mixtures, certain trace metals, and Swheat to exhibit thermal runaway. Today the drums at Los Alamos show no evidence of this behavior, but such an episode cannot be fully ruled out in the future. The reactions that we continue to investigate are those that would provide the initial heating from ambient temperatures to 60 ^{o}C. Current working hypotheses include either microbial reactions or low-level chemical reactions, of which the Swheat oxidation reaction described earlier is an example.

The two scenarios described and simulated below postulate that, for unknown reasons, reactivity conditions undergo a change to a more reactive state at a given point in time. In the first case, we assume that the Swheat reaction exhibits a step change in reaction rate by a factor of 10 at day 101 of the simulation. The resulting effect on the carbon dioxide concentration in the SWB headspace is shown by the red curve Figure 4-7, which is a close-up of the concentration in the time window during which the change occurs. The concentration predicted by the model deviates immediately and substantially from the previous trend (the blue curve), suggesting that such a change could be detected within a matter of a few days.

The second scenario postulates that a reaction independent of the Swheat oxidation reaction, such as microbial activity, provides an internal heat source sufficient to warm the RNS waste. For this scenario, it is assumed that at day 98, the temperature within the waste begins to deviate from the ambient temperature (29.7 ^{o}C, the maximum daily temperature on that day in the previous record) without detection in the temperature measurements, ramping at a rate of 1 ^{o}C per day.[7] At this rate, the RNS drum contents would reach 60 ^{o}C in 30 days, a time frame that is consistent with the breach of Drum 68660 in WIPP: the time between emplacement in WIPP and the breach was about two weeks. Figure 4-8 shows the postulated undetected ramping of waste temperature as it deviates from the temperature in the room. In this case, the reaction that gave rise to the previous headspace gas concentrations becomes a tool for monitoring the conditions within the drum, under the assumption that the reaction will exhibit the same temperature dependence as it has previously as temperatures in the RNS waste drum rise.

The simulation labeled "Drum T rise" in Figure 4-7 shows that the carbon dioxide concentration rises accordingly, reaching values 50% greater than before the excursion after 8 days (with a RNS drum temperature rise to about 38 ^{o}C); a doubling of the CO_2 concentration is predicted after 13 days (RNS Drum temperature of 43 ^{o}C). It is possible that more aggressive heating could take place with more rapid temperature rise; however, in that case, the time required to detect the changes would be reduced accordingly.

The concentration levels simulated are examples of the degree of change expected. Detectability presumes that one can discriminate a sustained rise from the "normal" scatter in the measurements. To shed light on this issue, concentration data from the record for this drum in 2014 are superimposed on the simulations in the figure. The data are relatively stable on the scale of the concentration deviations we are trying to detect, which is favorable from the standpoint of detectability and avoidance of false positives or failing to detect an actual excursion. Qualitatively, it seems likely that after about 5 days of concentration measurements, or in this case 5 ^{o}C of temperature rise within the RNS drum, an excursion from the baseline behavior would be detectable with high confidence. A rigorous statistical analysis of the data should be performed to solidify this conclusion.

Five days probably represents an upper bound on the time required to detect changes in internal reactivity conditions, for the following reason. The analysis just performed assumes that the only means for detecting changes is through temperature and headspace gas concentration changes indicated by the increased rate of reactions occurring at low levels within the drum. However, if

[7] *It is plausible that such a temperature excursion would go undetected in the temperature record because temperatures are measured on the outside of the SWB, which is thermally shielded from the temperature within the RNS waste drum.*

additional heat-generating microbial reactions or oxidation reactions are the cause of this heating, the character of the gas composition data would likely change dramatically as well. Additional sources of carbon dioxide, the presence of other gaseous by-products, or changes in the relative quantities of other gases would almost certainly accompany a significant change in the reactions occurring in the drum. It is also possible that low-level self-heating might begin to be visible from the SWB temperature measurements. Options should be explored to increase the likelihood of detecting directly such temperature anomalies, perhaps through the use of continuous, real-time infrared monitoring of the SWB in the vicinity of the drum vent. All of these indicators, and any new ones developed to enhance the monitoring program, would be available to diagnose potential incipient reactions causing deviations from the baseline observations.

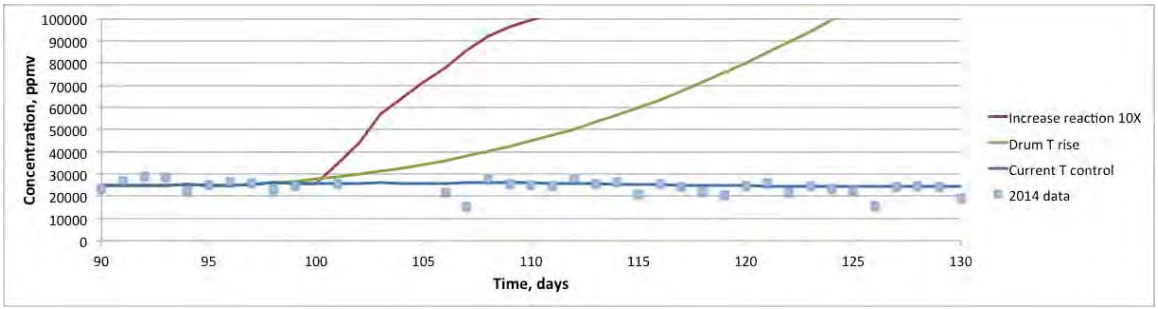


Figure 4-7 Simulated carbon dioxide concentrations for hypothetical scenarios in which reaction conditions change abruptly inside the RNS waste drum. Simulated scenarios track the baseline scenario until the postulated change, after which concentrations climb rapidly.

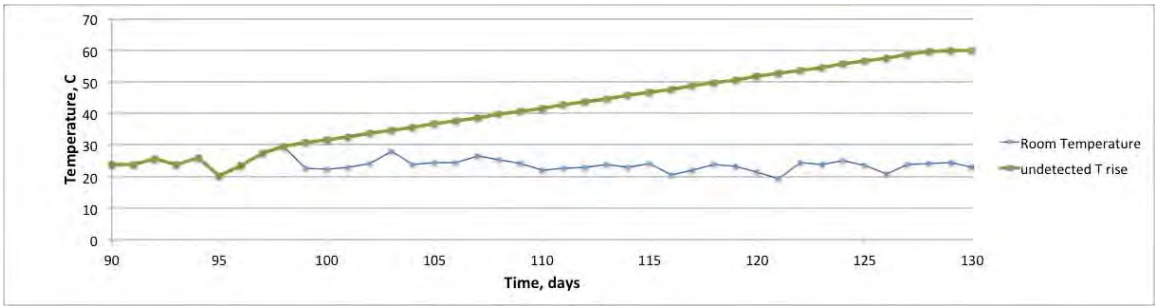


Figure 4-8 RNS waste drum temperature profile postulated for the scenario of undetected temperature rise due to low-level chemical or biological reaction. Self-heating begins at day 98, when it deviates from the temperature in the room.

Finally, note that the conclusions presuppose the continuation of daily analysis of headspace gas concentrations, and the continued storage of these drums in a manner similar to the past. Changes to the storage configuration, such as moving them to storage in a closed refrigerator, would complicate the interpretation and

make such diagnostic approaches less useful. This factor must be balanced against the benefits of cooling in reducing reaction rates. Also, daily measurements are currently being made only for seven of the SWBs containing RNS waste drums. Obviously, if incipient reactions begin to occur in drums other than these seven, they could escape timely detection if, for example, they are only being sampled monthly. The seven frequently sampled drums were chosen because their headspace gases are suggestive of a more reactive condition within the RNS waste. In addition, four other drums exhibit carbon dioxide concentrations exceeding 10000 ppmv (Table 2-1). Consideration should be given to adopting a more frequent sampling regimen for those four drums.

An additional safety consideration pertains to the rate of pressure rise in the RNS waste drum under an abnormal situation in which the filters are either blocked or plugged. Although there is no evidence that this condition applies to Drum 68685 or other drums in storage at Los Alamos, a pressure rise calculation can provide perspective on the conditions that would be experienced in other drums, including the breached drum at WIPP, if this were to occur. Taking the reaction rates determined from the model for Drum 68685, the ideal gas law can be applied to calculate the rate of pressure rise under this level of gas generation. Averaging the gas generation rate over the 260 day simulation period, and assuming that 100 L of the total 208 L is occupied by gas (the remainder being solid waste material), the model suggests that generation of gas at the rates estimated for Drum 68685 would lead to a rate of pressure rise under a filter blockage scenario of about 0.6 psi/day.

The SRNL (2015) study estimates drum failure at pressures between 35 and 75 psi, or roughly 20 to 60 psi above atmospheric pressure. These pressures would be reached after 33 to 100 days under a filter blockage scenario at the gas generation rates inferred from Drum 68685. This calculation illustrates the type of pressure rise that would be expected, and suggests a “time-to-failure” not unlike that experienced for the drum that breached in WIPP. Of course, the WIPP drum also experienced temperature rise and increased reaction rates, which would accelerate the process. However, if filter blockage was involved, it is possible that pressure rise at lower temperatures could have provided the initial impetus for increasing the reaction rates, heat generation rates, and ultimately the thermal runaway that resulted. Additional full-scale drum tests being planned by LANL should shed light on this subject.

As for the behavior of the headspace gases in the event of a filter clog in an RNS waste drum within an SWB, the model can be used to simulate this event by forcing the reaction rate in the RNS waste drum to 0 at a particular time. The premise is that the reaction continues to take place within the RNS waste drum, but the reaction gases are no longer expelled into the SWB. Figure 4-9 shows the resulting carbon dioxide concentration for such an event starting at day 98. The headspace gases continue to experience mixing with atmospheric air, but without a source term from the RNS waste drum, the concentration curve starts

to deviate towards lower values than would be expected had the clog not occurred. As with the case of a temperature excursion, this deviation from expected values should be detectable in the headspace gas concentration trends.

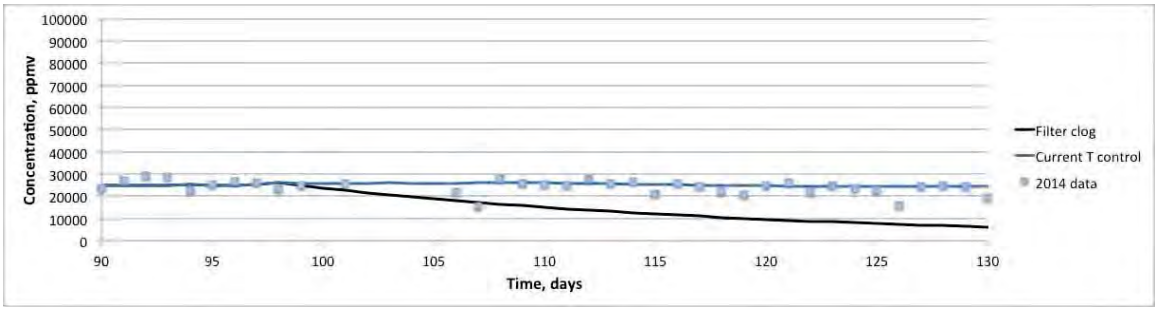


Figure 4-9 Simulated carbon dioxide concentrations for a hypothetical scenarios involving a clogging of the filter on the RNS waste drum.

5 Conclusions

This study supports the case for the use of gas concentration measurements of the SWB headspace as an interpretive tool for discerning the type and rate of gas-generating reactions within the RNS waste drums in storage at LANL. Model results imply that the measurements could provide an early warning for the occurrence of heat-generating chemical and biological reactions in the drums, enabling actions to be taken before self-heating at low temperatures triggers a runaway exothermic reaction at higher temperatures. The study conclusions are summarized below.

1. The headspace gas concentrations are consistent with a description consisting of the combination of a radiolysis mechanism for hydrogen gas generation and low-level, temperature-dependent chemical reactions such as oxidation for the generation of other gases such as carbon dioxide and nitrous oxide. Many of the SWBs have low levels of reaction product gases, whereas a subset exhibit higher concentrations indicative of somewhat higher levels of reactivity. The ratios of gases within the drum for the SWBs with the highest gas concentrations exhibited a similar characteristic signature, but with variability from drum to drum.

2. A simple mathematical and numerical model of the headspace gas behavior provides a plausible description of the long-term variations of concentrations of gases such as carbon dioxide and nitrous oxide in the SWB headspace. The model balances a gas generation source term from reactions in the RNS drum with mixing from the outside atmospheric air due to ventilation of the SWB. Excellent fits to the concentration data for Drum 68685 (a sibling to the drum that breached in WIPP) were obtained throughout the entire time period since the RNS drum was placed within the SWB in May of 2014.

3. The model results for Drum 68685 suggest a low level of chemical reaction within the RNS waste drum. Gas generation rates due to reaction are predicted to be a minute fraction of the ventilation rates into and out of the SWB, and calculated heat generation rates for a reasonable postulated reaction (oxidation of Swheat, which appears to have the correct stoichiometry based on the simultaneous fit to the carbon dioxide and nitrous oxide data) are also very low, nominally 1 W or less for the drum. If other reactions are occurring, these could also generate heat, but if they also generate carbon dioxide, this should have been reflected in the form of higher concentrations. Therefore, the level of carbon dioxide in the drums appears to provide a bound on the level of reactivity and heat generation; this bound is very low from a thermal perspective. Investigations should focus on the potential for reactions not involving the generation of carbon dioxide to attempt to identify other important reactions not reflected in the headspace gas data.

4. The reaction rates exhibit a significant temperature dependence, which explains the higher concentrations of carbon dioxide and other gases in the SWB headspace in the summertime compared to the winter. A model reaction exhibiting an Arrhenius temperature dependence was employed in the model. Calibrations to the data led to values of 15-20 kcal/mol for the activation energy. This range is well within the 10-30 kcal/mol range suggested by Clark and Funk (2015) for such reactions. The low level of reactivity also implies that at these rates, reactants will not be depleted for many years, and that the pattern of higher concentrations under the summertime temperature conditions will repeat itself this summer in a predictable manner. This prediction constitutes a blind test of the validity of the model.

5. Uncertainties in the model have been evaluated to estimate how tightly the model bounds parameters like heat generation rates, given the lack of perfect information on temperatures, available gas volumes inside the SWB and internal drums, and ventilation rates. Reaction and heat generation rates are unlikely to be more than about a factor of two higher than the rates cited above that were derived from the data fit. Other parameter combinations that would lead to higher rates produce simulations that begin to deviate significantly from the observed data.

6. The model could be applied to the data from other SWBs containing the LANL RNS wastes, but this study focused principally on Drum 68685. It is likely that different reaction rates and ventilation rates would be required to simulate other drums, which points to the uniqueness of each drum as a separate system. Notably, all seven of the drums being subjected to daily headspace gas sampling appear to have characteristic behavior similar to that of 68685: higher concentrations of carbon dioxide and other headspace gases than the other drums, and temperature dependence of the concentrations.

7. The drums are currently under temperature control within the Permacon, but there have also been efforts to study the possibility of enhancing the ability to keep the drums cooler throughout the year, including in the summer months. Simulations were performed to examine the effect of these actions on reaction rates. As expected, the model predicts reaction rates and gas concentrations in the SWB headspace to be lower for lower temperatures. As a defense-in-depth measure, temperature control seems prudent. However, recalling that even under the current level of temperature control, gas generation rates are low, it is unlikely that this additional curtailing of the concentrations represents a meaningful additional factor of safety over an already safe storage condition. Moreover, if cooling is achieved by placing the drums in a refrigerator, ventilation conditions will also be affected, which would likely result in added uncertainty in the interpretation

of concentration values, and thus added complexity to the technical arguments supporting the efficacy of the cooling measures taken.

8. Scenarios developed to examine the response of SWB headspace gases to abrupt changes in reactivity suggest that concentrations are a very sensitive means for observing such changes. In a simulation postulating a rise in temperature within an RNS waste drum of 1 ^{o}C per day (presumed to be undetected by measurements on the outside of the SWB), the model suggests that within about five days, the headspace gases would deviate enough from their current state to provide a high likelihood that this off-normal condition would be detected. Even if one assumes conservatively that this time is 10 days, the RNS waste temperature would still be well below the temperature specified by Clark and Funk (2015) and SRNL (2015) as the onset temperature for runaway exothermic reactions for this waste. Further work should be performed to solidify this conclusion by considering issues of detectability of deviations, given that the data are not perfectly smooth, and to make sure that additional drums beyond the seven receiving daily sampling are monitored more frequently for purposes of detecting incipient chemical reactions that might be the precursor of thermal runaway conditions.

Acknowledgements

The author thanks Kay Birdsell, Dan Taggert, Chris Chancellor for their thorough peer reviews of this study and Dave Funk and Dave Clark for helpful discussions on reactivity and headspace gas behavior in the RNS waste drums.

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Appendix 1. Analytical Solution and Test Cases for Numerical Model

With a temperature-dependent reaction, as well as inlet and outlet flow rates that are not necessarily equal, a numerical solution procedure was required to solve the model equations. To verify the correct numerical implementation, an analytical solution was developed under the more restrictive assumptions of constant temperature and $Q_{out} = Q_{in}$, that is, negligible contribution to the gas flow rates from the generation of additional gases due to reaction.

Under those additional assumptions, Equation 1 reduces to:

$$\tau \frac{dC}{dt} = -C + C_{in} + \frac{\chi}{Q} \tag{A1}$$

where $\tau = V_{HSG}/Q$, Qis the gas flow rate in or out, and χ is no longer temperature or time dependent. The analytical solution to this equation is

$$C = C_{in} + \frac{\chi}{Q} + (C_0 - C_{in} - \frac{\chi}{Q})e^{-t/\tau} \tag{A2}$$

Different combinations of the initial concentration, reaction rate, and τ lead to different transient concentration curves. Figure A-1 shows that the numerical model closely matches the analytical solution for different combinations of these parameters, thereby verifying the correct implementation of the model. Details of the parameters used for these comparisons are provided in the spreadsheet "*HSG model.xlsx*" that accompanies this report.

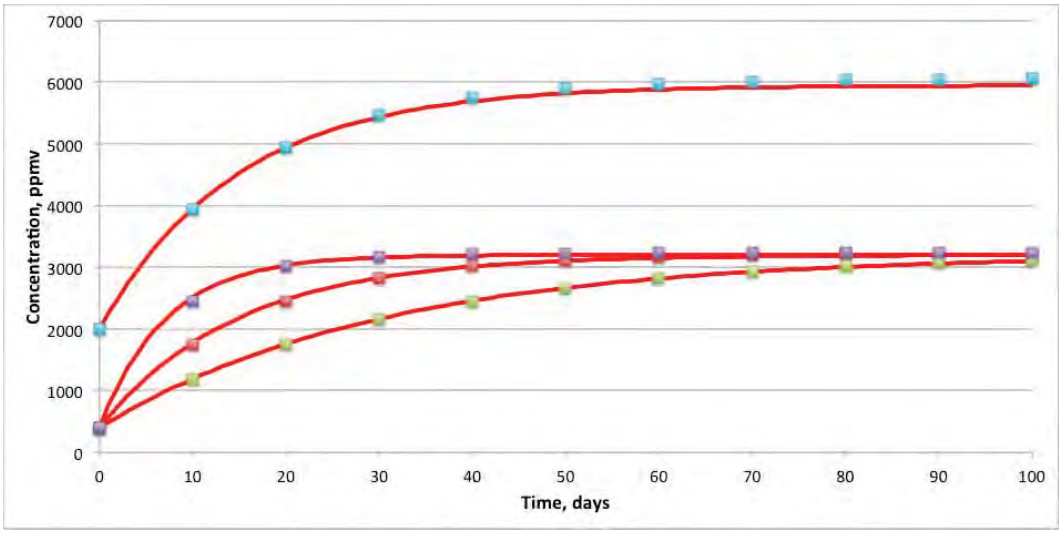


Figure A-1 Comparison of numerical model (curves) and analytical solution (points) for four different combinations of parameters.

Attachment 13

Los Alamos
NATIONAL LABORATORY

memorandum

Weapons Experiments Division

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Symbol: WXDIV-14-1554

Date: December 19, 2014

SUBJECT: Hazards Associated with Legacy Nitrate Salt Waste Drums Managed under the Container Isolation Plan

At present, there are 29 drums of nitrate waste salts (oxidizers with potentially acidic liquid bearing RCRA characteristics D001 and D002) that are awaiting processing, specifically to eliminate these characteristics and to allow for ultimate disposition at WIPP. As a result of the Feb. 14th, 2014 drum breach at WIPP, and the subsequent identification of the breached drum as a product of LANL TRU waste disposition on May 15th, 2014, these 29 containers were moved into the Permacon in Dome 231 at TA-54 Area G, as part of the New Mexico Environment Department (NMED) approved container isolation plan. The plan is designed to mitigate hazards associated with the nitrate salt bearing waste stream. The purpose of this document is to articulate the hazards associated with un-remediated nitrate salts while in storage at LANL. These hazards are distinctly different from the Swheat-remediated nitrate salt bearing drums, and this document is intended to support the request to remove the un-remediated drums from management under the container isolation plan. Plans to remediate and/or treat both of these waste types are being developed separately, and are beyond the scope of this document.

Historical Generation of TRU Nitrate Salt Waste

Wastes contaminated with transuranic (TRU) isotopes have been generated at Los Alamos National Laboratory (LANL) since the 1940s in research and development activities for nuclear weapons, nuclear fuel, and related national security missions. Historically, radioactive waste was buried in shallow landfills called Material Disposal Areas (MDAs); Area G at TA-54 first received radioactive waste in 1957 and has served as the primary onsite radioactive waste management facility since 1959.

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LA-UR-15-20084

Nitrate salt wastes result from aqueous nitric acid processing to recover and purify plutonium.[1] After plutonium recovery, the resulting nitric acid solution contains a number of metal ions that result from the processing operations. These nitric acid solutions were concentrated through distillation until the nonvolatile salts in the evaporator were close to saturation. According to procedures, 500 to 600 L of feed was reduced to 10 to 25 L of "bottoms". The hot evaporator "bottoms" were poured into a water-cooled tray and flash-crystallized, which precipitates primarily nitrate salts and leaves a liquid supernatant. After filtration, the salts were vacuum dried, which consisted of pulling air through the salts using house vacuum for approximately 15 minutes. The nitrate salts from the ion exchange processes were often washed with 3.3 M nitric acid to remove plutonium and ensure they met the Economic Discard Limit (EDL) for plutonium. However, nitrate salts derived from oxalate filtrates were not washed with bulk acid because it would accelerate decomposition of any oxalic acid present in the salts and could result in pressurization of the sealed 55-gallon drums containing the salts with oxalate.

The final composition of nitrate salts depends on the original process feed that was sent to the evaporator. The evaporator feed included ion-exchange effluent (both lean residue and chloride anion) and the filtrate from oxalate precipitation. The majority of LANL MIN02 wastes were derived from the ion exchange feed. Veazey et al documented the composition of the evaporator bottoms from each of these processes for waste batches produced between April 1992 and February 1994.[2] The solution concentrations[3] of the major metal ions from the lean residue are shown in Table 1. Contaminated most often with plutonium and americium, these granular, off-white salts were packaged into plastic bags and placed in containers for temporary, retrievable, onsite storage until a permanent waste facility became available—the Waste Isolation Pilot Plant (WIPP). LANL has used evaporators to concentrate liquids that contain nitrate salts since operations began at the TA-55 Plutonium Processing Facility in 1979.[1] This specific type of TRU waste was generated until 1991, when LANL developed a process to solidify the evaporator bottoms in grout rather than dispose of the nitrate salt waste as granular salts.

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[1] (a) Christensen, E. L.; Maraman, W. J. *Plutonium Processing at the Los Alamos Scientific Laboratory*; LA-3542; Los Alamos National Laboratory: Los Alamos, NM, 1969; (b) Christensen, E. L. *Plutonium Recovery at the Los Alamos Scientific Laboratory*; LA-UR-80-1168; Los Alamos National Laboratory: Los Alamos, NM, 1980.

[2] (a) Veazey, G. W. *TA-55 Evaporator Bottom Characterization*; Los Alamos National Laboratory: 1995. (b) Veazey, G. W.; Castaneda, A. *Characterization of TA-55 Evaporator Bottoms Waste Stream*; NMT-2:FY 96-13; Los Alamos National Laboratory: Los Alamos, NM, 1996.

[3] We note that the supernatant fluid metal ion concentrations will not represent the ion concentrations of the precipitated salts, which will be dominated by those metal nitrates with the lowest solubility product.

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Table 1. Important metal ion concentrations (median values) in evaporator bottoms from Veazey, et al.[2] (in g/l)

	Ion Exchange	Oxalate Filtrate
Ca	61	10.5
Mg	58.7	13.3
K	17.6	4.8
Fe	17.0	7.9
Na	7.4	23.9
Al	4.6	2.3
Cr	3.0	1.94
Ni	1.8	1.205
Pb	0.19	0.056

Nitrate salts are oxidizers, with the generally accepted DOT definition that they can promote or initiate combustion in other flammable materials. In general, oxidizers can:[4]

- Intensify combustion
- Widen the flammable range of flammable gases and liquids
- Lower the flashpoints and ignition temperatures of combustible materials so these materials ignite more readily

Typically, the increase in flammability results from either direct reaction of the oxidizer with a combustible material (fuel) or through the release of oxygen, which then stimulates the oxidation or combustion processes.

Thus, the principal hazard of an oxidizer is in its ability to stimulate or promote combustion, which requires fuel. In the case of legacy nitrate salts – those that have not been neutralized and remediated with Spilftyer and Swheat – these legacy salts were processed and stored in a configuration (lead-lined polyethylene liners placed inside of a 55 gallon steel drum) that eliminates this principal hazard. Without the presence of combustible material or fuel, the oxidizers cannot, in storage, lead to combustion. Thus, the un-remediated salts do not present the potential hazard of spontaneous combustion or enhanced combustion in their current configuration, and can be stored in any area in which combustible material is minimized and separated from the nitrate salt bearing containers, without fear of a release of radioactive materials through combustion processes.

[4] University of Nebraska Lincoln Safe Operating Procedure: Oxidizer Hazards and Risk Minimization

The nitrate salts remediated with Swheat, however, pose just the opposite risk. In this case, the remediation process introduced combustible material (Swheat) to the drum, creating a fuel-oxidizer mixture with the potential for combustion, if heated either internally or externally. In fact, while the specific trigger or ignition of the breached WIPP drum (68660) is still being investigated, there is no question that the fuel oxidizer mixture ignited and burned causing the breach of the drum and releasing radioactive combustion products.

Continued storage of the remediated nitrate salt bearing waste according to the container isolation plan is prudent, to prevent an additional release if one of these drums were to ignite.

DJF:dv

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