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Date: OCT 0 2 2017
Symbol: EPC-DO: 17-385
LA-UR: 17-28273
Locates Action No.: *N/A*

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

Subject: Request for Review and Approval of the Los Alamos National Laboratory Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 9

Dear Mr. Kieling:

This letter submits 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 9* (Isolation Plan) is being submitted to replace Revision 8 of the Isolation Plan, approved by the NMED on April 20, 2017. 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.

Isolation Plan, Revision 9 includes general updates and corrections to the plan to ensure that it is current, and allows for the storage of specific multiple containers that contain liquids within the refrigerator at the Waste Characterization, Reduction, and Repackaging Facility (WCRRF) where treatment of the waste will occur. Enclosure 1 includes a crosswalk table of changes made to the Isolation Plan and a copy of the plan with red editing marks. Enclosure 2 is a clean copy of the Isolation Plan that includes all attachments to the plan.

If you have comments/questions or would like to meet regarding this submittal, please contact Mark P. Haagenstad, LANS, at (505) 665-2014 or Arturo Duran, Environmental Management Los Alamos Field Office, at (505) 665-7772.

Sincerely,

John C. Bretzke
Division Leader

Sincerely,

Arturo Q. Duran
Permitting and Compliance Manager

JCB/AQD/MPH:am

Enclosure(s): 1) Revision Crosswalk and Isolation Plan, Revision 9 with Editing Marks
2) LANL Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 9

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Isolation Plan, Revision 9 includes general updates and corrections to the plan to ensure that it is current, and allows for the storage of specific multiple containers that contain liquids within the refrigerator at the Waste Characterization, Reduction, and Repackaging Facility (WCRRF) where treatment of the waste will occur. Enclosure 1 includes a crosswalk table of changes made to the Isolation Plan and a copy of the plan with red editing marks. Enclosure 2 is a clean copy of the Isolation Plan that includes all attachments to the plan.

Los Alamos National Laboratory Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 9

September 2017

ENCLOSURE 1

Crosswalk of Changes and Isolation Plan, Revision 9 with Editing Marks

EPC-DO: 17-385

LA-UR-17-28273

Date: OCT 0 2 2017

Revisions for Los Alamos National Laboratory Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 9

Location	Activity Supported	Description of Changes
Throughout Plan	General update.	Change to the current revision number of the Isolation Plan, move present and future words to past and present tense where appropriate, and reflect the current revision numbers for the Isolation Plan.
Table of Contents and List of Attachments	General update.	Changes reflect new page numbers.
I. Introduction	General update.	Changes reflect the intent of Revision 9 and changes the text for Revision 8 to past tense.
II. Background and General Implementation Updates	General update.	Addition to section to reflect the status of movement and treatment of remediated nitrate salt-bearing waste containers and editorial changes were also made within the general section.
III. Waste Container Categories	General update.	Description of the removal of two unremediated nitrate salt-bearing waste containers from the inventory of nitrate salt-bearing waste containers.
IV.7 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Changes add clarification that temperature measurement continues throughout storage of the waste container and editorial changes were also made within the section.
IV.8 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Change updates tense of text.
IV.9 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Changes clarify that the Emergency Operations Center is notified and that emergency personnel are not present during movement or shipment of waste containers.
IV.10 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Change reflects the location referenced by Section IV.10.
IV.11 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Change updates tense of text.

Location	Activity Supported	Description of Changes
IV.12 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Changes add clarification about head space gas sampling activities throughout storage of the waste container and editorial changes were also made within the section.
IV.16 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Changes add clarification about when pressure relief devices with supplemental filtration are removed, and the where storage is described in Isolation Plan, Revision 9.
IV.18 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Change updates tense of text.
IV.19 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Change updates tense of text.
IV.20 Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	Correction of typographical errors.	Editorial change.
V.1-8 Remediated Nitrate Salt-Bearing Waste Transport and Safe Storage Requirements at the WCRRF	General update.	Change updates tense of text.
V.9-10 Remediated Nitrate Salt-Bearing Waste Transport and Safe Storage Requirements at the WCRRF	Addition of the storage of multiple waste containers with liquids in the WCRRF refrigerator.	Changes to the section reflect the Permittees intent to ship and store pipe overpack containers with liquids together and a description of why this is an acceptable risk for these specific containers.
VI. (All) Immediate Actions and Storage Activities for Remediated Nitrate Salt-Bearing Waste Containers	General update.	Changes reflect the removal of two unremediated nitrate salt-bearing waste containers from the inventory of nitrate salt-bearing waste containers and additional description of the process for unremediated nitrate salt waste to be repackaged and transported for treatment.
VII.1-5 Remediation Planning	General update.	Editorial changes were made within the section for clarity, correction of tense, and to clarify the language within the section.

Location	Activity Supported	Description of Changes
IX. Immediate Action Implementation Schedule	Update to completed activities.	Addition of start date for transport and treatment of remediated nitrate salt-bearing waste, start dates for sampling activities, scheduled start dates for unremediated nitrate salt waste transport and treatment, and editorial changes.
X. Updates/Submissions	Correction of typographical error.	Change deletes a word that is not necessary to the sentence.

LANL Nitrate Salt-Bearing Waste Container Isolation Plan
Revision 9~~8~~

~~April~~ September 2017

LA-UR-17-28273~~22739~~

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LIST OF ATTACHMENTS

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 descriptions 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 moved into isolation in the Technical Area 54, Dome 375 (TA-54-375) Perma-Con®.

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

Isolation Plan, Revision 5, incorporated the Permittees' plan to remove the overpack container lids from the 55-gallon remediated nitrate salt-bearing waste containers and add a pressure relief device with supplemental filtration to the waste containers. Additional changes were also incorporated to make language throughout the plan consistent and provide for the storage of additional waste container sizes.

Isolation Plan, Revision 6 was drafted to 1) amend the time frame allowed between sampling headspace gas (HSG) and the application of the pressure relief device with supplemental filtration, 2) include additional containers to be equipped with pressure relief devices with supplemental filtration, and 3) incorporate changes due to new or updated procedures utilized for monitoring containers and abnormal instances.

Isolation Plan, Revision 7 included a discussion on 1) the path forward that was chosen by the Permittees for remediation of nitrate salt-bearing waste and the subsequent approval of a Class 1 permit modification to treat nitrate salt-bearing waste by stabilization in containers at the Waste Characterization, Reduction, and Repackaging Facility (WCRRF); 2) the requirements and controls identified by the Permittees for the transport of remediated nitrate salt waste from their current storage location to the WCRRF; and 3) the requirements and controls identified by the Permittees for the safe storage of remediated nitrate salt waste at the WCRRF.

Isolation Plan, Revision 8 ~~includes~~ incorporated the removal of a restriction on the type of forklift allowed for waste container movement at the WCRRF where treatment of the waste ~~will~~ occurs; ~~updates~~ updated relevant procedures; ~~removes~~ removed a canceled procedure; and made other general updates or corrections to the plan to ensure that it ~~is up-to-date for~~ accurately described activities conducted and ~~those~~ scheduled.

Isolation Plan, Revision 9 makes general updates and corrections and allows for the storage of specific multiple containers with liquids in the refrigerator at the WCRRF. The Isolation 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 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 9~~8~~ may also be taken and will be identified to NMED during the technical calls established in Section X.

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

5) On May 20, 2014, the Permittees held the initial meeting for the Remediation Team. (See Section VII 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 were 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 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. Note that one of the waste containers stored within the 55 SWBs was removed from the inventory of remediated nitrate salt-bearing waste containers, therefore, the Permittees continued to sample 54 SWBs on a regular basis while the SWB overpack containers were closed.

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 *sWheat Scoop*® 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.

Prior to commencement of treatment of remediated nitrate salt-bearing wasteTo date, the Permittees did not 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 Scoop*® 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 Scoop*® 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 *sWheat Scoop*® 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 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 received copies of corrected manifests from WCS and WIPP and the Permittees have subsequently provided copies of the corrected manifests to NMED. Additionally, the Permittees have provided NMED with all of the Permittees' other correspondence on this issue within Isolation Plan Revisions 2 & 3, and by letters dated October 22, 2015 and September 26, 2016 (ENV-DO-15-0293 and EPC-DO-16-282).

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 in 55-gallon Pipe Overpack Containers (POCs). These containers are 55-gallon waste containers that house a closed pipe component containing remediated nitrate salt-bearing waste. 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 four POCs located at LANL 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 TA-54-375 and placed them back in storage within the TA-54-375 Perma-Con®.

17) In February 2016, the Permittees concluded that the addition of a pressure relief device with supplemental filtration to the remediated nitrate salt-bearing waste containers was the best approach to increase safe storage of these containers. This conclusion was based on the Permittees continued evaluation of safe storage of these containers at LANL.

    In May 2016, pressure relief devices with supplemental filtration were placed on 48 55-gallon remediated nitrate salt-bearing waste containers within 46 open SWBs. Eight SWBs that contain POCs were opened and pressure relief devices with supplemental filtration were installed by December 17, 2016. The four POCs that are in 85 gallon overpack containers have been determined not to require the installation of pressure relief devices with supplemental filtration because these containers were not remediated with *sWheat Scoop*® kitty litter.

18) On July 25, 2016, the Permittees were granted approval to treat nitrate salt-bearing waste within the glovebox containment system at Technical Area 50, Building 69 (TA-50-69), also known as the ~~Waste Characterization, Reduction, and Repackaging Facility (~~WCRRF~~)~~ (*Fee Assessment and Approval Class 1 Modification to the Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit EPA ID #NM0890010515*, HWB-LANL-16-031). As a result, the Permittees identified specific actions necessary to safely remove the 55-gallon containers of remediated nitrate salt-bearing waste from overpack containers and transport them to TA-50-69 for treatment. Additional considerations for storage at the WCRRF were also developed.

19) Movement of 55-gallon remediated nitrate salt-bearing waste containers from open SWBs to refrigerated storage at TA-54-375 began on March 30, 2017.

20) Transport from refrigerated storage at TA-54, Area G, to the WCRRF started on May 17, 2017 and treatment of remediated nitrate salt-bearing waste began on May 18, 2017.

~~19)~~21) Pre-treatment and post-treatment remediated nitrate salt-bearing waste samples are collected as outlined in the LANL Hazardous Waste Facility Permit, Attachment C ("Waste Analysis Plan").

III. Waste Container Categories

The current inventory of nitrate salt-bearing waste containers that have been 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 that are not covered under this plan, but underwent reevaluation as described in Section VIII.

This plan addresses unremediated nitrate salt waste and the 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 *sWheat Scoop*® 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®. Additionally, in June 2017, the Permittees removed two containers from the inventory of unremediated nitrate salt waste because it was determined that the containers are filled with 1-gallon paint cans of cemented waste (EPC-DO: 17-224 or ESHID-602442).

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

- 267~~9~~ parent nitrate salt waste containers either remain parent containers or were remediated for a total inventory of 708~~10~~ nitrate salt-bearing waste containers.
    - 27~~9~~ of the 708~~10~~ waste containers are parent nitrate salt waste containers that remain in storage at LANL.
    - Three of the 708~~10~~ waste containers were shipped off-site for direct disposal because they did not require remediation.
    - 678 of the 708~~10~~ waste containers are remediated nitrate salt-bearing waste containers.

Of the 708~~10~~ identified nitrate salt-bearing containers, a total of 87~~89~~ remain at LANL, 60 are remediated daughter containers and 27~~9~~ 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 X.

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 VIII. 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.

Summary of Nitrate Salt-Bearing Waste Containers

Waste Type	Waste Container Type	Overpack size	Number of Waste Containers
Remediated Nitrate Salt-Bearing Waste	55-gallon	SWB	48
Remediated Nitrate Salt-Bearing Waste	55-gallon POC	SWB	8
Remediated Nitrate Salt-Bearing Waste	55-gallon POC	85 gallon	4
Unremediated Nitrate Salt Waste	55-gallon	85 gallon	2729

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

Prior to the commencement of treatment, there wereThere 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 by trained and qualified LANL TID users. The LANL TID User Manual was included as an attachment to Isolation Plan Revisions 1-5.

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.

TIDs on remediated nitrate salt-bearing waste containers (68685 and the SWB it is stored within) were removed as part of the addition of the pressure relief device with supplemental filtration described in Section IV.16. TIDs on empty parent containers (parent containers of 69120 and 68359) will be removed from the containers when they are packaged for shipment and disposal.

2) On May 18, 2014, the Permittees completed overpacking the 57 originally identified remediated nitrate salt-bearing waste containers at LANL into SWBs; 14 of these SWBs were already packaged within SWBs set to go to the WIPP and include other containers of waste within the SWB, rather than empty dunnage containers. 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 Attachment 3. 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 unused SWBs (including 8 that contain POCs) and four 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 because they 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 overpack containers that contain remediated nitrate salt-bearing waste drums as well as the 55-gallon waste containers within the open SWBs. Daily temperature measurements are also recorded for 55-gallon remediated nitrate salt-bearing waste containers within refrigerated storage attached to the TA-54-375 Perma-Con® or at the TA-50-69 WCRRF. As discussed above, all remediated nitrate salt-bearing containers were overpacked in SWBs or 85 gallon containers. Temperature measurements are taken of the top surface of the still closed overpack containers using a thermocouple, infrared thermometer, or Infrared Imaging Camera. For containers in the open SWBs, temperature measurements are taken from the top surface of the 55-gallon 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 75 °F.

The Permittees maintain records of all temperature monitoring. These activities at TA-54, Area G are performed in accordance with LANL's Procedure on *TA-54 Area G RNS Waste Container Monitoring,* AREAG-WO-DOP-1246, R.4 (Attachment 4). These records are 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 X. 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, hourly) are 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, at TA-54, Area G are performed in accordance with LANL's Procedure on *TA-54 Area G RNS Waste Container Monitoring,* AREAG-WO-DOP-1246, R.4. The Permittees maintain records of all visual monitoring. (See, Attachment 4) These records are updated on a daily basis and are available to NMED for inspection.

Further studyRecent studies, analysis, and an HSG data report (Attachment 5) providesd 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 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.

After removal of the overpack SWB lid, visual inspection of the 55-gallon waste containers within the open SWB continues. During this time, visual inspections are more difficult to conduct when compared to the closed SWB container, however, the drums continue to be inspected within the SWB from above for evidence of spills, leaks, or deterioration within the SWB. Should any leak or spill occur, the leak would be contained within the SWB. Additionally, visual inspections of the 55-gallon waste container are a more effective indicator of an abnormality, because the actual waste drum containing remediated nitrate salt-bearing waste is the container that is inspected. Daily visual inspections will continue through the removal from overpack containers, characterization (non-destructive assay), and cooling activities that will occur prior to shipping the containers to the TA-50-69 WCRRF.

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 procedures: *TA-54 Area G RNS Waste Container Monitoring*, AREAG-WO-DOP-1246, R.4 (Attachment 4); *TA-54 Area G RNS SWB Lid Removal*, AREAG-WO-DOP-1340, R.2 (Attachment 6); and TA-54-0*375 and RNS Waste Container Abnormal Conditions*, AREAG-RM-AOP-1299, R.1 (Attachment 7). 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 8, and associated procedures are found at Attachments 9, 10, and 11.

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 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. Overpack containers ~~have been~~ are stored with a minimum of 2 feet between containers and ~~will not be~~ were not moved prior to, or after, the removal of the SWB lid and addition of the pressure relief devices with supplemental filtration to the 55-gallon inner containers. Overpack containers are removed from the TA-54-375 Perma-Con® as remediated nitrate salt-bearing waste containers are removed from the overpack containers per Section IV.18.

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. A drawing that includes the locations of the overpack containers within the TA-54-375 Perma-Con® is included in Attachment 12. The use of fire curtains in between containers would not provide a measurable reduction in the thermal conductivity across the 24 inches but would provide protection from flame impingement.

Overpack 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 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 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 purchased fire resistant curtains that are not currently planned for use. If used, containers would be placed in rows that allow for safe egress and with 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 was 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 X.

In early 2016, the Permittees conducted detailed wildfire analyses that indicate with the current fuel loads and utilized storage space, wildfire will not impact the waste in storage. During the analysis, a defense-in-depth measure was identified, that involves covering of the waste containers in storage with reflective material or “fire blankets” in the event of a fire. The Permittees have acquired the reflective blankets and propose to deploy them if necessary.

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 HSG 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 was documented in *TA-54 Area G Domes TA-54-231 and TA-54-375 PermaCon Access Restrictions*, EWMO-AREAG-SO-1247. This standing order was included with Isolation Plan, Revisions 2-7; however, it was canceled by the facility on January 19, 2017 to allow for the planned removal of 55-gallon containers from overpack containers, cooling, and transport of remediated nitrate salt-bearing waste containers. Also, there are 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 unused SWBs (including 8 POCs), and nitrate salt-bearing waste identified after May 2014 were packed into 85 gallon overpacked POCs. 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 act as a barrier to provide a significant measure of worker protection. No other protective shields or barriers were deemed necessary for the protection of workers while the overpack containers were closed. After the installation of pressure relief devices and supplemental filtration to the 55-gallon waste containers, there is a low potential for lid loss from build-up pressure within the waste container.

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 are not~~will be~~ present during the movement of these containers, or ~~that responders will be present/alerted~~ during other actions undertaken to prepare the waste containers for shipment.

10) The Permittees have updated all procedures and safety basis documents to convert the applicable processing facilities at TA-54, Area G into storage facilities.

11) While used as overpack containers, SWBs and 85 gallon containers displayed the required labels for all inner containers or are reclassified as a new container in WCATS. This means that the container either displayed the container identification number for the 55-gallon nitrate salt-bearing waste container within the overpack or displayed a new container number. The 60 subject containers (including the sister drum to the breached drum in WIPP) were clearly labeled with the appropriate warning labels and any other required labeling. Specifically, the containers had 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® are identified as containing free liquids. The SWBs were not placed on secondary containment when this discovery was made because movement of the SWBs was~~is~~ prohibited until the removal of the 55-gallon containers from their overpack containers per Section IV.18. 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®.

After removal of the SWB lid, the internal 55-gallon remediated nitrate salt-bearing waste containers are stored within the open SWB. Appropriate labels are located on the top of the 55-gallon waste container and WCATS is updated, as appropriate, to include the 55-gallon waste drums as the containers in storage within the TA-54-375 Perma-Con®. After the addition of the pressure relief device and supplemental filtration, the 55-gallon waste containers were not removed from the open SWB overpack or elevated to meet the requirements of Permit Sections 3.7.1(1) or 3.7.2(1)(a). This storage configuration continues to be protective of human health and the environment, as daily visual inspections, temperature measurement, and HSG sampling on the 55-gallon drums are conducted as outlined in Sections IV.7 and IV.12. Any leak or spill that may occur will be contained within the SWB and would be discovered during the next inspection. Additionally, visual inspections, temperature measurements, and HSG sampling are more effective indicators of an abnormality, because the 55-gallon waste container is the container monitored.

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, H_2, O_2, N_2, CH_4, CO, CO_2, NO, and N_2O 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 13 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.

CH_4 is occasionally detected in small concentrations (i.e., < 50 ppm). He and NO 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 X.

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 (Note that one container was later removed from the remediated nitrate salt-bearing waste container inventory). The Permittees transitioned to sampling a subset of the 54 SWBs on a regular basis (this subset may change over time). All of this HSG monitoring was initiated as additional measures above those described in the original May 19, 2014 Isolation Plan and the May 29, 2014 Revised Isolation Plan, and are currently being performed as described within this 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 conduct HSG sampling to measure concentrations of H_2, CO_2, CO and N_2O within the containers for the remediated nitrate salt-bearing waste. The Permittees:

1. Conducted daily HSG sampling of SWB SB50522 and the SWB that containeds 68685 until the SWBs were opened. HSG sampling was then conducted daily of containers 68685 and 69490 until treatment of the waste within those containers began on June 13, 2017 and July 12, 2017, respectively.

2. Periodically sampled HSG of 52 other SWBs and four 85 gallon containers within the TA-54-375 Perma-Con®. HSG sampling occurs on a schedule that ensureds that each of the containers are were 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. At least monthly sampling continues from the 85 gallon overpack container or the 55-gallon container until each of the containers are attached to the glovebox at the WCRRF for treatment.

Originally, 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 (overpacked into 85 gallon containers) were added to the monthly sampling 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.

HSG sampling to measure concentrations of H_2, CO_2, CO, CH_4 and N_2O after the addition of the pressure relief devices with supplemental filtration continues. Samples are collected from the 55-gallon remediated nitrate salt-bearing waste containers (or the overpack container) according to the same schedule described for the overpack containers above.

The Permittees include HSG data (H_2, CO_2, CO, CH_4 and N_2O) in the written submissions provided to NMED, as established in Section X. 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. These records, and all temperature data, are 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:
- Remediated nitrate salt-bearing 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. From 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 and/or daily temperature measurements through September 13, 2016 were:

SB50522 Temperature	Degrees Fahrenheit
High	84.1
Low	27.7

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	24.1

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 5.

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 HSG 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 polyvinyl 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 HSG of the original 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 the 55 SWBs was initiated on May 19, 2014. All 55 SWBs were characterized. (Note that one container was later removed from the remediated nitrate salt-bearing waste container inventory). Elevated concentrations of HSG compounds have been observed at concentrations well above normal atmospheric concentrations in some of the 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. By September 19, 2014, the Permittees had 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.12 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 5). 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 container.

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 container, if the container is configured to accept additional filters. (This approach was successfully implemented by the Permittees with SWB 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 container 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 X.

16) As part of the Permittees continued evaluation for safe storage of remediated nitrate salt-bearing waste containers, tests continued with surrogate remediated nitrate salt-bearing waste mixtures. Test results indicated that pressure is crucial for establishing a self-sustained

thermal runaway in the tested material. These results pointed to pressure relief as a means to prevent over-pressurization of the waste containers and minimize the possibility of thermal runaway while in storage.

In February 2016, the Permittees concluded that the best approach to increasing the safe storage strategy for remediated nitrate salt-bearing waste containers was to add pressure relief devices with supplemental filtration to the waste containers stored within the TA-54-375 Perma-Con®. Remediated nitrate salt-bearing waste within the four POCs overpacked in 85 gallon containers do not present a thermal runaway hazard because these containers were not remediated with *sWheat Scoop*® kitty litter. Therefore, these containers do not require a pressure relief device with supplemental filtration. The remaining 56 remediated nitrate salt-bearing waste containers are were affixed with pressure relief devices with supplemental filtration until each container is about to be attached to the glovebox at the WCRRF for treatment of the remediated nitrate salt-bearing waste.

The process for addition of the pressure relief devices with supplemental filtration included opening the SWB containers to gain access to the 55-gallon remediated nitrate salt-bearing waste container(s) within each overpack container. For remediated nitrate salt-bearing waste containers within SWBs that do not contain POCs, the process continued by opening the 55-gallon container(s), piercing the internal bag, closing the 55-gallon container(s), and equipping the 55-gallon waste container with a pressure relief device and supplemental filter in the 2-inch bung hole. In the case of remediated nitrate salt-bearing waste containers within SWBs that contain POCs, after the SWB is opened, the 55-gallon waste container(s) was opened, the NFT filter on the pipe component removed, and the lid of the 55-gallon POC was replaced with a new lid, equipped with a pressure relief device and supplemental filter in the 2-inch bung hole. Steps for these processes are outlined further below.

Prior to opening SWB overpack containers, an HSG sample was collected from the SWB for analysis to verify the results did not indicate an adverse condition. Then, one of the four ¾ inch HEPA vent filters/plugs was removed and a radiological survey was performed to verify contamination levels were within radiological work permit limits. If contamination levels were within permit limits, a borescope was inserted in the vent hole to examine the condition of the SWB internals and the containers within the SWB. If there was no indication of a chemical reaction or drum deterioration, the Permittees began the process to remove the SWB lid.

Removal of the SWB lid was accomplished by first loosening all 42 lid bolts using a bit wrench. Bolts that were stripped, were drilled out using a slow velocity (90 revolutions per minute) magnetic drill using tool oil to lubricate the surface and mitigate any spark hazards. Multiple drills may have been used concurrently within the TA-54-375 Perma-Con®.

Although the tools used were not non-sparking tools, the potential for sparks was minimized and the ignitable waste is sealed within the inner 55-gallon waste container.

When all of the bolts were removed from the SWB, the lid was removed and a radiological survey was performed to verify that contamination levels were within radiological work permit limits. After this survey, the 55-gallon remediated nitrate salt-bearing waste drum was visually inspected to ensure its integrity. The containers were stored within the opened SWB prior to the addition of pressure relief devices with supplemental filtration. Daily visual inspections and temperature measurements on the 55-gallon drums were and will be conducted as outlined in Section IV.7.

SWB lid removal was postponed for overpack containers that undergo frequent HSG sampling (such as SWB SB50522 and the SWB that contains 68685) to preserve the ability to sample the gas through the multiple vents on the SWB. Prior to the addition of pressure relief devices with supplemental filtration, the 55-gallon drum only included one vent, which limited the number of HSG samples that could be collected from the container. Therefore, the Permittees coordinated the HSG sampling schedule with the SWB lid removal to ensure that HSG sampling and analysis continued uninterrupted.

Prior to the addition of the pressure relief device with supplemental filtration, or the replacement of the POC lid (for the 8 stored in SWB overpack containers), an HSG sample was collected from the 55-gallon drum for analysis. Within 36 hours of HSG sampling, for containers that are not POCs, the 2 inch bung was removed from the 55-gallon drum by unscrewing. Operators ensured that the tools used were at the same potential as the drum (through touching or bonding to the container). A borescope was inserted in the bung hole to examine the internal configuration of the waste within the container. If there was no indication of a chemical reaction, the process continued on to the next step.

The liner bag in the 55-gallon containers, not including the 8 POCs stored within SWB overpack containers, was pierced using a sharp non-sparking instrument, and a pressure relief device with supplemental filtration was screwed into the 2 inch bung hole. Piercing of the bag was necessary to ensure that there was no pressure contained within the bag. For the eight 55-gallon POCs that are in SWB overpacks, the NFT filter on the pipe component within the POC was removed, and the lid of the 55-gallon POC was replaced with a lid equipped with a pressure relief device and supplemental filtration.

The 55-gallon containers of remediated nitrate salt-bearing waste, not including the four POCs overpacked in 85 gallon containers, remained in isolated storage within the TA-54-375 Perma-Con® within open SWBs as described in Section IV.11 until transported for treatment (See IV.19). The four 85 gallon overpack containers that contain POCs remain in isolated storage within the TA-54-375 Perma-Con® per Section IV.11 or IV.19. Regular HSG sampling and analysis to verify that the HSG concentrations are consistent with expected trends have been, and will continue to be, conducted as outlined in Section IV.12.

17) The isolation configuration described in this section is protective of human health and the environment in light of the observed concentrations of H_2 and CO_2 in 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 to ensure continued protection of human health and the environment.

18) Before remediated nitrate salt-bearing waste containers ~~will be~~ are transported to the WCRRF for treatment processing, the four POCs within 85 gallon overpack containers and the 55-gallon waste containers stored within open SWBs (including the eight SWBs that contain POCs) will be removed from the overpack containers. An HSG sample will be collected within 36 hours of anticipated removal of the waste container from the overpack container. If present, the pressure relief device with supplemental filtration ~~will be~~is inspected prior to the removal of the waste container from the SWB to ensure that the rupture disc is not obstructed. The pressure relief device with supplemental filtration ~~will be~~is stabilized with tape to protect it during transport.

The four 85 gallon overpack containers that contain POCs will be visually inspected and a temperature measurement will be collected before the 55-gallon POC is removed from the overpack container. Additionally, a borescope is inserted in the bung hole to examine the condition of the inside of the 85 gallon overpack container and the 55-gallon POC within the overpack. If there is no indication of a chemical reaction or drum deterioration, the lid will be removed using non-sparking tools.

Removal of 55-gallon containers from all overpack containers will be accomplished with the use of an electric overhead hoist with a clamshell (or equivalent) lifting device attached to the drum to lift each individual 55-gallon container out of the SWB or 85 gallon overpack. A spotter and personnel on fire watch will be present during removal of the waste containers from the overpack container.

As the 55-gallon container is removed from the overpack container, the container will be visually inspected for evidence of damage or degradation. If there is no indication of a compromised container, the remediated nitrate salt-bearing waste container will be removed from the overpack and the overpack will be removed from under the 55-gallon waste container. The 55-gallon waste container will then be placed onto a caster for placement in storage as described below.

The interior of the SWB or 85 gallon overpack will beis inspected when the remediated nitrate salt-bearing waste container(s) are removed and the overpack container, dunnage drums, and other waste containers will beare moved out of the TA-54-375 Perma-Con® and into a designated storage location.

19) After a drum is removed from the overpack container, it will be is put into storage within the TA-54-375 Perma-Con® or moved into a refrigerator attached to the TA-54-375 Perma-Con® that is maintained at a temperature ≤ 57 °F. Additionally, prior to transportation, the containers must be kept within the TA-54-375 refrigerator at a temperature ≤ 41 °F for a minimum of four consecutive days. The cooled drums will remain in the TA-54-375 refrigerator until their removal is required for transportation to the WCRRF. Daily visual inspections and temperature measurements on the 55-gallon waste containers will continue to be conducted as outlined in Section IV.7. The maximum number of containers that can be stored in the TA-54-375 refrigerator is 10; containers will be are configured to allow for inspection and with adequate aisle space to allow for emergency egress.

When in storage within the refrigerator attached to the TA-54-375 Perma-Con®, secondary containment, in accordance with Permit Section 3.7.1(1) may not be feasible due to movement and safety constraints. However, the five containers that have been identified to contain liquids, and the two containers that are suspected to contain liquids, will not have a significant quantity of liquid within the container (a maximum of 2 liters is estimated, and three of the five containers only contain milliliters of liquid). While stored within TA-54-375 refrigerator, containers will be elevated and would be protected from contact with accumulated liquids if a spill or leak should occur. Additionally, there will be daily inspections of the containers conducted for evidence of spills, leaks, or deterioration of the container; should any leak or spill occur, the leak would be contained within the refrigerator that is located within the dome, further decreasing the likelihood of a release to the environment. Should an abnormal condition be observed, the Permittees will implement their emergency response plan.

20) Characterization of the remediated nitrate salt-bearing waste containers may be required prior to transporting the waste containers to the WCRRF for processing. If required, non-destructive assay will be performed inside the TA-54-375 Perma-Con®. To isolate the waste and minimize background, lead shielding and some minor container movement inside the Perma-Con® may be required for characterization.

V. Remediated Nitrate Salt-Bearing Waste Transport and Safe Storage Requirements at the WCRRF

The transport of remediated nitrate salt-bearing waste containers from the TA-54-375 Perma-Con® to the WCRRF is~~ anticipated to be~~ a well-coordinated and concentrated effort; therefore, the Permittees have identified controls and requirements specific to mitigating certain hazards during the transport of the waste containers from storage within the TA-54-375 Perma-Con® to the WCRRF. Requirements and controls for the safe storage of remediated nitrate salt-bearing waste at the WCRRF have also been established and are summarized below.

1) A pre-shipment inspection of the pressure relief devices with supplemental filtration ~~will~~ occurs to ensure that the device is installed correctly to provide a venting pathway that will prevent thermal runaway during normal transport conditions. The four POCs that were overpacked in 85 gallon containers do not require the pressure relief devices with supplemental filtration.

2) An HSG sample ~~will be ~~is collected within 36 hours of anticipated transfer of remediated nitrate salt-bearing waste container. Additionally, a pre-shipment visual inspection and a temperature measurement ~~will be ~~are conducted.

3) Remediated nitrate salt-bearing waste containers are~~will~~ not ~~be ~~transported in inclement weather. ~~The waste~~Waste containers are~~will be~~ transferred from the TA-54-375 refrigerator to the TA-54-375 Perma-Con® loading dock where they are~~it will be~~ loaded onto transportation vehicle.

4) For transport, a maximum number of four containers ~~will be ~~are shipped at a time and each container ~~will be ~~is fitted with a thermal cooling jacket prior to securing the drum in the enclosed cargo compartment of the transport vehicle with tie-down straps or other securing devices. This control ~~will ~~prevents the waste container from experiencing elevated temperatures during the transport period. The transfer of remediated nitrate salt-bearing waste containers is performed along roads on which access is restricted to the public.

5) All movement and handling of remediated nitrate salt-bearing waste containers at the WCRRF is~~will be~~ monitored by a stationary fire watch. Personnel assigned to stationary fire watch duty are~~will be~~ tasked with making safety observations about the presence of ignition sources, changes in combustible loading, unauthorized activities, and situations that could increase the potential or consequences of a fire.

6) All movement of remediated nitrate salt-bearing waste containers during staging or storage at TA-54-375 and at the WCRRF ~~will be~~ is accomplished with the use of manual, electric, or hydraulic type lift equipment. At the WCRRF, battery operated forklifts may be used for the movement and handling of remediated nitrate salt-bearing waste.

7) A walk-down of TA-50-69 and the WCRRF refrigerator where the remediated nitrate salt-bearing waste containers are~~will be~~ stored for cooling is~~will be~~ performed prior to waste handling or processing activities to ensure that only transient combustibles required by the process are present. The WCRRF refrigerator is ~~will be~~ maintained at a temperature ≤ 57 °F.

8) Prior to movement or handling of the remediated nitrate salt waste containers on the transportation vehicle, a visual inspection of the pressure relief device with supplemental filtration on the containers ~~shall be~~is performed to ensure that the outlet of the rupture disc is not obstructed and that the disc is still intact. The pressure relief device with supplemental filtration is~~will be~~ stabilized with tape to protect it during transport. Additionally, a post-shipment visual inspection and temperature measurement is~~will be~~ conducted. The remediated nitrate salt-bearing waste container is~~will be~~ transferred from the transportation vehicle to the WCRRF refrigerator within 12 hours of removal from the TA-54-375 refrigerator.

9) No more than four containers ~~will be~~ are stored in the WCRRF refrigerator at one time; and while stored at the WCRRF, daily visual inspections and temperature measurements on the 55-gallon waste containers ~~will be~~ are conducted as outlined in Section IV.7.

When in storage within the WCRRF refrigerator, secondary containment, in accordance with Permit Section 3.7.1(1), for the remediated nitrate salt-bearing waste container may not be feasible due to movement and safety constraints. However, the five containers that have been identified to contain liquids, and the two containers that are suspected to contain liquids, will not have a significant quantity of liquid within the container (a maximum of 3~~2~~ liters is estimated and three of the five containers only contain milliliters of liquid). While stored within WCRRF refrigerator, containers will be elevated and would be protected from contact with accumulated liquids if a spill or leak should occur. Additionally, only a single container of remediated nitrate salt-bearing waste with liquid will be in storage within the WCRRF refrigerator at one time for the majority of the remediated nitrate salt-bearing waste treatment campaign. Daily inspections of the containers ~~will be~~ are conducted for evidence of spills, leaks, or deterioration of the container. Should any leak or spill occur, the leak would be contained within the refrigerator that is located within the building, further decreasing the likelihood of a release to the environment. Should an abnormal condition be observed, the Permittees will implement their emergency response plan.

10) The final four containers that will be transported to the WCRRF for treatment are the remediated nitrate salt-bearing waste within the four POCs that are overpacked in 85 gallon containers. These containers are grouped together at the end of the waste treatment campaign because the waste within the POCs was remediated with Waste Lock® 770 and not remediated with *sWheat Scoop*® kitty litter. Therefore, these containers do not present a thermal runaway hazard and are not equipped with pressure relief devices with supplemental filtration. They have been prioritized for treatment accordingly to ensure that all containers remediated with *sWheat Scoop*® are treated first. These four containers are in good condition and were originally remediated in 2013, however, all four of these POCs are anticipated to contain liquids based on review of RTR.

For operational efficiency and to expedite completion of treatment of remediated nitrate salt-bearing waste, the Permittees will ship the last four POCs to the WCRRF as two shipments of two containers each. These combined shipments will reduce the time and personnel resources it requires for each container to reach WCRRF; decrease by half the number of road closures required to transport the containers. Prior to transport, the containers will be removed from the 85 gallon overpack containers, and stored in the refrigerator attached to the TA-54-375 Perma-Con®, as described in Sections IV.18 and IV.19; and will be transported as described in Sections V.1 through V.8

After the first shipment to WCRRF, one waste container will be placed on to the glovebox to begin treatment. After the second shipment there will be a total of three waste containers with liquids in the WCRRF refrigerator at the same time. The estimated liquid volumes within the pipe components within each of the three POCs is 3 liters, 3 liters, and 1.4 liters, respectively. The Permittees have determined that storage of these three POCs within the refrigerator at the same time is acceptable because the liquids are confined within the pipe component within each of the POCs. There is sufficient volume within the 55-gallon waste container in the event that the pipe component fails to contain the liquids (equivalent to secondary containment). This is extremely unlikely due to the robustness of the pipe component itself. All of the same precautions described in Section V.9 above will be implemented for these waste containers.

~~10)~~11) Pre-treatment and post-treatment remediated nitrate salt-bearing waste samples are collected as outlined in the Permit Attachment C (“Waste Analysis Plan”).

VI. Immediate Actions and Storage Activities for Unremediated Nitrate Salt-Bearing Waste Containers

There are currently 2729 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 2927 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 X. 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 organizations 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 HSG sampling), and other required inspections (e.g., Permit required inspections) were allowed into the storage areas. This was 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 were 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 14 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 continues 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 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.
- The most recent RTRs indicate that Dome 230 is designed for secondary containment, but the 26 all 27 unremediated nitrate salt-bearing waste containers that have free liquids; therefore, all are stored on with appropriate secondary containment pallets orand 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.

12) Unremediated nitrate salt waste will be treated at the WCRRF utilizing the treatment method described in Section VII. As preparations for transport and treatment are performed, unremediated nitrate salt-bearing waste containers will be moved to other locations for characterization purposes (e.g. RTR, non-destructive assay, visual inspection, etc.). Prior to shipment to the WCRRF for treatment, unremediated nitrate salt waste containers will be visually inspected and the contents repackaged as necessary within appropriate confinement. Refrigerated storage and thermal cooling jacket during shipment of unremediated nitrate salt waste containers is not anticipated.

~~11)~~13) Pre-treatment and post-treatment unremediated nitrate salt-bearing waste samples will be collected as outlined in the Permit Attachment C ("Waste Analysis Plan").

VII. Remediation Planning

1) The Permittees 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 met with NMED on multiple occasions to discuss the Team's progress, and plan to continue these communications as treatment activities progress.

   As discussed in Paragraphs IV.2 and IV.5 above, the Permittees overpacked the 56 remediated nitrate salt-bearing waste containers at LANL into 54 SWBs. The SWB lids have been removed to gain access to the internal 55-gallon remediated nitrate salt-bearing waste containers and install a pressure relief device with supplemental filtration to each container. These 55-gallon containers of remediated nitrate salt-bearing waste remain in isolated storage within the TA-54-375 Perma-Con® within SWBs or within the refrigerator attached to the TA-54-375 Perma-Con® as described in Section IV.11 or IV.19. The 85 gallon overpack containers that contain POCs ~~will~~ also remain closed and in storage as described in Section IV.11 or IV.19.

   NMED and the Permittees have had discussions on potential remediation actions and the Permittees will continue 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 additional submittals to NMED.

2) The treatment plan developed by the Remediation Team was discussed with the NMED. These discussions included, but were not limited to, neutralization steps, the potential reagents that may have been used, the location of the process for treating wastes, and all other key specific information related to all potential treatment options. The treatment plan

developed included the type of characteristic (toxicity, reactivity, ignitability, corrosivity) mixed TRU wastes the WCRRF is authorized to treat – including, as appropriate, the removal of the characteristics of ignitability (D001) and/or corrosivity (D002). Permittees discussed with NMED the permit modification necessary for treatment of the nitrate salt-bearing wastes.

3) The key events, actions and activities are 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 and in this Isolation Plan (e.g., safe storage configuration, the stabilization steps, the reagents used, the location of the process for treating drums). These records are~~will be~~ updated and ~~be~~ are available to NMED for inspection.

4) After research on the activities necessary to treat nitrate salt-bearing waste, a plan for treatment of the waste was established. A Class 1 permit modification to treat the waste at the TA-50-69 WCRRF was submitted to, and approved by the NMED on July 25, 2016. As discussed in Section V above, the Permittees ~~have~~ identified specific requirements and controls related to the transport of remediated nitrate salt waste from their current storage location within the TA-54-375 Perma-Con® to TA-50-69 where they will be treated. Requirements for the safe storage of remediated nitrate salt-bearing waste containers at the TA-50-69 WCRRF have also been identified and are included in Section V.

5) Nitrate salt-bearing waste ~~will be~~ is transported to the TA-50-69 WCRRF for treatment by stabilization in containers within the glovebox containment system. The treatment process of mixing nitrate salt waste with water (if applicable), and zeolite ~~will~~ removes the D001 and D002 EPA Hazardous Waste Numbers. Specific treatment requirements and confirmation verification sample requirements are found within the LANL Hazardous Waste Facility Permit as approved by NMED on July 25, 2016.

VIII. 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.

IX. Immediate Action Implementation Schedule

All actions within the schedule and implementation of the LANL Isolation Plan are conducted and communicated with NMED in the meetings and written submissions established in Section X.

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 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.
Removal of lids from SWBs and labeling of inner containers that do not contain POCs	Completed on 05/26/16.
Removal of lids from SWBs and labeling of inner containers that contain POCs	Completed by 12/16/16.
Removal from 85 gallon overpack and labeling of 55-gallon POCs	Scheduled to be completed per Section IV.18 prior to transport for treatment at the WCRRF.
Installation of pressure relief device with supplemental filtration for containers that are not POCs	Completed on 05/26/16.
Installation of pressure relief device with supplemental filtration for containers that are POCs within SWB overpack containers (Not POCs overpacked in 85 gallon containers)	Completed by 12/16/16.
Removal of 55-gallon containers from overpack containers and placement into cooled storage	Began on 3/30/17.
Transport of containers to the WCRRF for treatment	Began on 5/17/2017~~Scheduled to begin on 4/17/17~~.

Activity	Due Date
Treatment of remediated nitrate salt-bearing waste	Began on 5/18/2017Scheduled to begin on 4/19/17.
Post-treatment sampling of remediated nitrate salt-bearing waste	Began on 5/18/2017.
Pre-treatment sampling of remediated nitrate salt-bearing waste	Began on 6/13/2017.
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.
Inspection and repackaging unremediated nitrate salt-bearing waste	Scheduled to begin October 2017.
Treatment of unremediated nitrate salt-bearing waste	Scheduled to begin November 2017.

X. 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 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.

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. For purposes of this Plan, working days refers to business days, and excludes state and federal holidays.

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 X.

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

ENCLOSURE 2

LANL Nitrate Salt-Bearing Waste Container Isolation Plan
Revision 9

EPC-DO: 17-385

LA-UR-17-28273

OCT 0 2 2017

Date: ______________________________

LANL Nitrate Salt-Bearing Waste Container Isolation Plan
Revision 9

September 2017

LA-UR-17-28273

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LIST OF ATTACHMENTS

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 descriptions 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 moved into isolation in the Technical Area 54, Dome 375 (TA-54-375) Perma-Con®.

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

Isolation Plan, Revision 5, incorporated the Permittees' plan to remove the overpack container lids from the 55-gallon remediated nitrate salt-bearing waste containers and add a pressure relief device with supplemental filtration to the waste containers. Additional changes were also incorporated to make language throughout the plan consistent and provide for the storage of additional waste container sizes.

Isolation Plan, Revision 6 was drafted to 1) amend the time frame allowed between sampling headspace gas (HSG) and the application of the pressure relief device with supplemental filtration, 2) include additional containers to be equipped with pressure relief devices with supplemental filtration, and 3) incorporate changes due to new or updated procedures utilized for monitoring containers and abnormal instances.

Isolation Plan, Revision 7 included a discussion on 1) the path forward that was chosen by the Permittees for remediation of nitrate salt-bearing waste and the subsequent approval of a Class 1 permit modification to treat nitrate salt-bearing waste by stabilization in containers at the Waste Characterization, Reduction, and Repackaging Facility (WCRRF); 2) the requirements and controls identified by the Permittees for the transport of remediated nitrate salt waste from their current storage location to the WCRRF; and 3) the requirements and controls identified by the Permittees for the safe storage of remediated nitrate salt waste at the WCRRF.

Isolation Plan, Revision 8 incorporated the removal of a restriction on the type of forklift allowed for waste container movement at the WCRRF where treatment of the waste occurs; updated relevant procedures; removed a canceled procedure; and made other general updates or corrections to the plan to ensure that it accurately described activities conducted and scheduled.

Isolation Plan, Revision 9 makes general updates and corrections and allows for the storage of specific multiple containers with liquids in the refrigerator at the WCRRF. The Isolation 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 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 9 may also be taken and will be identified to NMED during the technical calls established in Section X.

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

5) On May 20, 2014, the Permittees held the initial meeting for the Remediation Team. (See Section VII 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 were 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 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. Note that one of the waste containers stored within the 55 SWBs was removed from the inventory of remediated nitrate salt-bearing waste containers, therefore, the Permittees continued to sample 54 SWBs on a regular basis while the SWB overpack containers were closed.

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 *sWheat Scoop*® 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.

Prior to commencement of treatment of remediated nitrate salt-bearing waste, the Permittees did not sample 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 Scoop*® 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 Scoop®* 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 *sWheat Scoop®* 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 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 received copies of corrected manifests from WCS and WIPP and the Permittees have subsequently provided copies of the corrected manifests to NMED. Additionally, the Permittees have provided NMED with all of the Permittees' other correspondence on this issue within Isolation Plan Revisions 2 & 3, and by letters dated October 22, 2015 and September 26, 2016 (ENV-DO-15-0293 and EPC-DO-16-282).

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 in 55-gallon Pipe Overpack Containers (POCs). These containers are 55-gallon waste containers that house a closed pipe component containing remediated nitrate salt-bearing waste. 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 four POCs located at LANL 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 TA-54-375 and placed them back in storage within the TA-54-375 Perma-Con®.

17) In February 2016, the Permittees concluded that the addition of a pressure relief device with supplemental filtration to the remediated nitrate salt-bearing waste containers was the best approach to increase safe storage of these containers. This conclusion was based on the Permittees continued evaluation of safe storage of these containers at LANL.

    In May 2016, pressure relief devices with supplemental filtration were placed on 48 55-gallon remediated nitrate salt-bearing waste containers within 46 open SWBs. Eight SWBs that contain POCs were opened and pressure relief devices with supplemental filtration were installed by December 17, 2016. The four POCs that are in 85 gallon overpack containers have been determined not to require the installation of pressure relief devices with supplemental filtration because these containers were not remediated with *sWheat Scoop*® kitty litter.

18) On July 25, 2016, the Permittees were granted approval to treat nitrate salt-bearing waste within the glovebox containment system at Technical Area 50, Building 69 (TA-50-69), also known as the WCRRF (*Fee Assessment and Approval Class 1 Modification to the Los Alamos National Laboratory (LANL) Hazardous Waste Facility Permit EPA ID #NM0890010515*, HWB-LANL-16-031). As a result, the Permittees identified specific actions necessary to safely remove the 55-gallon containers of remediated nitrate salt-bearing waste from overpack containers and transport them to TA-50-69 for treatment. Additional considerations for storage at the WCRRF were also developed.

19) Movement of 55-gallon remediated nitrate salt-bearing waste containers from open SWBs to refrigerated storage at TA-54-375 began on March 30, 2017.

20) Transport from refrigerated storage at TA-54, Area G, to the WCRRF started on May 17, 2017 and treatment of remediated nitrate salt-bearing waste began on May 18, 2017.

21) Pre-treatment and post-treatment remediated nitrate salt-bearing waste samples are collected as outlined in the LANL Hazardous Waste Facility Permit, Attachment C ("Waste Analysis Plan").

III. Waste Container Categories

The current inventory of nitrate salt-bearing waste containers that have been 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 that are not covered under this plan, but underwent reevaluation as described in Section VIII.

This plan addresses unremediated nitrate salt waste and the 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 *sWheat Scoop®* 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®. Additionally, in June 2017, the Permittees removed two containers from the inventory of unremediated nitrate salt waste because it was determined that the containers are filled with 1-gallon paint cans of cemented waste (EPC-DO: 17-224 or ESHID-602442).

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

- 267 parent nitrate salt waste containers either remain parent containers or were remediated for a total inventory of 708 nitrate salt-bearing waste containers.
    - 27 of the 708 waste containers are parent nitrate salt waste containers that remain in storage at LANL.
    - Three of the 708 waste containers were shipped off-site for direct disposal because they did not require remediation.
    - 678 of the 708 waste containers are remediated nitrate salt-bearing waste containers.

Of the 708 identified nitrate salt-bearing containers, a total of 87 remain at LANL, 60 are remediated daughter containers and 27 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 X.

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 VIII. 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.

Summary of Nitrate Salt-Bearing Waste Containers

Waste Type	Waste Container Type	Overpack size	Number of Waste Containers
Remediated Nitrate Salt-Bearing Waste	55-gallon	SWB	48
Remediated Nitrate Salt-Bearing Waste	55-gallon POC	SWB	8
Remediated Nitrate Salt-Bearing Waste	55-gallon POC	85 gallon	4
Unremediated Nitrate Salt Waste	55-gallon	85 gallon	27

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

Prior to the commencement of treatment, there were 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 by trained and qualified LANL TID users. The LANL TID User Manual was included as an attachment to Isolation Plan Revisions 1-5.

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.

TIDs on remediated nitrate salt-bearing waste containers (68685 and the SWB it is stored within) were removed as part of the addition of the pressure relief device with supplemental filtration described in Section IV.16. TIDs on empty parent containers (parent containers of 69120 and 68359) will be removed from the containers when they are packaged for shipment and disposal.

2) On May 18, 2014, the Permittees completed overpacking the 57 originally identified remediated nitrate salt-bearing waste containers at LANL into SWBs; 14 of these SWBs were already packaged within SWBs set to go to the WIPP and include other containers of waste within the SWB, rather than empty dunnage containers. 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 Attachment 3. 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 unused SWBs (including 8 that contain POCs) and four 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 because they 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 overpack containers that contain remediated nitrate salt-bearing waste drums as well as the 55-gallon waste containers within the open SWBs. Daily temperature measurements are also recorded for 55-gallon remediated nitrate salt-bearing waste containers within refrigerated storage attached to the TA-54-375 Perma-Con® or at the TA-50-69 WCRRF. As discussed above, all remediated nitrate salt-bearing containers were overpacked in SWBs or 85 gallon containers. Temperature measurements are taken of the top surface of the still closed overpack containers using a thermocouple, infrared thermometer, or Infrared Imaging Camera. For containers in the open SWBs, temperature measurements are taken from the top surface of the 55-gallon 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 75 °F.

The Permittees maintain records of all temperature monitoring. These activities at TA-54, Area G are performed in accordance with LANL's Procedure on *TA-54 Area G RNS Waste Container Monitoring,* AREAG-WO-DOP-1246, R.4 (Attachment 4). These records are 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 X. 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, hourly) are 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, at TA-54, Area G are performed in accordance with LANL's Procedure on *TA-54 Area G RNS Waste Container Monitoring,* AREAG-WO-DOP-1246, R.4. The Permittees maintain records of all visual monitoring. (See, Attachment 4) These records are updated on a daily basis and are available to NMED for inspection.

Further study, analysis, and an HSG data report (Attachment 5) provided 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 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.

After removal of the overpack SWB lid, visual inspection of the 55-gallon waste containers within the open SWB continues. During this time, visual inspections are more difficult to conduct when compared to the closed SWB container, however, the drums continue to be inspected within the SWB from above for evidence of spills, leaks, or deterioration within the SWB. Should any leak or spill occur, the leak would be contained within the SWB. Additionally, visual inspections of the 55-gallon waste container are a more effective indicator of an abnormality, because the actual waste drum containing remediated nitrate salt-bearing waste is the container that is inspected. Daily visual inspections continue through the removal from overpack containers, characterization (non-destructive assay), and cooling activities that occur prior to shipping the containers to the TA-50-69 WCRRF.

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 procedures: *TA-54 Area G RNS Waste Container Monitoring*, AREAG-WO-DOP-1246, R.4 (Attachment 4); *TA-54 Area G RNS SWB Lid Removal*, AREAG-WO-DOP-1340, R.2 (Attachment 6); and TA-54-0*375 and RNS Waste Container Abnormal Conditions*, AREAG-RM-AOP-1299, R.1 (Attachment 7). 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 8, and associated procedures are found at Attachments 9, 10, and 11.

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 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. Overpack containers are stored with a minimum of 2 feet between containers and were not moved prior to, or after, the removal of the SWB lid and addition of the pressure relief devices with supplemental filtration to the 55-gallon inner containers. Overpack containers are removed from the TA-54-375 Perma-Con® as remediated nitrate salt-bearing waste containers are removed from the overpack containers per Section IV.18.

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. A drawing that includes the locations of the overpack containers within the TA-54-375 Perma-Con® is included in Attachment 12. The use of fire curtains in between containers would not provide a measurable reduction in the thermal conductivity across the 24 inches but would provide protection from flame impingement.

Overpack 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 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 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 purchased fire resistant curtains that are not currently planned for use. If used, containers would be placed in rows that allow for safe egress and with 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 was 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 X.

In early 2016, the Permittees conducted detailed wildfire analyses that indicate with the current fuel loads and utilized storage space, wildfire will not impact the waste in storage. During the analysis, a defense-in-depth measure was identified, that involves covering of the waste containers in storage with reflective material or “fire blankets” in the event of a fire. The Permittees have acquired the reflective blankets and propose to deploy them if necessary.

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 HSG 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 was documented in *TA-54 Area G Domes TA-54-231 and TA-54-375 PermaCon Access Restrictions*, EWMO-AREAG-SO-1247. This standing order was included with Isolation Plan, Revisions 2-7; however, it was canceled by the facility on January 19, 2017 to allow for the planned removal of 55-gallon containers from overpack containers, cooling, and transport of remediated nitrate salt-bearing waste containers. Also, there are 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 unused SWBs (including 8 POCs), and nitrate salt-bearing waste identified after May 2014 were packed into 85 gallon overpacked POCs. 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 act as a barrier to provide a significant measure of worker protection. No other protective shields or barriers were deemed necessary for the protection of workers while the overpack containers were closed. After the installation of pressure relief devices and supplemental filtration to the 55-gallon waste containers, there is a low potential for lid loss from build-up pressure within the waste container.

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 notify the LANL Emergency Operations Center (EOC). The EOC will notify the Los Alamos Fire Department and other responders, if needed. The Permittees notify the EOC at the completion of the move. The responders are not present during the movement of these containers, or during other actions undertaken to prepare the waste containers for shipment.

10) The Permittees have updated all procedures and safety basis documents to convert the applicable processing facilities at TA-54, Area G into storage facilities.

11) While used as overpack containers, SWBs and 85 gallon containers displayed the required labels for all inner containers or are reclassified as a new container in WCATS. This means that the container either displayed the container identification number for the 55-gallon nitrate salt-bearing waste container within the overpack or displayed a new container number. The 60 subject containers (including the sister drum to the breached drum in WIPP) were clearly labeled with the appropriate warning labels and any other required labeling. Specifically, the containers had 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® are identified as containing free liquids. The SWBs were not placed on secondary containment when this discovery was made

because movement of the SWBs was prohibited until the removal of the 55-gallon containers from their overpack containers per Section IV.18. 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®.

After removal of the SWB lid, the internal 55-gallon remediated nitrate salt-bearing waste containers are stored within the open SWB. Appropriate labels are located on the top of the 55-gallon waste container and WCATS is updated, as appropriate, to include the 55-gallon waste drums as the containers in storage within the TA-54-375 Perma-Con®. After the addition of the pressure relief device and supplemental filtration, the 55-gallon waste containers were not removed from the open SWB overpack or elevated to meet the requirements of Permit Sections 3.7.1(1) or 3.7.2(1)(a). This storage configuration continues to be protective of human health and the environment, as daily visual inspections, temperature measurement, and HSG sampling on the 55-gallon drums are conducted as outlined in Sections IV.7 and IV.12. Any leak or spill that may occur will be contained within the SWB and would be discovered during the next inspection. Additionally, visual inspections, temperature measurements, and HSG sampling are more effective indicators of an abnormality, because the 55-gallon waste container is the container monitored.

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, H_2, O_2, N_2, CH_4, CO, CO_2, NO, and N_2O 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 13 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.

CH_4 is occasionally detected in small concentrations (i.e., < 50 ppm). He and NO 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 X.

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 (Note that one container was later removed from the remediated nitrate salt-bearing waste container inventory). The Permittees transitioned to sampling a subset of the 54 SWBs on a regular basis (this subset may change over time). All of this HSG monitoring was initiated as additional measures above those described in the original May 19, 2014 Isolation Plan and the May 29, 2014 Revised Isolation Plan, and are currently being performed as described within this 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 conduct HSG sampling to measure concentrations of H_2, CO_2, CO and N_2O within the containers for the remediated nitrate salt-bearing waste. The Permittees:

1. Conducted daily HSG sampling of SWB SB50522 and the SWB that contained 68685 until the SWBs were opened. HSG sampling was then conducted daily of containers 68685 and 69490 until treatment of the waste within those containers began on June 13, 2017 and July 12, 2017, respectively.

2. Periodically sampled HSG of 52 other SWBs and four 85 gallon containers within the TA-54-375 Perma-Con® on a schedule that ensured that each of the containers were 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. At least monthly sampling continues from the 85 gallon overpack container or the 55-gallon container until each of the containers are attached to the glovebox at the WCRRF for treatment.

Originally, 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 (overpacked into 85 gallon containers) were added to the monthly sampling 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.

HSG sampling to measure concentrations of H_2, CO_2, CO, CH_4 and N_2O after the addition of the pressure relief devices with supplemental filtration continues. Samples are collected from the 55-gallon remediated nitrate salt-bearing waste containers (or the overpack container) according to the same schedule described for the overpack containers above.

The Permittees include HSG data (H_2, CO_2, CO, CH_4 and N_2O) in the written submissions provided to NMED, as established in Section X. 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. These records, and all temperature data, are 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:
- Remediated nitrate salt-bearing 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. From 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 and/or daily temperature measurements through September 13, 2016 were:

SB50522 Temperature	Degrees Fahrenheit
High	84.1
Low	27.7

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	24.1

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 5.

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 HSG 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 polyvinyl 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 HSG of the original 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 the 55 SWBs was initiated on May 19, 2014. All 55 SWBs were characterized. (Note that one container was later removed from the remediated nitrate salt-bearing waste container inventory). Elevated concentrations of HSG compounds have been observed at concentrations well above normal atmospheric concentrations in some of the 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. By September 19, 2014, the Permittees had 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.12 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 5). 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 container.

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 container, if the container is configured to accept additional filters. (This approach was successfully implemented by the Permittees with SWB 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 container 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 X.

16) As part of the Permittees continued evaluation for safe storage of remediated nitrate salt-bearing waste containers, tests continued with surrogate remediated nitrate salt-bearing waste mixtures. Test results indicated that pressure is crucial for establishing a self-sustained

thermal runaway in the tested material. These results pointed to pressure relief as a means to prevent over-pressurization of the waste containers and minimize the possibility of thermal runaway while in storage.

In February 2016, the Permittees concluded that the best approach to increasing the safe storage strategy for remediated nitrate salt-bearing waste containers was to add pressure relief devices with supplemental filtration to the waste containers stored within the TA-54-375 Perma-Con®. Remediated nitrate salt-bearing waste within the four POCs overpacked in 85 gallon containers do not present a thermal runaway hazard because these containers were not remediated with *sWheat Scoop*® kitty litter. Therefore, these containers do not require a pressure relief device with supplemental filtration. The remaining 56 remediated nitrate salt-bearing waste containers were affixed with pressure relief devices with supplemental filtration until each container is about to be attached to the glovebox at the WCRRF for treatment of the remediated nitrate salt-bearing waste.

The process for addition of the pressure relief devices with supplemental filtration included opening the SWB containers to gain access to the 55-gallon remediated nitrate salt-bearing waste container(s) within each overpack container. For remediated nitrate salt-bearing waste containers within SWBs that do not contain POCs, the process continued by opening the 55-gallon container(s), piercing the internal bag, closing the 55-gallon container(s), and equipping the 55-gallon waste container with a pressure relief device and supplemental filter in the 2-inch bung hole. In the case of remediated nitrate salt-bearing waste containers within SWBs that contain POCs, after the SWB is opened, the 55-gallon waste container(s) was opened, the NFT filter on the pipe component removed, and the lid of the 55-gallon POC was replaced with a new lid, equipped with a pressure relief device and supplemental filter in the 2-inch bung hole. Steps for these processes are outlined further below.

Prior to opening SWB overpack containers, an HSG sample was collected from the SWB for analysis to verify the results did not indicate an adverse condition. Then, one of the four ¾ inch HEPA vent filters/plugs was removed and a radiological survey was performed to verify contamination levels were within radiological work permit limits. If contamination levels were within permit limits, a borescope was inserted in the vent hole to examine the condition of the SWB internals and the containers within the SWB. If there was no indication of a chemical reaction or drum deterioration, the Permittees began the process to remove the SWB lid.

Removal of the SWB lid was accomplished by first loosening all 42 lid bolts using a bit wrench. Bolts that were stripped, were drilled out using a slow velocity (90 revolutions per minute) magnetic drill using tool oil to lubricate the surface and mitigate any spark hazards. Multiple drills may have been used concurrently within the TA-54-375 Perma-Con®.

Although the tools used were not non-sparking tools, the potential for sparks was minimized and the ignitable waste is sealed within the inner 55-gallon waste container.

When all of the bolts were removed from the SWB, the lid was removed and a radiological survey was performed to verify that contamination levels were within radiological work permit limits. After this survey, the 55-gallon remediated nitrate salt-bearing waste drum was visually inspected to ensure its integrity. The containers were stored within the opened SWB prior to the addition of pressure relief devices with supplemental filtration. Daily visual inspections and temperature measurements on the 55-gallon drums were and will be conducted as outlined in Section IV.7.

SWB lid removal was postponed for overpack containers that undergo frequent HSG sampling (such as SWB SB50522 and the SWB that contains 68685) to preserve the ability to sample the gas through the multiple vents on the SWB. Prior to the addition of pressure relief devices with supplemental filtration, the 55-gallon drum only included one vent, which limited the number of HSG samples that could be collected from the container. Therefore, the Permittees coordinated the HSG sampling schedule with the SWB lid removal to ensure that HSG sampling and analysis continued uninterrupted.

Prior to the addition of the pressure relief device with supplemental filtration, or the replacement of the POC lid (for the 8 stored in SWB overpack containers), an HSG sample was collected from the 55-gallon drum for analysis. Within 36 hours of HSG sampling, for containers that are not POCs, the 2 inch bung was removed from the 55-gallon drum by unscrewing. Operators ensured that the tools used were at the same potential as the drum (through touching or bonding to the container). A borescope was inserted in the bung hole to examine the internal configuration of the waste within the container. If there was no indication of a chemical reaction, the process continued on to the next step.

The liner bag in the 55-gallon containers, not including the 8 POCs stored within SWB overpack containers, was pierced using a sharp non-sparking instrument, and a pressure relief device with supplemental filtration was screwed into the 2 inch bung hole. Piercing of the bag was necessary to ensure that there was no pressure contained within the bag. For the eight 55-gallon POCs that are in SWB overpacks, the NFT filter on the pipe component within the POC was removed, and the lid of the 55-gallon POC was replaced with a lid equipped with a pressure relief device and supplemental filtration.

The 55-gallon containers of remediated nitrate salt-bearing waste, not including the four POCs overpacked in 85 gallon containers, remained in isolated storage within the TA-54-375 Perma-Con® within open SWBs as described in Section IV.11 until transported for treatment (See IV.19). The four 85 gallon overpack containers that contain POCs remain in isolated storage within the TA-54-375 Perma-Con® per Section IV.11 or IV.19. Regular HSG sampling and analysis to verify that the HSG concentrations are consistent with expected trends have been, and will continue to be, conducted as outlined in Section IV.12.

17) The isolation configuration described in this section is protective of human health and the environment in light of the observed concentrations of H_2 and CO_2 in 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 to ensure continued protection of human health and the environment.

18) Before remediated nitrate salt-bearing waste containers are transported to the WCRRF for treatment processing, the four POCs within 85 gallon overpack containers and the 55-gallon waste containers stored within open SWBs (including the eight SWBs that contain POCs) will be removed from the overpack containers. An HSG sample will be collected within 36 hours of anticipated removal of the waste container from the overpack container. If present, the pressure relief device with supplemental filtration is inspected prior to the removal of the waste container from the SWB to ensure that the rupture disc is not obstructed. The pressure relief device with supplemental filtration is stabilized with tape to protect it during transport.

The four 85 gallon overpack containers that contain POCs will be visually inspected and a temperature measurement will be collected before the 55-gallon POC is removed from the overpack container. Additionally, a borescope is inserted in the bung hole to examine the condition of the inside of the 85 gallon overpack container and the 55-gallon POC within the overpack. If there is no indication of a chemical reaction or drum deterioration, the lid will be removed using non-sparking tools.

Removal of 55-gallon containers from all overpack containers will be accomplished with the use of an electric overhead hoist with a clamshell (or equivalent) lifting device attached to the drum to lift each individual 55-gallon container out of the SWB or 85 gallon overpack. A spotter and personnel on fire watch will be present during removal of the waste containers from the overpack container.

As the 55-gallon container is removed from the overpack container, the container will be visually inspected for evidence of damage or degradation. If there is no indication of a compromised container, the remediated nitrate salt-bearing waste container will be removed from the overpack and the overpack will be removed from under the 55-gallon waste container. The 55-gallon waste container will then be placed onto a caster for placement in storage as described below.

The interior of the SWB or 85 gallon overpack is inspected when the remediated nitrate salt-bearing waste container(s) are removed and the overpack container, dunnage drums, and other waste containers are moved out of the TA-54-375 Perma-Con® and into a designated storage location.

19) After a drum is removed from the overpack container, it is put into storage within the TA-54-375 Perma-Con® or moved into a refrigerator attached to the TA-54-375 Perma-Con® that is maintained at a temperature ≤ 57 °F. Additionally, prior to transportation, the containers must be kept within the TA-54-375 refrigerator at a temperature ≤ 41 °F for a minimum of four consecutive days. The cooled drums remain in the TA-54-375 refrigerator until their removal is required for transportation to the WCRRF. Daily visual inspections and temperature measurements on the 55-gallon waste containers continue to be conducted as outlined in Section IV.7. The maximum number of containers that can be stored in the TA-54-375 refrigerator is 10; containers are configured to allow for inspection and with adequate aisle space to allow for emergency egress.

When in storage within the refrigerator attached to the TA-54-375 Perma-Con®, secondary containment, in accordance with Permit Section 3.7.1(1) may not be feasible due to movement and safety constraints. However, the five containers that have been identified to contain liquids, and the two containers that are suspected to contain liquids, will not have a significant quantity of liquid within the container (a maximum of 2 liters is estimated, and three of the five containers only contain milliliters of liquid). While stored within TA-54-375 refrigerator, containers will be elevated and would be protected from contact with accumulated liquids if a spill or leak should occur. Additionally, there will be daily inspections of the containers conducted for evidence of spills, leaks, or deterioration of the container; should any leak or spill occur, the leak would be contained within the refrigerator that is located within the dome, further decreasing the likelihood of a release to the environment. Should an abnormal condition be observed, the Permittees will implement their emergency response plan.

20) Characterization of the remediated nitrate salt-bearing waste containers may be required prior to transporting the waste containers to the WCRRF for processing. If required, non-destructive assay will be performed inside the TA-54-375 Perma-Con®. To isolate the waste and minimize background, lead shielding and some minor container movement inside the Perma-Con® may be required for characterization.

V. Remediated Nitrate Salt-Bearing Waste Transport and Safe Storage Requirements at the WCRRF

The transport of remediated nitrate salt-bearing waste containers from the TA-54-375 Perma-Con® to the WCRRF is a well-coordinated and concentrated effort; therefore, the Permittees have identified controls and requirements specific to mitigating certain hazards during the transport of the waste containers from storage within the TA-54-375 Perma-Con® to the WCRRF. Requirements and controls for the safe storage of remediated nitrate salt-bearing waste at the WCRRF have also been established and are summarized below.

1) A pre-shipment inspection of the pressure relief devices with supplemental filtration occurs to ensure that the device is installed correctly to provide a venting pathway that will prevent thermal runaway during normal transport conditions. The four POCs that were overpacked in 85 gallon containers do not require the pressure relief devices with supplemental filtration.

2) An HSG sample is collected within 36 hours of anticipated transfer of remediated nitrate salt-bearing waste container. Additionally, a pre-shipment visual inspection and a temperature measurement are conducted.

3) Remediated nitrate salt-bearing waste containers are not transported in inclement weather. Waste containers are transferred from the TA-54-375 refrigerator to the TA-54-375 Perma-Con® loading dock where they are loaded onto transportation vehicle.

4) For transport, a maximum number of four containers are shipped at a time and each container is fitted with a thermal cooling jacket prior to securing the drum in the enclosed cargo compartment of the transport vehicle with tie-down straps or other securing devices. This control prevents the waste container from experiencing elevated temperatures during the transport period. The transfer of remediated nitrate salt-bearing waste containers is performed along roads on which access is restricted to the public.

5) All movement and handling of remediated nitrate salt-bearing waste containers at the WCRRF is monitored by a stationary fire watch. Personnel assigned to stationary fire watch duty are tasked with making safety observations about the presence of ignition sources, changes in combustible loading, unauthorized activities, and situations that could increase the potential or consequences of a fire.

6) All movement of remediated nitrate salt-bearing waste containers during staging or storage at TA-54-375 and at the WCRRF is accomplished with the use of manual, electric, or hydraulic type lift equipment. At the WCRRF, battery operated forklifts may be used for the movement and handling of remediated nitrate salt-bearing waste.

7) A walk-down of TA-50-69 and the WCRRF refrigerator where the remediated nitrate salt-bearing waste containers are stored for cooling is performed prior to waste handling or

processing activities to ensure that only transient combustibles required by the process are present. The WCRRF refrigerator is maintained at a temperature ≤ 57 °F.

8) Prior to movement or handling of the remediated nitrate salt waste containers on the transportation vehicle, a visual inspection of the pressure relief device with supplemental filtration on the containers is performed to ensure that the outlet of the rupture disc is not obstructed and that the disc is still intact. The pressure relief device with supplemental filtration is stabilized with tape to protect it during transport. Additionally, a post-shipment visual inspection and temperature measurement is conducted. The remediated nitrate salt-bearing waste container is transferred from the transportation vehicle to the WCRRF refrigerator within 12 hours of removal from the TA-54-375 refrigerator.

9) No more than four containers are stored in the WCRRF refrigerator at one time; and while stored at the WCRRF, daily visual inspections and temperature measurements on the 55-gallon waste containers are conducted as outlined in Section IV.7.

   When in storage within the WCRRF refrigerator, secondary containment, in accordance with Permit Section 3.7.1(1), for the remediated nitrate salt-bearing waste container may not be feasible due to movement and safety constraints. However, the five containers that have been identified to contain liquids, and the two containers that are suspected to contain liquids, will not have a significant quantity of liquid within the container (a maximum of 3 liters is estimated and three of the five containers only contain milliliters of liquid). While stored within WCRRF refrigerator, containers will be elevated and would be protected from contact with accumulated liquids if a spill or leak should occur. Additionally, only a single container of remediated nitrate salt-bearing waste with liquid will be in storage within the WCRRF refrigerator at one time for the majority of the remediated nitrate salt-bearing waste treatment campaign. Daily inspections of the containers are conducted for evidence of spills, leaks, or deterioration of the container. Should any leak or spill occur, the leak would be contained within the refrigerator that is located within the building, further decreasing the likelihood of a release to the environment. Should an abnormal condition be observed, the Permittees will implement their emergency response plan.

10) The final four containers that will be transported to the WCRRF for treatment are the remediated nitrate salt-bearing waste within the four POCs that are overpacked in 85 gallon containers. These containers are grouped together at the end of the waste treatment campaign because the waste within the POCs was remediated with Waste Lock® 770 and not remediated with *sWheat Scoop*® kitty litter. Therefore, these containers do not present a thermal runaway hazard and are not equipped with pressure relief devices with supplemental filtration. They have been prioritized for treatment accordingly to ensure that all containers remediated with *sWheat Scoop*® are treated first. These four containers are in good condition

and were originally remediated in 2013, however, all four of these POCs are anticipated to contain liquids based on review of RTR.

For operational efficiency and to expedite completion of treatment of remediated nitrate salt-bearing waste, the Permittees will ship the last four POCs to the WCRRF as two shipments of two containers each. These combined shipments will reduce the time and personnel resources it requires for each container to reach WCRRF; decrease by half the number of road closures required to transport the containers. Prior to transport, the containers will be removed from the 85 gallon overpack containers, and stored in the refrigerator attached to the TA-54-375 Perma-Con®, as described in Sections IV.18 and IV.19; and will be transported as described in Sections V.1 through V.8

After the first shipment to WCRRF, one waste container will be placed on to the glovebox to begin treatment. After the second shipment there will be a total of three waste containers with liquids in the WCRRF refrigerator at the same time. The estimated liquid volumes within the pipe components within each of the three POCs is 3 liters, 3 liters, and 1.4 liters, respectively. The Permittees have determined that storage of these three POCs within the refrigerator at the same time is acceptable because the liquids are confined within the pipe component within each of the POCs. There is sufficient volume within the 55-gallon waste container in the event that the pipe component fails to contain the liquids (equivalent to secondary containment). This is extremely unlikely due to the robustness of the pipe component itself. All of the same precautions described in Section V.9 above will be implemented for these waste containers.

11) Pre-treatment and post-treatment remediated nitrate salt-bearing waste samples are collected as outlined in the Permit Attachment C (“Waste Analysis Plan”).

VI. Immediate Actions and Storage Activities for Unremediated Nitrate Salt-Bearing Waste Containers

There are currently 27 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 27 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 X. 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 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 organizations 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 HSG sampling), and other required inspections (e.g., Permit required inspections) were allowed into the storage areas. This was 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 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 were 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 14 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 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 continues 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 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.
- The most recent RTRs indicate that all 27 unremediated nitrate salt-bearing waste containers have free liquids; therefore, all are stored with appropriate secondary containment and the containers will be separated or segregated to prevent any contact with accumulated liquids as required by Permit Section 3.7.
- Waste containers are not stacked.

12) Unremediated nitrate salt waste will be treated at the WCRRF utilizing the treatment method described in Section VII. As preparations for transport and treatment are performed, unremediated nitrate salt-bearing waste containers will be moved to other locations for characterization purposes (e.g. RTR, non-destructive assay, visual inspection, etc.). Prior to shipment to the WCRRF for treatment, unremediated nitrate salt waste containers will be visually inspected and the contents repackaged as necessary within appropriate confinement. Refrigerated storage and thermal cooling jacket during shipment of unremediated nitrate salt waste containers is not anticipated.

13) Pre-treatment and post-treatment unremediated nitrate salt-bearing waste samples will be collected as outlined in the Permit Attachment C ("Waste Analysis Plan").

VII. Remediation Planning

1) The Permittees 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 met with NMED on multiple occasions to discuss the Team's progress, and plan to continue these communications as treatment activities progress.

   As discussed in Paragraphs IV.2 and IV.5 above, the Permittees overpacked the 56 remediated nitrate salt-bearing waste containers at LANL into 54 SWBs. The SWB lids have been removed to gain access to the internal 55-gallon remediated nitrate salt-bearing waste containers and install a pressure relief device with supplemental filtration to each container. These 55-gallon containers of remediated nitrate salt-bearing waste remain in isolated storage within the TA-54-375 Perma-Con® within SWBs or within the refrigerator attached to the TA-54-375 Perma-Con® as described in Section IV.11 or IV.19. The 85 gallon overpack containers that contain POCs also remain closed and in storage as described in Section IV.11 or IV.19.

   NMED and the Permittees have had discussions on potential remediation actions and the Permittees will continue 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 additional submittals to NMED.

2) The treatment plan developed by the Remediation Team was discussed with the NMED. These discussions included, but were not limited to, neutralization steps, the potential reagents that may have been used, the location of the process for treating wastes, and all other key specific information related to all potential treatment options. The treatment plan developed included the type of characteristic (toxicity, reactivity, ignitability, corrosivity) mixed TRU wastes the WCRRF is authorized to treat – including, as appropriate, the removal of the characteristics of ignitability (D001) and/or corrosivity (D002). Permittees discussed with NMED the permit modification necessary for treatment of the nitrate salt-bearing wastes.

3) The key events, actions and activities are documented as specified in the treatment plan. The Permittees 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 and in this Isolation Plan (e.g., safe storage configuration, the stabilization steps, the reagents used, the location of the process for treating drums). These records are updated and are available to NMED for inspection.

4) After research on the activities necessary to treat nitrate salt-bearing waste, a plan for treatment of the waste was established. A Class 1 permit modification to treat the waste at the TA-50-69 WCRRF was submitted to, and approved by the NMED on July 25, 2016. As

discussed in Section V above, the Permittees identified specific requirements and controls related to the transport of remediated nitrate salt waste from their current storage location within the TA-54-375 Perma-Con® to TA-50-69 where they will be treated. Requirements for the safe storage of remediated nitrate salt-bearing waste containers at the TA-50-69 WCRRF have also been identified and are included in Section V.

5) Nitrate salt-bearing waste is transported to the TA-50-69 WCRRF for treatment by stabilization in containers within the glovebox containment system. The treatment process of mixing nitrate salt waste with water (if applicable), and zeolite removes the D001 and D002 EPA Hazardous Waste Numbers. Specific treatment requirements and confirmation verification sample requirements are found within the LANL Hazardous Waste Facility Permit as approved by NMED on July 25, 2016.

VIII. 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.

IX. Immediate Action Implementation Schedule

All actions within the schedule and implementation of the LANL Isolation Plan are conducted and communicated with NMED in the meetings and written submissions established in Section X.

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 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.

Activity	**Due Date**
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.
Removal of lids from SWBs and labeling of inner containers that do not contain POCs	Completed on 05/26/16.
Removal of lids from SWBs and labeling of inner containers that contain POCs	Completed by 12/16/16.
Removal from 85 gallon overpack and labeling of 55-gallon POCs	Scheduled to be completed per Section IV.18 prior to transport for treatment at the WCRRF.
Installation of pressure relief device with supplemental filtration for containers that are not POCs	Completed on 05/26/16.
Installation of pressure relief device with supplemental filtration for containers that are POCs within SWB overpack containers (Not POCs overpacked in 85 gallon containers)	Completed by 12/16/16.
Removal of 55-gallon containers from overpack containers and placement into cooled storage	Began on 3/30/17.
Transport of containers to the WCRRF for treatment	Began on 5/17/2017.
Treatment of remediated nitrate salt-bearing waste	Began on 5/18/2017.
Post-treatment sampling of remediated nitrate salt-bearing waste	Began on 5/18/2017.
Pre-treatment sampling of remediated nitrate salt-bearing waste	Began on 6/13/2017.
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.

Activity	Due Date
Inspection and repackaging unremediated nitrate salt-bearing waste	Scheduled to begin October 2017.
Treatment of unremediated nitrate salt-bearing waste	Scheduled to begin November 2017.

X. 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 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.

All submissions related to 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. For purposes of this Plan, working days refers to business days, and excludes state and federal holidays.

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 X.

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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Tables

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

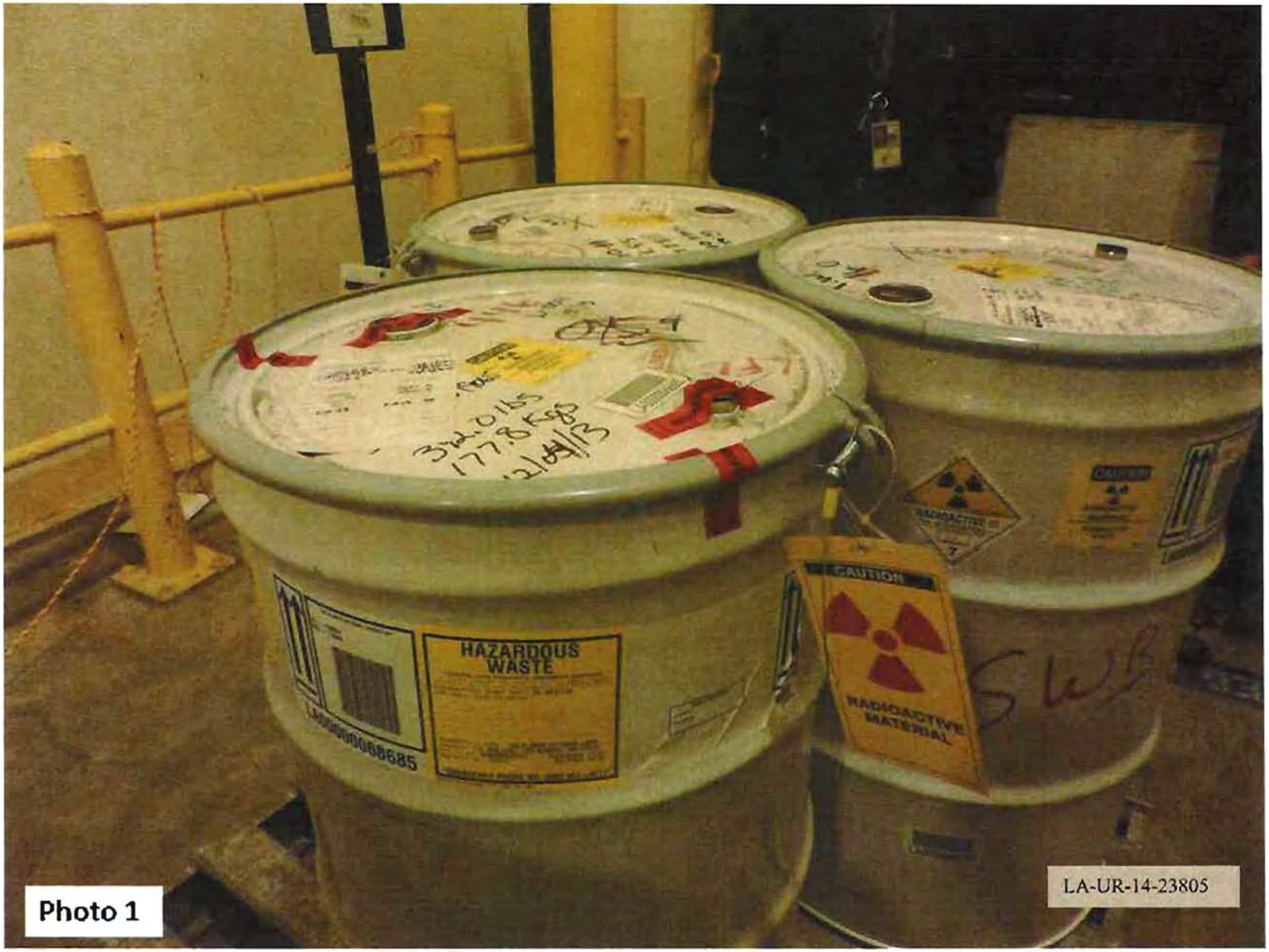
Original Container ID	PKG_ID	Salt Type	Waste Stream	Type	Code	Dataset Date
S832150	S832150	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832155	S832155	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832156	S832156	Nitrate	LA-MHD01.001	Original	72	7/31/2012
S832241	S832241	Nitrate	LA-MHD01.001	Original	72	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



LA-UR-14-23805

Photo 1

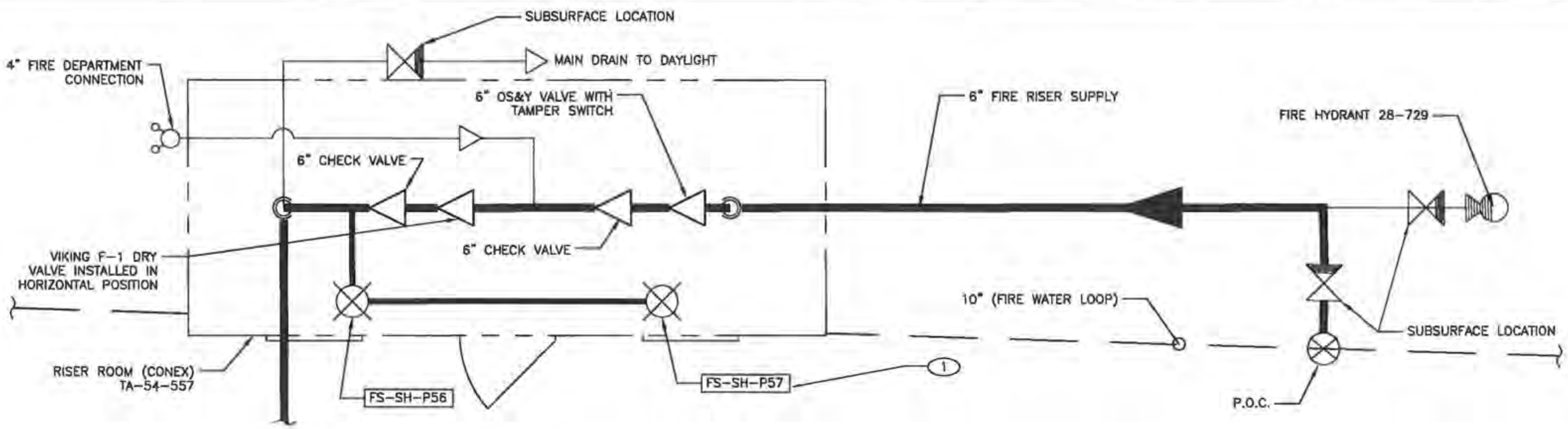
LA-UR-14-23805

Photo 2


USA DOT 7A TYPE A
RADIOACTIVE MATERIAL
HAZARDOUS
WASTE
LA00000068685
LA-UR-14-23805
Photo 3

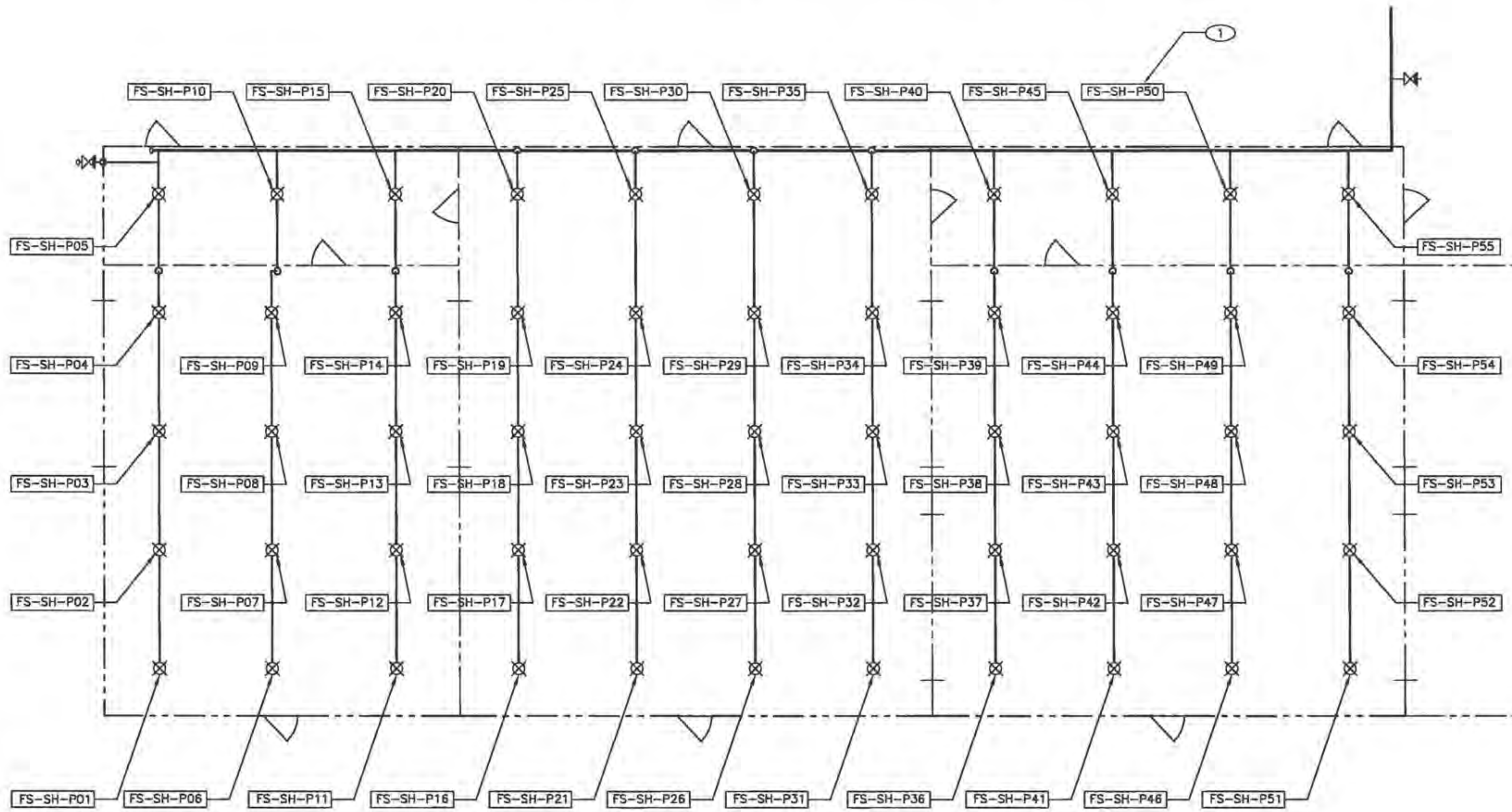
Attachment 3

ERID-523189



54-557 RISER ROOM SPRINKLER HEADS LOCATION PLAN

SCALE: NONE



PERMACON SPRINKLER HEADS LOCATION PLAN

SCALE: NONE

LEGEND

- ⊠ UPRIGHT SPRINKLER ON LINE FITTING (57 TOTAL)
- OS&Y VALVE

GENERAL NOTES:

1. REFER TO SHEET F-7001 FOR MASTER EQUIPMENT LIST.

KEYED NOTES:

(1) THE FOLLOWING ID NOMENCLATURE IS IDENTIFIED IN THE MASTER EQUIPMENT LIST (MEL) ON SHEET F-7001.

◇32◇ SH

NO	DATE	CLASS REV	DC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
1	8/2/13	U	CP	REVISED TO INCLUDE ROOM NUMBER FOR RISER ROOM	TL	JS	CP	JMH	AB

ENGINEERING SERVICES

TA-54-375 FRP BOXLINE DRAWINGS - SUPPORT

FIRE PROTECTION SYSTEM SPRINKLER HEADS LOCATION PLAN

TA-54 BLDG 375

DRAWN	T. LAWRENCE
DESIGN	J. SISNEROS
CHECKED	J. KANZLEITER
DATE	02-25-2013

SUBMITTED JULIA MINTON-HUGHES

APPROVED FOR RELEASE FOD, STEVE HENRY

Los Alamos NATIONAL LABORATORY — PO Box 1663 Los Alamos, New Mexico 87545

SHEET F-1001 — 4 OF 21

D.C.: U | REVIEWER: CHRIS PILCHER | BASIS: N/A | DATE: 02-22-13

PROJECT ID 102489 | DRAWING NO C56010 | ESR NO.: NA | REV 1

Attachment 4

AREAG-WO-DOP-1246, R.4

TA-54 Area G
RNS Waste Container Monitoring

Effective Date: March 16, 2017

Next Review Date: March 16, 2020

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.

Operations Manager	Engineering
WD Operator SME	Quality Assurance
WD Operation	Safety Basis
WD-WPE Group Leader	Industrial Hygiene and Safety
Criticality Safety Analyst	Radiation Protection
Criticality Safety Officer	Environmental Compliance Programs
Deployed Environmental Professional	WD-WPE SME

Classification Review: ☒ Unclassified ☐ UCNI ☐ Classified

Patrice Stevens	/ 106047	/ /s/ Patrice Stevens	/ 03/15/17
Name (print)	Z#	Signature	Date

Responsible Manager, WD-WSS Group Leader

Paul Newberry	/ 112056	/ /s/ Paul Newberry	/ 03/15/17
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

A comprehensive log of changes made to this procedure, including superseded documents and complete revision descriptions, is accessible through the Electronic Document Management System (EDMS). The following log is abridged to one page and includes only the latest revisions.

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.
AREAG-WO-DOP-1246, R.0	March 30, 2016	Major Revision	Revised procedure to update daily rounds checklist to include drum numbers. Added steps to conduct visual inspection through Perma-Con window before performing visual inspection inside of Perma-Con. Updated Attachments to include inspections of RNS drums once SWB lid is removed.
AREAG-WO-DOP-1246, R.0, IPC-1	April 11, 2016	IPC	Modified Attachment 1 to match Step 5.[6]. To properly capture SAC 002 A& B.
AGREAG-WO-DOP-1246, R.0, IPC-2	April 18, 2016	IPC	Revised container temperature response limit from 15°F to 10°F and added ESS driven hydrogen headspace gas limits and response actions. Section 5, Note 1 revised to delete “within 24 hours.”
AREAG-WO-DOP-1246, R.0 IPC-3	May 9, 2016	IPC	Revised Step 5.[6] for inspection of drum for a rounded bottom per ESS.
AREAG-WO-DOP-1246, R.1	July 15, 2016	Major Revision	Revised to include inspection of the PRDwSF rupture disc.
AREAG-WO-DOP-1246, R.2	December 21, 2016	Major Revision	Revised to include daily refrigerator temperature surveillance. Attachments revised to provide flexibility in RNS waste container location post-denesting.
AREAG-WO-DOP-1246, R.3	February 1, 2017	Major Revision	Deleted respiratory requirements consistent with revised RWP. Revised P&L bullets to address gas hazards. Attachment 2 revised to three separate attachments, one for each cell, for ease of use.
AREAG-WO-DOP-1246, R.4	March 16, 2017	Major Revision	Added section for use of the RNS waste container temperature monitoring system (TMS). Clarified applicability of 8.[5] to address RNS waste container denesting, cold safing, and shipment preparation.

TABLE OF CONTENTS

TABLE OF CONTENTS (continued)

Section Page

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 RNS waste containers in accordance with New Mexico Environment Department (NMED) approvals or the Los Alamos National Laboratory (LANL) Nitrate Salt-Bearing Waste Container Isolation Plan
- Daily visual inspection of the pressure relief device with supplemental filtration (PRDwSF) rupture disc as a best management practice
- Daily visual inspections of the RNS 85-gallon overpack drums in accordance with AREAG-ESS-14-002
- Daily visual inspections of RNS waste containers in standard waste boxes (SWBs) in accordance with AREAG-ESS-14-002
- Daily temperature readings of waste containers in accordance with LANL Nitrate Salt-Bearing Waste Container Isolation Plan
- Daily ambient air temperature readings of Cells 1, 2, and 3 in accordance with AREAG-ESS-14-002, Surveillance Requirement (SR) 4.ESS.5.1.
- Daily ambient air temperature readings of the refrigerator in accordance with ABD-WFM-002, Attachment 1, SR 4.6.2.1.
- Periodic inspection of the Technical Area (TA) 54 East Entrance Road into Area G following significant precipitation
- Periodic evaluation of RNS waste container headspace gas analysis in accordance with LANL Nitrate Salt-Bearing Waste Container Isolation Plan

This procedure applies to 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.

- Abnormal or unexpected conditions encountered during performance of this procedure are documented in the attachments' comment section. Guidance provided by TA-54 Operations Center, as well as follow-on actions, shall also be documented therein.

- If a waste container is discovered with evidence of an imminent thermal runaway (i.e., signs of heating, pressurization, chemical reaction, smoke, or fire), Waste Operators will initiate emergency response actions in accordance with EWMO-BEP-20048, EWMO Division Building Emergency Plan. The Person-In-Charge (PIC) will notify the TA-54 Operations Center.

- Personnel shall review and understand the requirements of the Radiological Work Permit (RWP).

- The calibrated infrared thermometer is equipped with a laser that can cause eye injury if the eye is exposed to the beam. Never point beam at eyes.

- 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.

- Toxic gases/vapors can accumulate over time in RNS waste container headspaces. These gases/vapors include nitrous oxide (N_2O), carbon monoxide (CO), nitrogen dioxide (NO_2), nitric acid vapor, hydrogen, and volatile organic compounds (VOCs). N_2O and CO may be present in the headspace of an RNS waste container at levels above occupational exposure limits. VOCs are expected at lower levels. Toxic gas hazards are controlled by maintaining waste container temperature to minimize gas generation; RNS waste container filtered vent which prevents gas build-up and pressurization; and use of general ventilation.

3.1 General Task Hazards and Controls (continued)

- Flammable mixtures of gases can accumulate over time in RNS waste container headspace due to waste constituents and chemical/radiological breakdown of RNS wastes. The principal flammable component is hydrogen gas, but VOCs such as methanol, acetone, and benzene may be present. N_2O is also expected from waste breakdown or waste constituents. N_2O is an oxidizing gas that could increase the rate of burning. The nitrate salts in the wastes are also oxidizers. RNS wastes are classified as ignitable (EPA D001). Flammable/combustible hazards are controlled by maintaining waste container temperature to minimize gas generation; RNS container filtered vent which prevents gas build-up and pressurization; use of local ventilation; and air monitoring of the refrigerator prior to entry.

- Prior to entering the refrigerator, daily air monitoring must be performed.

- Personnel are not allowed to work inside the refrigerator with the door closed. The refrigerator door must be secured when open. The refrigerator will be inspected prior to closing the door to ensure it is unoccupied.

3.2 Safety Basis

- Procedure steps marked with the **($)** symbol implement key requirements associated with the facility's safety basis. These steps may <u>not</u> 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. AREAG-ESS-14-002, Revision 6.1 requirements incorporated and controlled within this procedure include:

3.2 Safety Basis (continued)

- RNS waste containers inside of TA-54-0375 Perma-Con shall be inspected as follows:
  - 85-gallon drum overpacks shall be inspected daily for abnormal conditions (e.g., signs of heat, fire, pressurization, or chemical reaction) [ESS-14-002, SAC 02-A]

  AND
  - RNS waste containers inside an open overpack (excluding 85-gallon drums) shall be inspected for abnormal conditions daily (e.g., signs of heat, fire, pressurization, or chemical reactions daily. [ESS-14-002, SAC 02-B]
  - Ambient air temperature in Perma-Con shall be verified daily between the hours of 1300 and 1700. [LCO 4.ESS.5.1]

- ABD-WFM-002, Attachment 1 requirement incorporated and controlled within this procedure includes:

  - Ambient air temperature in the refrigerator shall be verified daily between the hours of 1300 and 1700. [Surveillance Requirement (SR) 4.6.2.1]

3.3 RCRA and Environmental

- Procedure steps marked with the **(&)** symbol implement key requirements associated with the Resource Conservation and Recovery Act or other environmental regulatory requirements including the LANL Nitrate Salt-Bearing Waste Container Isolation Plan (IP). These steps may not be changed without Environmental Compliance Program approval to ensure that applicable limits are maintained.

- RNS waste containers inside of Perma-Con shall be inspected as follows:
  - Daily visual inspection (IP IV.7)
  - Daily temperature reading (IP IV.7)
  - Periodic headspace gas sampling (IP IV.12)

4. PREREQUISITE ACTIONS

The listed prerequisite actions may be completed in any order or concurrently.

4.1 Planning and Coordination

PIC

[1] **ENSURE** that the procedure is the latest revision and **DOCUMENT** on the Title Page.

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

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

- Two Waste Operators (Sections 5 through 7)
- One Radiological Control Technician (when performing operations within the Perma-Con)

[4] **VERIFY** that AREAG-FO-DOP-1249, TA-54 Area G Dome 375 Round Sheet, has been completed on the same day and prior to the performance of this procedure.

[5] **IF** a precipitation event has occurred since the last performance of this procedure, **THEN CONTACT** the TA-54 Operations Center or the on-call SOM to determine if Section 7, TA-54 Area G East Entrance/Road into Area G Monitoring, needs to be performed.

[6] **IF** abnormal condition or ESS acceptance criteria cannot be or are not met, **THEN STOP** work and **DEVELOP** a recovery plan.

4.2 Materials and Equipment

Waste Operator

[1] **ENSURE** that a PRDwSF inspection mirror is available.

[2] **IF** performing Section 6, **THEN ENSURE** that a calibrated infrared thermometer within the calibration due date is available.

5. PERFORMANCE—VISUAL INSPECTIONS OF RNS WASTE CONTAINERS

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

The daily visual inspection meets the requirements of AREAG-ESS-14-002 and the LANL Nitrate Salt-Bearing Waste Container Isolation Plan.

Surveillance inspection must be performed at least once DAILY. This inspection frequency may be increased at the discretion of WD-Waste Storage and Shipping management.

Due to operating restrictions within the Perma-Con, Waste Operators may convey inspection information to personnel outside the Perma-Con for recording on attachments.

Waste Operators

[1] **ENSURE** that the prerequisite actions have been completed and **INITIAL** Attachment 1.

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

[3] Prior to entering the Perma-Con, **PERFORM** an initial visual inspection through the windows of Perma-Con looking for evidence of a chemical reaction such as smoke, fire, or release of internal contents to the atmosphere.

.

[4] **IF** evidence of a chemical reaction is discovered,
THEN PERFORM an <u>emergency response</u> in accordance with EWMO-BEP-20048.

[5] **ENTER** the Perma-Con.

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

NOTE *Inspections performed in Steps 5.[6] through 5.[12] may be performed concurrently in each cell and in the refrigerator.*

[6] **($)(&) VISUALLY INSPECT** 85-gallon drum overpacks, RNS waste containers inside open SWBs, and denested RNS waste containers in the refrigerator 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 heating such as discoloration, peeling, or yellowing of the paint
- Evidence of loss of container integrity such as leakage or compromised lid
- Evidence of pressurization such as expansion of side walls, rounded bottom (e.g., container is not level) or rounded top
- Signs of chemical reaction such as smoke or release of contents to atmosphere
- Signs of smoke or fire from a container

and **CHECK** (✓) SAT or UNSAT on Attachment 1 for each RNS waste container. (ESS-14-002 SAC 02-A and 02-B) (IP IV.7)

[7] **IF** evidence of a chemical reaction such as smoke, fire, or release of internal contents to the atmosphere, compromised container lid or seam, substantial paint wrinkling, peeling or darkening, or other signs of a chemical/thermal reaction are discovered,
THEN PERFORM an <u>emergency response</u> in accordance with EWMO-BEP-20048.

[8] **IF** evidence of rusting, leaking, or other signs of deterioration which does not appear related to a chemical reaction of drum contents are discovered,
THEN PERFORM an <u>abnormal response</u> in accordance with EWMO-BEP-20048.

[9] **IF** the RNS waste container has been removed from the Perma-Con and the refrigerator,
THEN CHECK (✓) N/A on Attachment 1.

NOTE *85-gallon overpack drums and 55-gallon POC drums originally stored in 85-gallon overpack drums do not have PRDwSFs and are noted as N/A on Attachment 1.*

[10] **VISUALLY INSPECT** the pressure relief device rupture disc on the RNS waste containers for sign of damage, degradation, or rupture and **CHECK** (√) SAT or UNSAT, on Attachment 1 for the RNS waste container.

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

[11] **IF** rupture disc is damaged, degraded, or ruptured,
THEN PERFORM an abnormal response in accordance with EWMO-BEP-20048.

[12] **IF** the RNS waste container has been removed from the Perma-Con and the refrigerator,
THEN CHECK (✓) N/A on Attachment 1.

[13] **REPEAT** Steps 5.[6] through 5.[12] for the remaining Perma-Con cells and the refrigerator.

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

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

6. PERFORMANCE—TEMPERATURE READINGS

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

This section shall be performed daily between 1300 and 1700 per AREAG-ESS-14-002 Surveillance Requirement 4.ESS.5.1 and ABD-WFM-002, Attachment 1 frequency requirements. The following attachments, based on original waste container location, are used to document these temperature measurements.

- Attachment 2, TA-54-0375, Refrigerator and 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

Temperature measurements must be performed at least once daily per LANL Nitrate Salt-Bearing Waste Container Isolation Plan, Section IV.7. Temperature measurement frequency of one or more RNS waste containers may be increased at the discretion of WD-Waste Storage and Shipping management. Attachment 5, TA-54-0375 RNS Waste Container Supplemental Temperature Data Sheet, is use to document these supplemental temperature measurements

NOTE *Daily waste container temperature measurements are obtained by entering the Perma-Con and individually measuring and recording the RNS waste container temperatures.*

Waste Operators

[1] **ENSURE** that all Section 4 prerequisite actions have been completed.

[2] **RECORD** the date and start time on the applicable attachment for the applicable day of the week.

[3] **RECORD** the following infrared calibration information on the applicable attachment:

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

6. PERFORMANCE—TEMPERATURE READINGS (continued)

[4] **DETERMINE** the ambient air temperature in the following locations on the wall of the contamination control enclosure and the refrigerator in the designated location using a calibrated infrared thermometer and **RECORD** the ambient temperature (in °F) on the applicable attachment.

- Cell 1
- Cell 2
- Cell 3
- Refrigerator

[5] **($) VERIFY** the Perma-Con (Cells 1, 2, and 3) ambient air temperature is less than or equal to 75°F and **CHECK** (√) SAT or UNSAT on the applicable attachment. (ESS-14-002, SR 4.ESS.5.1)

[6] **IF** the Cell ambient temperature is greater than 75°F,
THEN NOTIFY the Operations Center of the temperature.

NOTE *Step 6.[7] combines the implementation of ABD-WFM-002, Att. 1, SAC 5.7.24 (refrigerator greater than 32°F and less than or equal to 41°F) and SR 4.6.2.1 (refrigerator less than or equal to 57°F).*

[7] **($) VERIFY** the refrigerator ambient air temperature is greater than 32°F and less than or equal to 41°F and **CHECK** (√) SAT or UNSAT on Attachment 2. [ABD-WFM-002, Att. 1, SAC 5.7.24 and SR 4.6.2.1]

[8] **IF** the refrigerator ambient air temperature is less than or equal to 32°F or greater than 41°F,
THEN NOTIFY the Operations Center of the temperature.

[9] **MARK** the location (i.e., Cell 1, 2, 3, or refrigerator) of the RNS waste container or "N/A," if the RNS waste container is removed from the Perma-Con and the refrigerator, on the applicable attachment.

[10] **(&) IF** the RNS waste container is <u>not</u> in a closed overpack,
THEN MEASURE the temperature (in °F) on the top approximate center of the RNS waste container using a calibrated infrared thermometer and **RECORD** the container number (Attachment 5 only) and the temperature on the applicable attachment. (IP IV.7)

6. PERFORMANCE—TEMPERATURE READINGS (continued)

[11] **(&) IF** the RNS waste container is in a closed overpack,
THEN MEASURE the temperature (in °F) on the top of the overpack lid at the approximate center of each RNS waste container using a calibrated infrared thermometer and **RECORD** the container number (Attachment 5 only) and the temperature on the applicable attachment. (IP IV.7)

[12] **IF** the RNS waste container is in Cells 1, 2, or 3 and the container temperature is greater than 10°F above the ambient air temperature of the Cell where it is located,
THEN PERFORM an <u>abnormal response</u> in accordance with EWMO-BEP-20048.

[13] **IF** the RNS waste container is located in the refrigerator and the container temperature is greater than the entry container temperature as provided on the container specific white board on the outside of the refrigerator or the applicable attachment of AREAG-WO-DOP-1371,
THEN PERFORM an <u>abnormal response</u> in accordance with EWMO-BEP-20048.

[14] **IF** a discrepancy with a container number pre-populated on the attachment is discovered,
THEN REQUEST applicable actions from TA-54 Operations Center or SOM.

[15] **REPEAT** Steps 6.[9] through 6.[14] until temperatures for all of the RNS waste containers in the Perma-Con, including the refrigerator, have been recorded.

[16] **RECORD** the end time and **INITIAL** on the applicable attachment.

[17] **RECORD** N/A for RNS waste container temperature readings that were <u>not</u> recorded and **DOCUMENT** an explanation in the Comments section of the applicable attachment.

[18] **PROVIDE** a description of any unsatisfactory conditions, notifications, and corrective actions in the Comments section of the applicable attachment.

[19] **PRINT** name, **SIGN**, and **RECORD** Z# and date the applicable attachment.

7. PERFORMANCE—TA-54 AREA G EAST ENTRANCE/ROAD INTO AREA G MONITORING

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

SOM

[1] **DETERMINE** if a significant precipitation event has occurred in the last 24 hours.

[2] **VISUALLY INSPECT** the TA-54 Area G East entrance/road for deterioration (e.g., washout).

[3] **IF** deterioration is observed or 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.

[C] **NOTIFY** Deployed Environmental Professional of the situation.

[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 stormwater tracking purposes.

8. PERFORMANCE—EVALUATION OF HEADSPACE GAS ANALYSIS OF RNS WASTE CONTAINERS

This section is a stand-alone section and may be performed independently of other Performance 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, Section IV.12.*

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 parts per million (ppm),
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.

8. PERFORMANCE—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 or a departure from expected trends indicating an adverse condition,
THEN NOTIFY the Operations Center or SOM to enter AREAG-RM-AOP-1299, 375 Perma-Con Nitrate Salt Waste Container Abnormal Conditions.

[5] **($) IF** a container's headspace gas concentration indicates any of the following conditions AND the container's headspace gas was sampled to support RNS waste container denesting, cold safing, overpack lid removal, and shipment preparation activities:

- A hydrogen concentration greater than or equal to 10,000 ppm
- A departure from expected trends

THEN ENSURE that the WD-Waste Storage and Shipping Group is notified.

[6] 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, Records Management.

9. PERFORMANCE—SUPPLEMENTAL TEMPERATURE MONITORING

This section is a stand-alone section and may be performed independently of other Performance sections.

Performance of this section is at the discretion of the WD-WPE or WD-WSS Group Leader for the purpose of collecting supplemental temperature data using the RNS Waste Container Temperature Monitoring System (TMS). This section cannot be used to credit SR 4.ESS.5.1 performance.

Performance of this section may be used to satisfy the Isolation Plan RNS waste container temperature monitoring requirements.

NOTE *Appendix A, Thermocouple Numbers and RNS Waste Container Crosswalk, provides a list of thermocouple numbers and their associated RNS waste container.*

Waste Operator

[1] **RECORD** the date and time on Attachment 6.

[2] **ACCESS** TMS at pn1503040.lanl.gov:8000/RNS.html.

[3] **PRINT** the RNS waste container TMS intranet page.

[4] **REVIEW** the graph on the TMS intranet page for the following and **CHECK** (√) SAT or UNSAT on Attachment 6:

- Date and time are correct.
- No indication of flat-lined temperature lines.
- No indication of temperature spikes.
- No temperature lines are “trending high” (e.g. individual temperatures that deviate high from other temperature readings).

NOTE *Thermocouple 13 is non-functioning and indicates “NaN”. Notification to WPE is not required.*

[5] **REVIEW** the data on the TMS intranet page (right hand side) for the following and **CHECK** (√) SAT or UNSAT on Attachment 6:

- No thermocouples indicating “NaN” (not a number) excluding Thermocouple 13.
- Data for TC1 through TC65 is visible in the Temperature column

9. PERFORMANCE—SUPPLEMENTAL TEMPERATURE MONITORING (continued)

[6] **REVIEW** the Alarms/Alerts section on the TMS intranet page (bottom left hand side) for the following and **CHECK** (√) SAT or UNSAT on Attachment 6:

- All alarms and alerts are green.

[7] **IF** any UNSAT conditions,
THEN NOTIFY the WD-WPE Representative and **DOCUMENT** observations/comments and guidance provided on Attachment 6.

[8] **ATTACH** the RNS waste container TMS intranet page printout to Attachment 6.

[9] **PRINT** name, **SIGN**, and **RECORD** Z#, and date on Attachment 6.

10. POST-PERFORMANCE ACTIVITY

10.1 Activity Closeout

NOTE *Steps 10.1[1] through 10.1[3] are performed at the completion of each work shift.*

SOM

[1] **REVIEW** the applicable attachments (Attachments 1 through 5) for accuracy and completeness.

[2] **PRINT** name, **SIGN**, and **RECORD** Z# and date on the applicable attachments.

[3] **IF** abnormal conditions were identified during the performance of this procedure, **THEN INITIATE** actions to correct the deficiency/discrepancy, such as generating a Nonconformance Report or Performance Feedback and Improvement Tracking System and **DOCUMENT** actions taken in the Comments Section of the applicable attachment.

NOTE *Steps 10.1[4] and 10.1[6] may be performed at an operationally convenient time.*

[4] **ENSURE** all attachments are forwarded for final disposition.

NOTE *Completing a Post-Job Review may be accomplished using the applicable P300, Integrated Work Management, 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]).*

[5] **PERFORM** a Post-Job Review in accordance with P300.

[6] **IF** the Post-Job Review identified any necessary changes to this procedure, **THEN INITIATE** a revision to this procedure.

10.2 Records Processing

Records generated while performing this procedure must be processed and maintained in accordance with EP-AP-10003, Records Management.

Record Name	QA Record	Non-QA Record
Attachment 1, TA-54-0375 Daily Rupture Disc and Visual Inspection of RNS Waste Containers Data Sheet	☒	☐
Attachment 2, TA-54-0375 Refrigerator and 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-54-0375 RNS Waste Container Supplemental Temperature Data Sheet	☒	☐
Attachment 6, TA-54-0375 RNS Waste Container TMS Data Sheet	☒	☐

Records associated with Isolation Plan Implementation are also part of the Operating Record and must be retained accordingly.

11. REFERENCES

ABD-WFM-002, Attachment 1, Technical Safety Requirements (TSRs) for RNS Waste Activities

AREAG-ESS-14-002, Transuranic (TRU) Waste Drums Containing Treated Nitrate Salts May Challenge the Safety Basis

AREAG-RM-AOP-1299, 375 Perma-Con Nitrate Salt Waste Container Abnormal Conditions

AREAG-FO-DOP-1249, TA-54 Area G Dome 375 Round Sheet

EP-AP-10003, Records Management

EWMO-AP-0112, EWMO Pre-Job Briefings

EWMO-AP-20253, EWMO General Site Hazards and Controls

EWMO-BEP-20048, EWMO Division Building Emergency Plan (BEP)

LANL Nitrate Salt-Bearing Waste Container Isolation Plan, LA-UR-16-26708

P300, Integrated Work Management

P322-4, Laboratory Performance Feedback and Improvement Process

P330-6, Nonconformance Reporting

APPENDIX A

Page 1 of 1

THERMOCOUPLE NUMBERS AND RNS WASTE CONTAINER CROSSWALK

Thermo-couple Number	Assigned RNS Waste Container ID/Ambient Cell Location	Thermo-couple Number	Assigned RNS Waste Container ID/Ambient Cell Location
1	69079	34	68648
2	69208	35	68430
3	92669	36	69615
4	69636	37	69639
5	69280	38	68624
6	68685	39	69644
7	69298	40	69633
8	69616	41	69635
9	69076	42	69637
10	68540	43	69638
11	68553	44	69183
12	69641	45	69630
13	NaN*	46	69642
14	69490	47	54-0375 Cell 2
15	69445	48	69036
16	69520	49	69595
17	69620	50	69519
18	69013	51	69361
19	69618	52	68665
20	54-0375 Cell 1	53	69645
21	69598	54	69559
22	69553	55	69604
23	68567	56	94068
24	69634	57	69491
25	68408	58	69548
26	92459	59	93605
27	92472	60	87825
28	69568	61	87823
29	94227	62	87826
30	68631	63	87827
31	68638	64	54-0375 Cell 3
32	69015	65	54-0375 Refrigerator
33	68507		

* NaN = Not a number. Thermocouple 13 is non-functioning.

ATTACHMENT 1
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TA-54-0375 DAILY RUPTURE DISC AND VISUAL INSPECTION OF RNS WASTE CONTAINERS DATA SHEET

5.[2] Date: ____________________ Time: ____________________

5.[1] Prerequisite actions have been completed (Initials): ____________

NOTE *Container 69417 is no longer considered a RNS waste container by LANL or NMED. Containers 87823, 87825, 87826, 87827 do not have PRDwSFs. Document N/A if the container is removed from Perma-Con and refrigerator.*

TA-54-0375			
Container ID #	Original Cell Location	**($)(&)** Visual Inspection of RNS Waste Containers (ESS-14-002, SAC 02-A/B) (IP IV.7) (5.[7]/5.[10])	Visual Inspection of PRDwSF Rupture Discs on RNS Waste Container (5.[11]/5.[13])
68408	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68430	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68507	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68540	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68553	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68567	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68624	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68631	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68638	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68648	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68665	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
68685	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69013	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69015	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69036	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69076	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69079	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69183	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A

ATTACHMENT 1
Page 2 of 3

5.[2] Date: ____________________

TA-54-0375			
Container ID #	Original Cell Location	**($)(&)** Visual Inspection of RNS Waste Containers (ESS-14-002, SAC 02-A/B) (IP IV.7) (5.[7]/5.[10])	Visual Inspection of PRDwSF Rupture Discs on RNS Waste Container (5.[11]/5.[13])
69208	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69280	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69298	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69361	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69417	1	N/A	N/A
69445	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69490	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69491	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69519	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69520	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69548	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69553	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69559	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69568	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69595	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69598	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69604	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69615	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69616	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69618	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69620	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69630	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69633	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69634	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69635	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69636	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A

ATTACHMENT 1
Page 3 of 3

5.[2] Date: ____________________

TA-54-0375			
Container ID #	Original Cell Location	**($)(&)** Visual Inspection of RNS Waste Containers (ESS-14-002, SAC 02-A/B) (IP IV.7) (5.[7]/5.[10])	Visual Inspection of PRDwSF Rupture Discs on RNS Waste Container (5.[11]/5.[13])
69637	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69638	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69639	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69641	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69642	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69644	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
69645	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
87823	3	☐ SAT ☐ UNSAT ☐ N/A	N/A
87825	3	☐ SAT ☐ UNSAT ☐ N/A	N/A
87826	3	☐ SAT ☐ UNSAT ☐ N/A	N/A
87827	3	☐ SAT ☐ UNSAT ☐ N/A	N/A
92459	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
92472	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
92669	1	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
93605	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
94068	3	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A
94227	2	☐ SAT ☐ UNSAT ☐ N/A	☐ SAT ☐ UNSAT ☐ N/A

Comments: ____

____

____

____

____

5.[15] Performed by: ____________________ / ____________________ / __________ / __________
Waste Operator (print) Signature Z # Date

10.1[2] Reviewed By: ____________________ / ____________________ / __________ / __________
SOM (print) Signature Z # Date

ATTACHMENT 2

Page 1 of 3

TA-54-0375 REFRIGERATOR AND CELL 1 RNS WASTE CONTAINER DAILY TEMPERATURE DATA SHEET

NOTE 1 *Drum 69417 is no longer considered a RNS drum by LANL or NMED.*

NOTE 2 ① = Cell 1; ② = Cell 2; ③ = Cell 3; ® = refrigerator; N/A – removed from Perma-Con and refrigerator

	Monday 6.[2] Date & Start Time: ______________	Tuesday 6.[2] Date & Start Time: ______________	Wednesday 6.[2] Date & Start Time: ______________	Thursday 6.[2] Date & Start Time: ______________	Friday 6.[2]Date & Start Time: ______________	Saturday 6.[2] Date & Start Time: ______________	Sunday 6.[2] Date & Start Time: ______________
TA-54-0375 Cell 1							
Calibrated infrared thermometer (6.[3])	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.[4])	Cell 1: ________°F	Cell 1: ________°F	Cell 1: ________°F	Cell 1: ________°F	Cell 1: ________°F	Cell 1: ________°F	Cell 1: ________°F
($) Temperature ≤ 75°F SR 4.ESS.5.1 (6.[5])	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT
Ambient Temperature (6.[7])	Refrig.: _______°F	Refrig.: _______°F	Refrig.: _______°F	Refrig.: _______°F	Refrig.: _______°F	Refrig.: _______°F	Refrig.: _______°F
($) Ambient Refrig. Temp.: > 32°F and ≤ 41°F; SR 4.6.2.1, SAC 5.7.24 (6.[7])	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT	☐ SAT ☐ UNSAT
Container ID #	**Location/(&) Temp (°F) (6.[9]/6.[10]/6.[11]) (IP IV.7)**						
68685	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A
68540	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A
68553	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A
69445	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A	① ② ③ ® N/A

ATTACHMENT 2

Page 2 of 3

	Monday 6.[2]		Tuesday 6.[2]		Wednesday 6.[2]		Thursday 6.[2]		Friday 6.[2]		Saturday 6.[2]		Sunday 6.[2]	
TA-54-0375 Cell 1 (continued)														
69618	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69013	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69490	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69076	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69280	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69208	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69079	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69636	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69616	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69417	N/A		N/A		N/A		N/A		N/A		N/A		N/A	
69620	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69520	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69641	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69298	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
92669	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
End Time (6.[16])	______________		______________		______________		______________		______________		______________		______________	
Initial (6.[16])	WO: _________ WO: _________		WO: _________ WO: _________		WO: _________ WO: _________		WO: _________ WO: _________		WO: _________ WO: _________		WO: _________ WO: _________		WO: _________ WO: _________	

ATTACHMENT 2
Page 3 of 3

Comments:

6.[19] Performed by:

Waste Operator (print)	Signature	Z#	Date
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Waste Operator (print)	Signature	Z#	Date
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10.1[2] Reviewed by:

SOM (print)	Signature	Z#	Date
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ATTACHMENT 3
Page 1 of 3

TA-54-0375 CELL 2 RNS WASTE CONTAINER DAILY TEMPERATURE DATA SHEET

NOTE ① = Cell 1; ② = Cell 2; ③ = Cell 3; ® = refrigerator; N/A – removed from Perma-Con and refrigerator

	Monday 6.[2] Date & Start Time: ______		Tuesday 6.[2] Date & Start Time: ______		Wednesday 6.[2] Date & Start Time: ______		Thursday 6.[2] Date & Start Time: ______		Friday 6.[2] Date & Start Time: ______		Saturday 6.[2] Date & Start Time: ______		Sunday 6.[2] Date & Start Time: ______	
TA-54-0375 Cell 2														
Calibrated infrared thermometer (6.[3])	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.[4])	Cell 2: ______°F		Cell 2: ______°F		Cell 2: ______°F		Cell 2: ______°F		Cell 2: ______°F		Cell 2: ______°F		Cell 2: ______°F	
($) Temperature ≤ 75°F SR 4.ESS.5.1 (6.[5])	☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT	
Container ID #	**Location/(&) Temp (°F) (6.[9]/6.[10]/6.[11]) (IP IV.7)**													
68408	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
68638	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69615	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69635	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69642	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69630	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69633	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
68430	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
68631	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69634	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	

ATTACHMENT 3

Page 2 of 3

	Monday 6.[2]		Tuesday 6.[2]		Wednesday 6.[2]		Thursday 6.[2]		Friday 6.[2]		Saturday 6.[2]		Sunday 6.[2]	
TA-54-0375 Cell 2 (continued)														
Container ID #	**Location/(&) Temp (°F) (6.[9]/6.[10]/6.[11]) (IP IV.7)**													
68567	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
94227	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
68648	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69644	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69183	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69638	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
68624	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
68507	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69568	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69553	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69598	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
92472	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
92459	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69015	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69639	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69637	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
End Time (6.[16])	______________		______________		______________		______________		______________		______________		______________	
Initial (6.[16])	WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________	

ATTACHMENT 3
Page 3 of 3

Comments:

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6.[19] Performed by:

Waste Operator (print)	Signature	Z#	Date
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10.1[2] Reviewed by:

SOM (print)	Signature	Z#	Date
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ATTACHMENT 4
Page 1 of 3

TA-54-0375 CELL 3 RNS WASTE CONTAINER DAILY TEMPERATURE DATA SHEET

NOTE ① = Cell 1; ② = Cell 2; ③ = Cell 3; ® = refrigerator; N/A – removed from Perma-Con and refrigerator

	Monday 6.[2] Date & Start Time: ______		Tuesday 6.[2] Date & Start Time: ______		Wednesday 6.[2] Date & Start Time: ______		Thursday 6.[2] Date & Start Time: ______		Friday 6.[2] Date & Start Time: ______		Saturday 6.[2] Date & Start Time: ______		Sunday 6.[2] Date & Start Time: ______	
TA-54-0375 Cell 3														
Calibrated infrared thermometer (6.[3])	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.[4])	Cell 3: ______°F		Cell 3: ______°F		Cell 3: ______°F		Cell 3: ______°F		Cell 3: ______°F		Cell 3: ______°F		Cell 3: ______°F	
($) Temperature ≤ 75°F SR 4.ESS.5.1 (6.[5])	☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT		☐ SAT ☐ UNSAT	
Container ID #	**Location/(&) Temp (°F) (6.[9]/6.[10]/6.[11]) (IP IV.7)**													
69519	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69645	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
94068	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
93605	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69548	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	

ATTACHMENT 4
Page 2 of 3

	Monday 6.[2]		Tuesday 6.[2]		Wednesday 6.[2]		Thursday 6.[2]		Friday 6.[2]		Saturday 6.[2]		Sunday 6.[2]	
TA-54-0375 Cell 3 (continued)														
Container ID #	**Location/(&) Temp (°F) (6.[9]/6.[10]/6.[11]) (IP IV.7)**													
69604	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
68665	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69595	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69036	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69361	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69559	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
69491	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
87827	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
87826	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
87823	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
87825	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
End Time (6.[16])	______________		______________		______________		______________		______________		______________		______________	
Initial (6.[16])	WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________		WO: _________ WO:__________	

ATTACHMENT 4

Page 3 of 3

Comments:

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ATTACHMENT 5

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TA-54-0375 RNS WASTE CONTAINER SUPPLEMENTAL TEMPERATURE DATA SHEET

	Date & Start Time: (6.[2])						
	Date _______ Time: ______	Date _______ Time: ______	Date _______ Time: ______	Date _______ Time: ______	Date _______ Time: ______	Date _______ Time: ______	Date _______ Time: ______
Calibrated infrared thermometer (6.[3])	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.[4])	Cell 1: ________°F Cell 2 ________°F Cell 3: ________°F Refrigerator: _______°F	Cell 1: ________°F Cell 2 ________°F Cell 3: ________°F Refrigerator: _______°F	Cell 1: ________°F Cell 2 ________°F Cell 3: ________°F Refrigerator: _______°F	Cell 1: ________°F Cell 2 ________°F Cell 3: ________°F Refrigerator: _______°F	Cell 1: ________°F Cell 2 ________°F Cell 3: ________°F Refrigerator: _______°F	Cell 1: ________°F Cell 2 ________°F Cell 3: ________°F Refrigerator: _______°F	Cell 1: ________°F Cell 2 ________°F Cell 3: ________°F Refrigerator: _______°F
($) Cell Temperature ≤ 75°F SR 4.ESS.5.1 (6.[5])	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA
($) Refrigerator Temperature > 32°F and ≤ 41°F; SR 4.6.2.1, SAC 5.7.24 (6.[7])	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA	□ SAT □ UNSAT □ NA

ATTACHMENT 5

Page 2 of 3

Container ID #	**Location/(&) Temp (°F) (6.[9]/6.[10]/6.[11]) (IP IV.7)**													
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
	① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A		① ② ③ ® N/A	
End Time (6.[16])														
Initials (6.[16])	WO: ________________ WO: ________________		WO: ________________ WO: ________________		WO: ________________ WO: ________________		WO: ________________ WO: ________________		WO: ________________ WO: ________________		WO: ________________ WO: ________________		WO: ________________ WO: ________________	

ATTACHMENT 5
Page 3 of 3

Comments:

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Waste Operator (print)	Signature	Z#	Date	Waste Operator (print)	Signature	Z#	Date
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10.1[2] Reviewed by:

SOM (print)	Signature	Z#	Date

ATTACHMENT 6

Page 1 of 1

TA-54-0375 RNS WASTE CONTAINER TMS DATA SHEET

9.[1] Date: ____________________ Time: ____________________

Graph (9.[4])	
Date and time are correct.	☐ SAT ☐ UNSAT
No indication of flat-lined temperature lines.	☐ SAT ☐ UNSAT
No indication of temperature spikes.	☐ SAT ☐ UNSAT
No temperature lines "trending high."	☐ SAT ☐ UNSAT
Data (9.[5])	
NOTE *Thermocouple 13 is non-functioning and indicates "NaN". Notification to WPE is not required.*	
No thermocouples indicating "NaN" (not a number) excluding Thermocouple 13.	☐ SAT ☐ UNSAT
Data for TC1 through TC65 is visible in the Temperature column	☐ SAT ☐ UNSAT
Alarms and Alerts (9.[6])	
All alarms and alerts are green.	☐ SAT ☐ UNSAT

9.[7] Observations/Comments: ____

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9.[7] Guidance Provided: ____

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9.[9] Performed by: ____________________ / ____________________ / __________ / __________

Waste Operator (print) Signature Z # Date

10.1[2] Reviewed By: ____________________ / ____________________ / __________ / __________

SOM (print) Signature Z # Date

Attachment 5

LA-UR-15-22661
Approved for public release; distribution is unlimited.

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)

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.

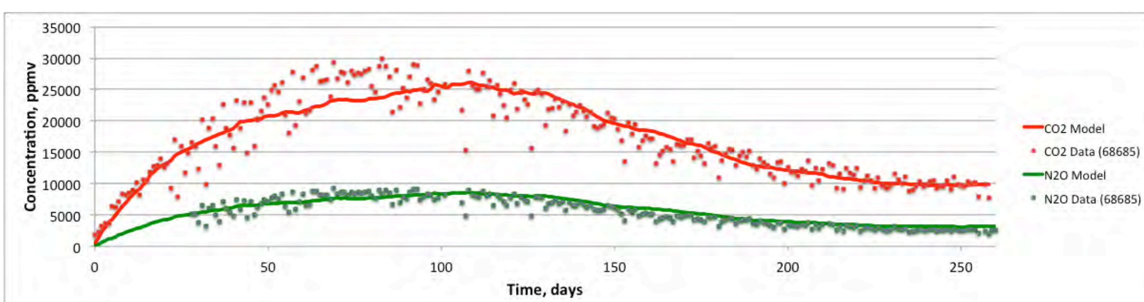

Figure ES-1 Simulation results compared to data for carbon dioxide and nitrous oxide concentrations for Drum 68685.

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.

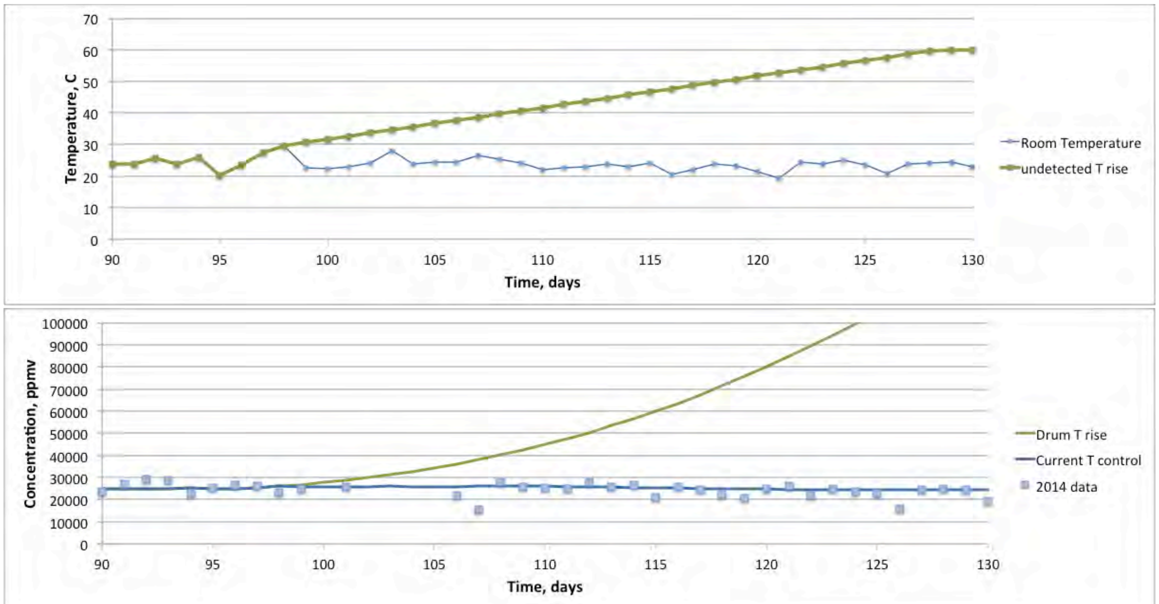

Figure ES-2 Simulation of hypothetical scenario in which the RNS waste drum experiences an undetected temperature rise due to low-level chemical or biological reaction. Top figure: Postulated RNS waste drum temperature profile. Self-heating begins at day 98, when it deviates from the temperature in the 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

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[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

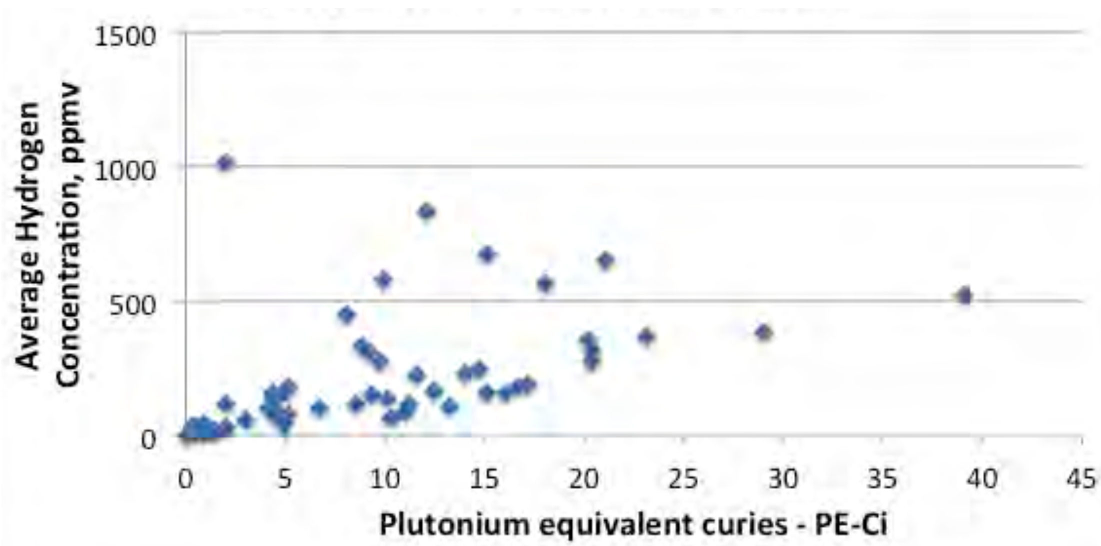
Figure 2-1 Diagram and physical dimensions of a Standard Waste Box (SWB)

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.

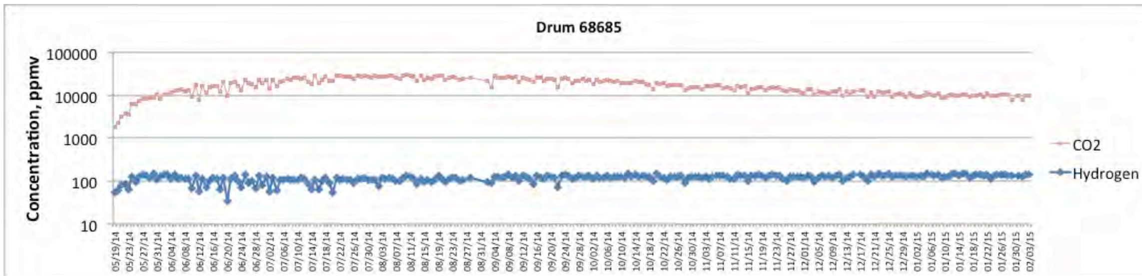


Figure 2-3 Trends of concentration for carbon dioxide and hydrogen gases in Drum 68685.

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.

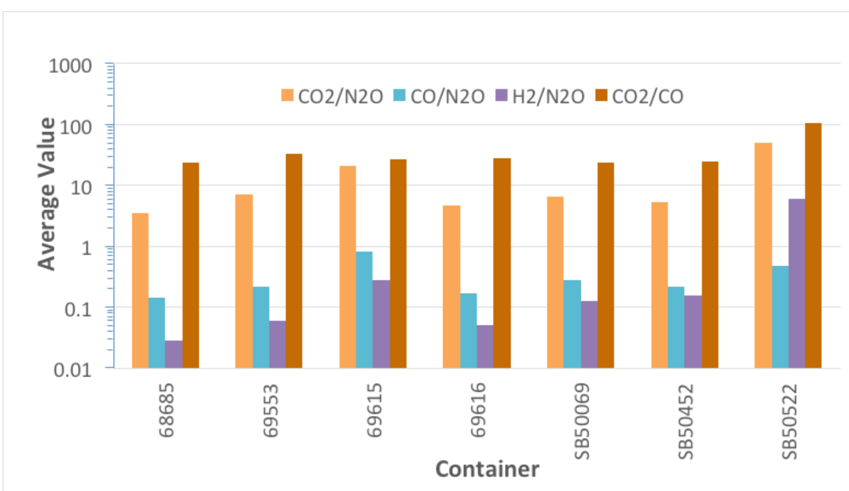


Figure 2-4 Average gas concentration ratios in the headspace of SWBs containing RNS waste. Reproduced from Leibman et al. (2015). These seven drums exhibit the highest concentrations of the 55 SWBs in storage.

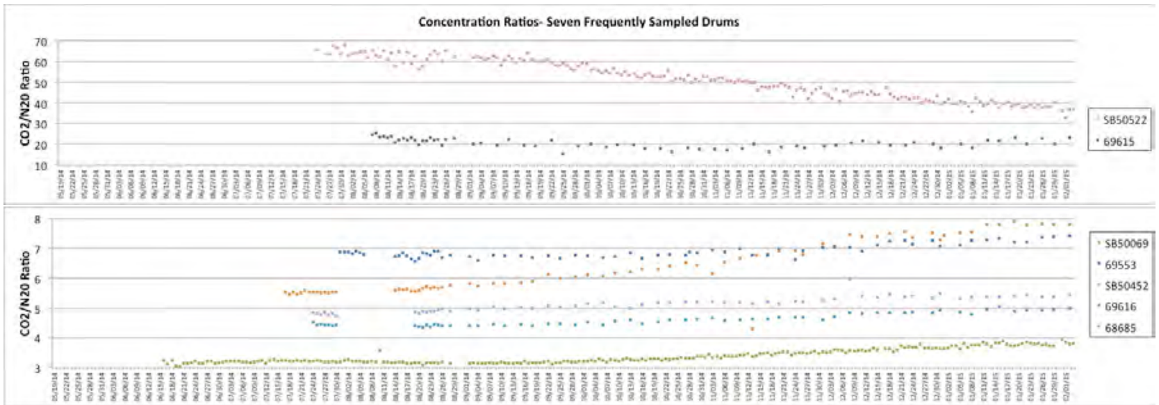


Figure 2-5 Time-varying ratio of carbon dioxide/nitrous oxide concentration for the most frequently monitored SWBs containing RNS waste. Top panel: two drums with the highest ratios; Bottom panel: five drums with the lower ratios.

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.

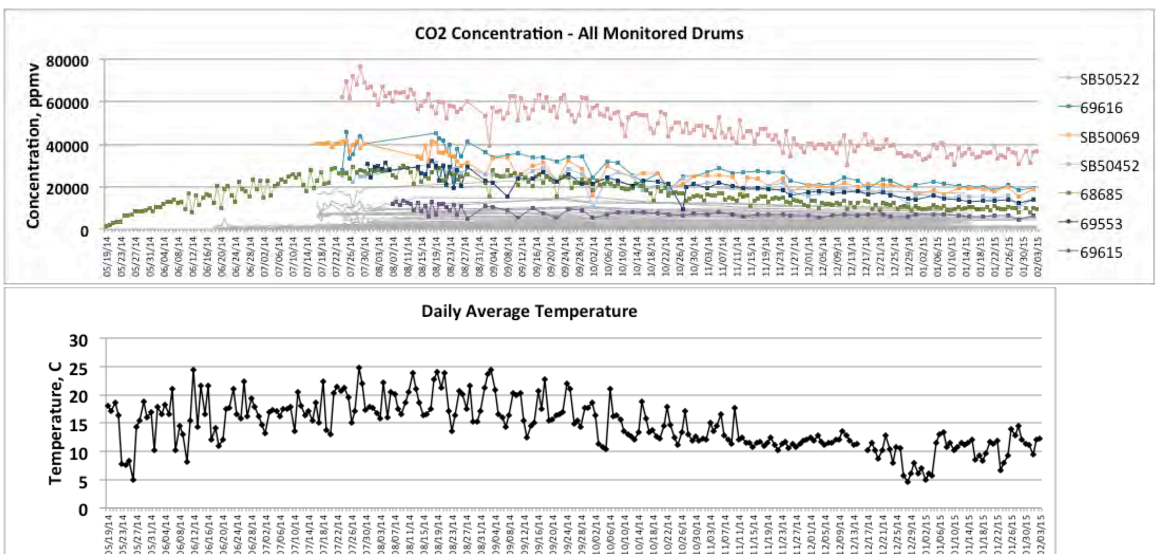


Figure 2-6 Carbon dioxide concentration-time and temperature-time histories of the seven most frequently sampled drums. Gray lines are curves plotted for the remaining 48 SWBs. Top panel: concentrations; Bottom panel: daily average temperatures for the cell containing Drum 68685.

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.

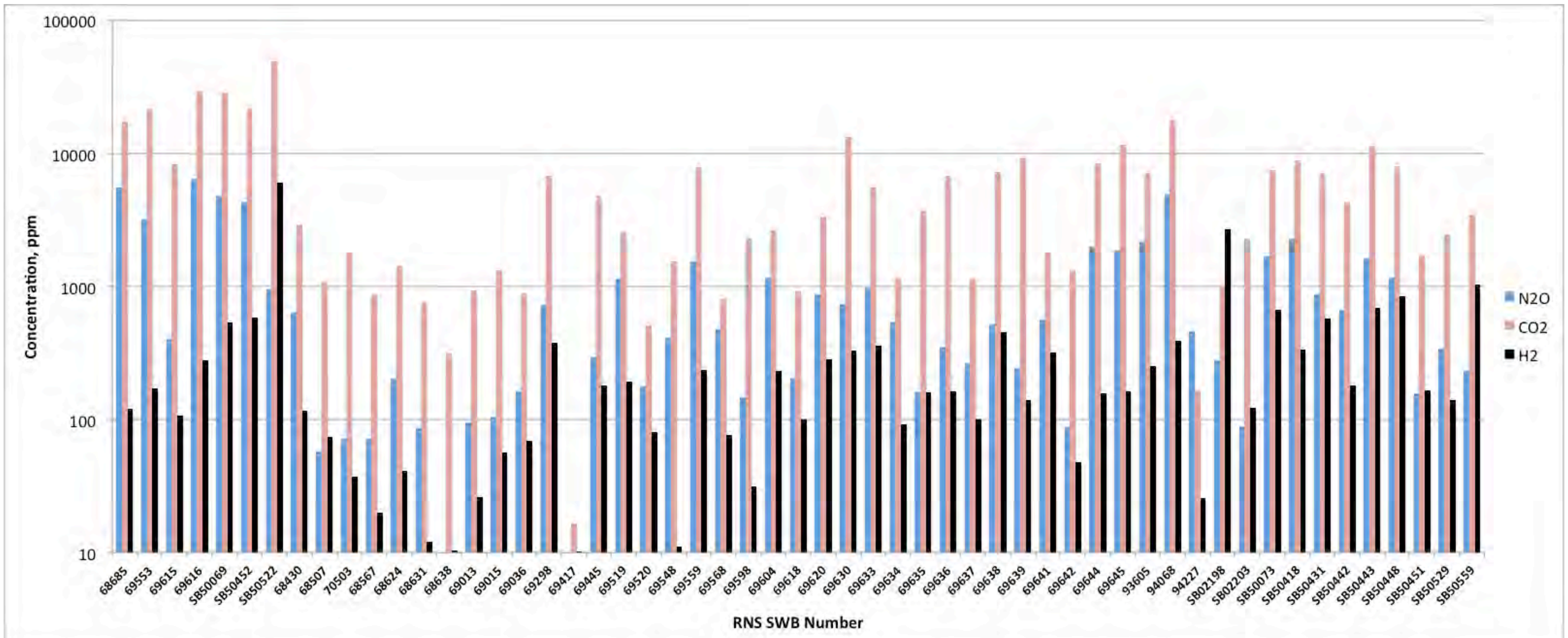


Figure 2-7 Average concentrations of gases in each of the 55 SWBs containing RNS waste

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			✔				

<table>
<tr><th colspan="3"></th><th colspan="6">Carbon Dioxide Concentration (ppmv)</th></tr>
<tr><th>RNS Drum ID</th><th>Parent Drum ID</th><th>SWB ID*</th><th><1000</th><th>1000-2000</th><th>2000-5000</th><th>5000-7500</th><th>7500-10000</th><th>>10000</th></tr>
<tr><td>69635</td><td>S851418</td><td></td><td></td><td></td><td>✔</td><td></td><td></td><td></td></tr>
<tr><td>69636</td><td>S843672</td><td></td><td></td><td></td><td></td><td>✔</td><td></td><td></td></tr>
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<tr><td>94227</td><td>S813475</td><td></td><td>✔</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Color Legend</td><td>Total</td><td>7</td><td>11</td><td>12</td><td>4</td><td>10</td><td>11</td></tr>
<tr><td>Frequently sampled drums</td><td>Two RNS drums in an SWB</td><td colspan="7"></td></tr>
<tr><td colspan="9">* If SWB ID is blank, the SWB is referred to by its RNS drum ID</td></tr>
</table>

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.

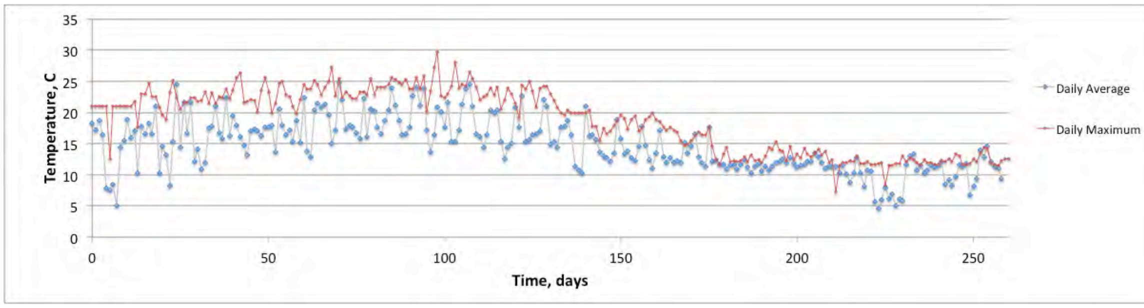

Figure 3-1 Measured temperatures within the cell containing the SWB of Drum 68685.

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

$$\chi(T) = A e^{-E_a/RT} \quad (2)$$

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.

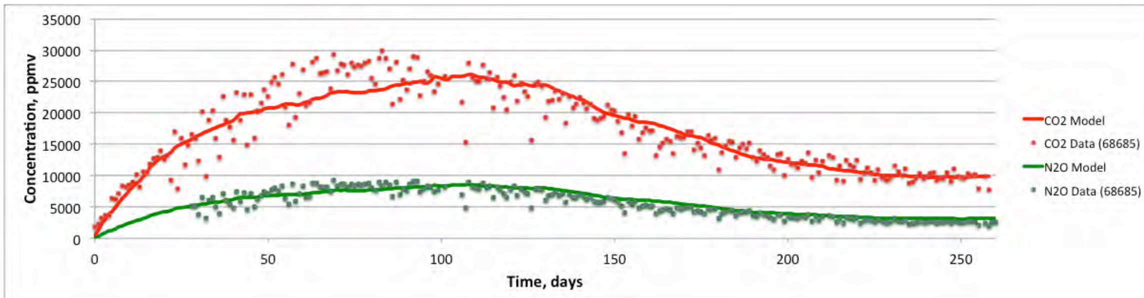

Figure 4-1 Simulation results for carbon dioxide and nitrous oxide concentrations for Drum 68685. Daily maximum temperature record and minimum SWB headspace volume used.

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.

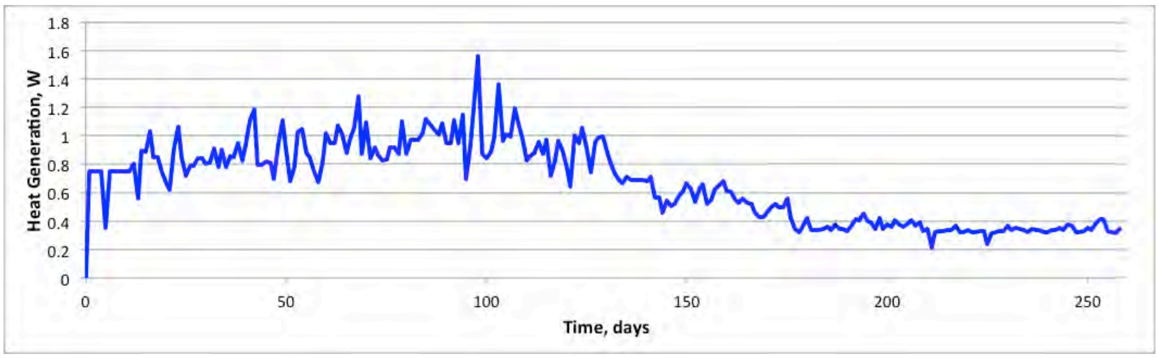

Figure 4-2 Simulation of heat generation assuming the postulated Swheat reaction for Drum 68685.

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.

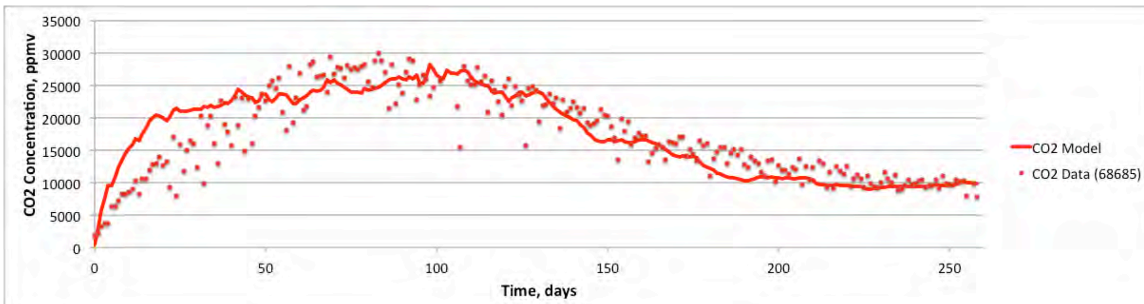

Figure 4-3 Simulation attempting to fit the carbon dioxide concentrations for Drum 68685 with higher reaction rates combined with higher ventilation rates.

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.

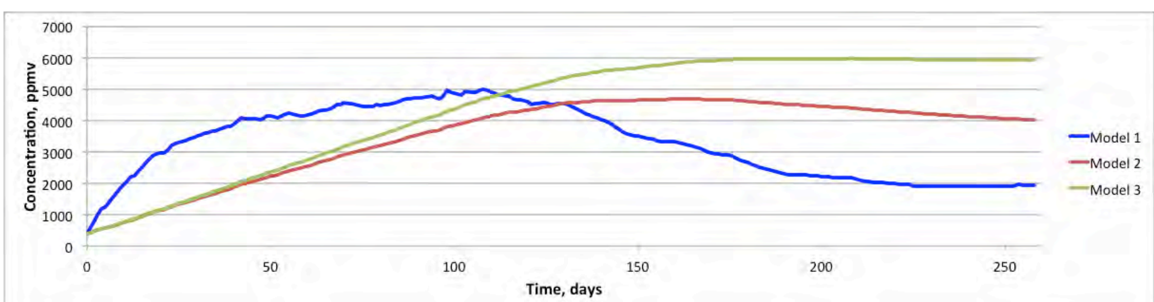

Figure 4-4 Example model results showing different characteristic carbon dioxide concentration behavior depending on the selection of kinetics and flow parameters.

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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^{o}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.*

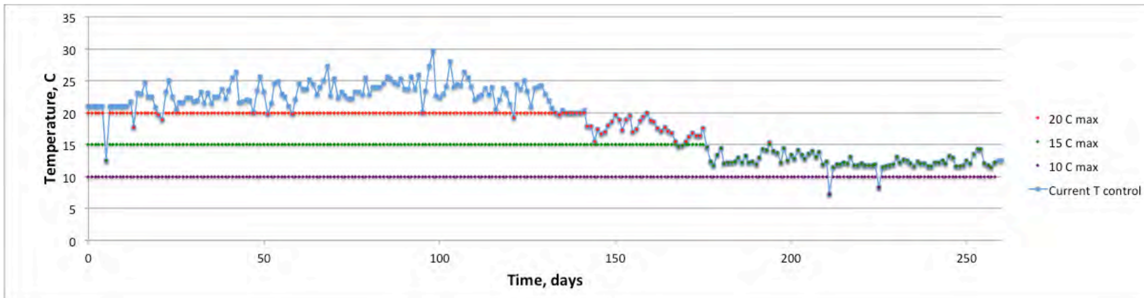

Figure 4-5 Temperature profiles used to examine the impact of different temperature control options on the headspace gas behavior.

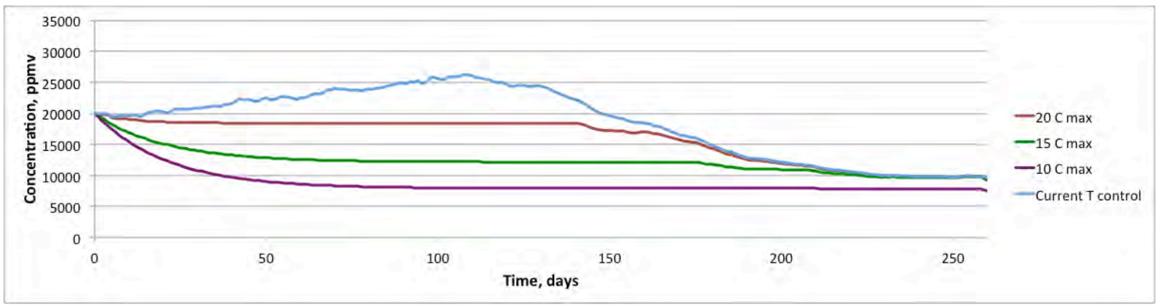

Figure 4-6 Projected carbon dioxide concentrations for the alternative cooling scenarios, compared to the option assuming the current temperature control is applied.

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 °C, the maximum daily temperature on that day in the previous record) without detection in the temperature measurements, ramping at a rate of 1 °C per day.[7] At this rate, the RNS drum contents would reach 60 °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 °C); a doubling of the CO_2 concentration is predicted after 13 days (RNS Drum temperature of 43 °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 °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.

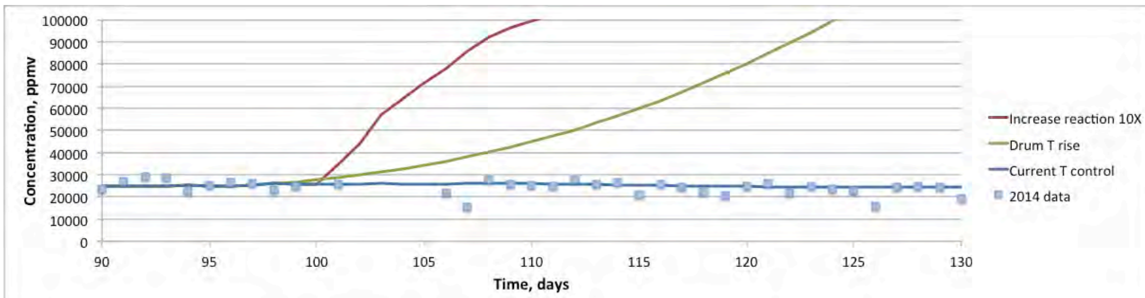

Figure 4-7 Simulated carbon dioxide concentrations for hypothetical scenarios in which reaction conditions change abruptly inside the RNS waste drum. Simulated scenarios track the baseline scenario until the postulated change, after which concentrations climb rapidly.

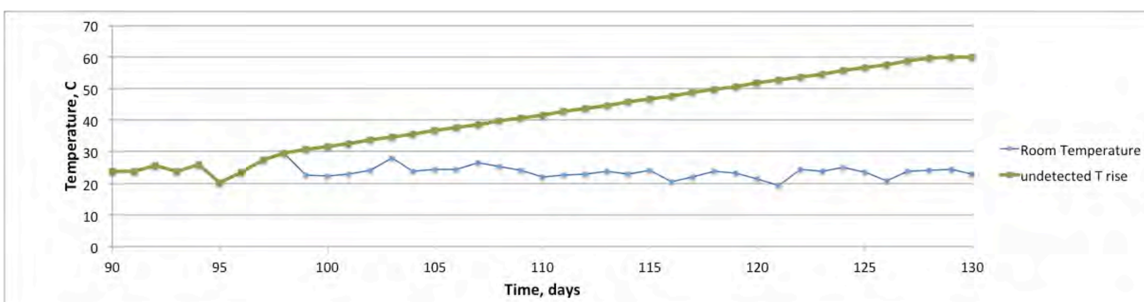

Figure 4-8 RNS waste drum temperature profile postulated for the scenario of undetected temperature rise due to low-level chemical or biological reaction. Self-heating begins at day 98, when it deviates from the temperature in the room.

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.

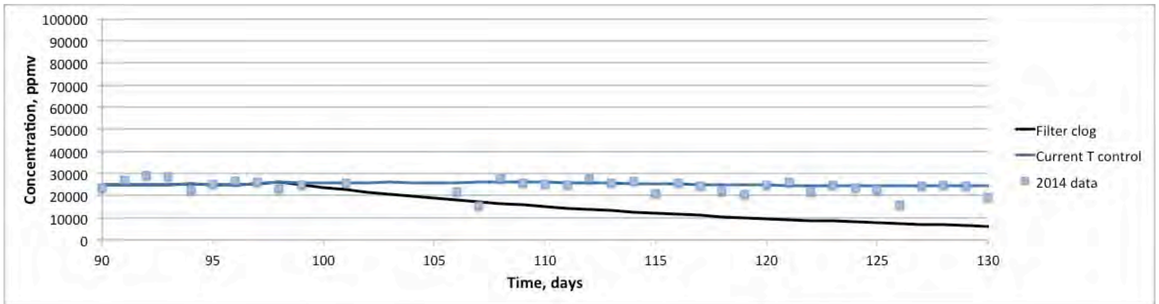

Figure 4-9 Simulated carbon dioxide concentrations for a hypothetical scenarios involving a clogging of the filter on the RNS waste drum.

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.

References

Clark, D. L. and D. J. Funk, 2015. Waste Isolation Pilot Plant (WIPP): Chemical Reactivity and Recommended Remediation Strategy for Los Alamos Remediated Nitrate Salt (RNS) Wastes. LANL Report LA-CP-15-20082.

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Savannah River National Laboratory (SRNL, 2015). Waste Isolation Pilot Plant Technical Assessment Team Report, SRNL-RP-2014-01198, Rev 0, March 17, 2015.

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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:

$$\tau \frac{dC}{dt} = -C + C_{in} + \frac{\chi}{Q} \qquad \text{(A1)}$$

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

$$C = C_{in} + \frac{\chi}{Q} + (C_0 - C_{in} - \frac{\chi}{Q})e^{-t/\tau} \qquad \text{(A2)}$$

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.

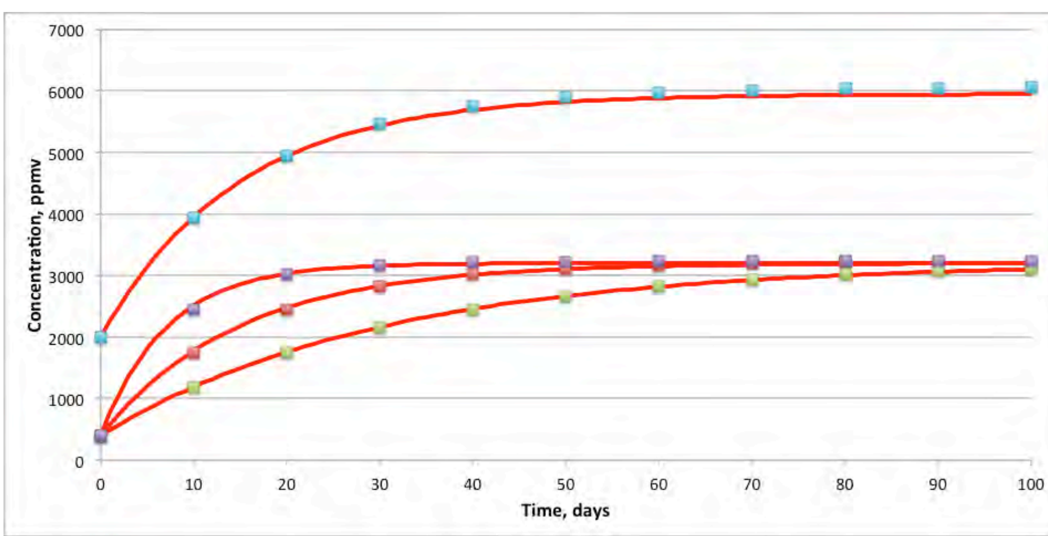

Figure A-1 Comparison of numerical model (curves) and analytical solution (points) for four different combinations of parameters.

Attachment 6

AREAG-WO-DOP-1340, R.2

TA-54 Area G
RNS SWB Lid Removal

Effective Date:	December 13, 2016
Next Review Date:	December 13, 2019

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.

WD-WPE Group Leader	CCP & Difficult Waste Team
EWMO Operations Manager	Radiation Protection
Operator SME	WD-SRS Operations
Quality Assurance	Engineering
IH&S	Safety Basis
Criticality Safety Analyst	Criticality Safety Officer
Environmental Compliance Programs	

Classification Review: ☒ Unclassified ☐ UCNI ☐ Classified

Name (print)	Z#	Signature	Date
Patrice Stevens	106047	/s/ Patrice Stevens	12/06/16

Responsible Manager, WD-WSS Group Leader

Name (print)	Z#	Signature	Date
Paul Newberry	112056	/s/ Paul Newberry	12/07/16

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 Number	Issue Date	Action	Description
AREAG-WO-DOP-1340, R.0	March 30, 2016	New Document	Initial release of procedure describing removal of the RNS SWB lids.
AREAG-WO-DOP-1340, R.1	April 8, 2016	Major Revision	Revise to clarify response and notification requirements if a compromised container is observed.
AREAG-WO-DOP-1340, R.2	December 13, 2016	Major Revision	Revised to include POC RNS waste containers and updates from later RNS procedures.

TABLE OF CONTENTS

1. PURPOSE

This procedure provides instructions for the lid removal from the standard waste boxes (SWBs) which contain remediated nitrate salt (RNS) waste containers prior to addition of a Pressure Relief Device with Supplemental Filtration. RNS waste containers include 55-gallon drums containing RNS waste and 55-gallon drums containing pipe overpack components (POCs) which contain RNS waste. Activities are performed within Technical Area (TA) 54 Area G, Dome 375 where the RNS waste containers are currently stored.

2. SCOPE

Activities described in this procedure include:

- Internal visual examination via inspection camera of the SWB containing the RNS waste container
- Purging of the SWB
- Removal of the SWB lid bolts
- Removal of the SWB lid

Activities described in this procedure are approved under Evaluation of the Safety of the Situation (ESS) AREAG-ESS-14-002, Potential Inadequacy of the Safety Analysis (PISA) – TRU Waste Drums Containing Treated Nitrate Salts May Challenge the Safety Analysis. This procedure does not include the POCs overpacked in 85-gallon drums.

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.

- Abnormal or unexpected conditions encountered during performance of this procedure are documented in the Attachments' Comment section. Guidance provided by TA-54 Operations Center, as well as follow-on actions, will also be documented therein.

- If a waste container is discovered with evidence of an imminent thermal runaway (i.e., signs of heating, pressurization, chemical reaction, smoke, or fire), Waste Operators will initiate emergency response actions in accordance with EWMO-BEP-20048, EWMO Division Building Emergency Plan. The Person-In-Charge (PIC) will notify the TA-54 Operations Center.

- Personnel shall be briefed to understand the requirements of the Radiological Work Permit (RWP).

- Flammable gases can accumulate over time in SWB headspaces due to waste constituents and chemical and radiological breakdown of RNS waste container contents venting into the SWB. The expected chemical constituents include hydrogen gas, but may also include volatile organic compounds (VOCs) such as methanol, acetone and benzene. Nitrous oxide (N_2O) is also expected from waste breakdown. These chemical hazards are controlled by:
  1) SWB vent which prevents gas build-up and SWB pressurization,
  2) headspace gas analysis prior to opening the SWB, and
  3) purging of SWB gases prior to removing lid.

3.1 General Task Hazards and Controls (continued)

- Toxic gases/vapors can accumulate over time in SWB headspaces. These gases/vapors include N_2O, carbon monoxide (CO), nitrogen dioxide (NO_2), nitric acid vapor, and VOCs. N_2O and CO may be present in the headspace of the SWB at levels above occupational exposure limits. VOCs are expected at lower levels. Control is provided by:
  1) purging of the SWB gases via local exhaust ventilation prior to removing lid,
  2) general enclosure ventilation, and
  3) use of air-purifying respirators (APRs) or powered air-purifying respirators (PAPRs) equipped with organic vapor, acid gas, high-efficiency particulate (OV/AG-HE) cartridges or equivalent approved by Industrial Hygiene and Safety (IH&S).

- Area air monitoring is performed using a direct reading instrument to detect hazardous conditions or to confirm the effectiveness of purging prior to removing the SWB lid. Measurements are taken for combustible gases (lower explosive limit [LEL]), oxygen, CO, and NO_2. These serve as indicators of the effectiveness of controls for all the gases of concern. These are reported to the IH&S Representative and PIC for evaluation. If measurements exceed determined levels, then Waste Operators will pause operations and notify the PIC and IH&S. Waste Operators may be asked to repeat measurement at IH&S direction.

3.2 Safety Basis

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

- If any abnormal condition or ESS acceptance criteria ($ steps) cannot be or are not met, 1) workers will stop work, 2) the PIC will notify the TA-54 Operations Center, and 3) a recovery plan will be developed.

- 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.

3.2 Safety Basis (continued)

- Safety basis requirements incorporated and controlled within this procedure include:
  - Surveillance Requirement (SR) 4.ESS.5, 54-0375 Perma-Con® temperature control
  - SAC 02-B, Visual inspection of RNS waste container inside an OVERPACK after the lid is removed
  - SAC 03, Visual inspection of the OVERPACK prior to filter vent, bolt, or lid removal
  - SAC 04, Visual inspection of RNS waste container prior to OVERPACK bolt removal
  - SAC 05, Headspace gas analysis
  - SAC 06, OVERPACK surface temperature monitoring

- A single SWB overpack visual inspection will be performed the day of SWB lid removal to meet the requirements of SAC 03.

- Movement of the SWBs or RNS waste containers is not conducted in this procedure. EP-AREAG-SO-1372, TA-54 Area Operating Requirements, controls the spacing and movement of SWBs and RNS waste containers. This includes ESS requirements associated with SAC 07, SAC 08, and SACs 12-1, 12-2, and 12-3.

3.3 RCRA and Environmental

- Procedure steps marked with the **(&)** symbol implement key requirements associated with the Resource Conservation and Recovery Act (RCRA), the Los Alamos National Laboratory (LANL) Nitrate Salt-Bearing Waste Container Isolation Plan, or other environmental regulatory requirements. These steps may <u>not</u> be changed without Environmental Compliance approval to ensure that applicable limits are maintained.

- RNS SWB lid removal does not constitute waste treatment under the LANL Hazardous Waste Facility Permit (HWP), but is covered by the LANL Nitrate Salt-Bearing Waste Container Isolation Plan.

- Storage and inspection requirements associated with the RNS SWB lid removal activities are in addition to the HWP requirements. Nothing in this procedure is intended to authorize or imply noncompliance with Permit requirements relating to general facility conditions, management of waste containers, secondary containment systems, container labeling, and other required inspection schedules or procedures.

3.3 RCRA and Environmental (continued)

- If an SWB container is “open,” then all waste containers nested inside must be properly labeled. A closed SWB must have at least four (4) bolts, evenly spaced around the lid, securing the lid.

3.4 Criticality Safety

- NCS-CSED-16-015, Criticality Safety Evaluation for Opening Overpacks Containing RNS-bearing Drums in Dome 375 at TA-54, allows for co-mingling of secondary waste from multiple parent containers.

4. PREREQUISITE ACTIONS

4.1 Planning and Coordination

Steps in this subsection may be completed in any order and/or concurrently.

NOTE *Steps 4.1[1] through 4.1[9] are completed each work shift.*

PIC

[1] **ENSURE** that this procedure is the latest revision in the Electronic Document Management System and **IDENTIFY** this document as Working Copy on the Title Page.

[2] **ENSURE** that the following trained or qualified personnel are available:

Control/Safety Personnel (activities in only one cell at a time)

- One (1) PIC; outside Perma-Con®
- One (1) IH&S Representative; outside Perma-Con®
- One (1) Radiological Control Technician (RCT); outside Perma-Con®
- Waste Management Coordinator (WMC); when needed

Per Active/Operating Cell

- Two (2) Waste Operators trained to the following tasks: drill press operations, borescope/inspection camera operations
- Four (4) Waste Operators are required for SWB lid removal
- One (1) RCT

[3] **ENSURE** that Dome 375 DEFINED AREA is in OPERATION MODE and that TA-54 Area G is in staffing condition 1.

[4] **VERIFY** that EWMO-AREAG-WO-DOP-1249, TA-54 Area G Dome 375 Round Sheet, is completed.

[5] **VERIFY** that the inspection sheet is completed for Area G Dome 375 in accordance with EP-AREAG-FO-DOP-1087, TA-54 Work Release Inspection Sheets.

4.1 Planning and Coordination (continued)

[6] **NOTIFY** the Nitrate Drum Observer PIC of lid removal schedule to provide coordination with RNS daily monitoring conducted under AREAG-WO-DOP-1246, TA-54 Area G Remediated Nitrate Salt Waste Container Monitoring.

[7] **ENSURE** that access control is established outside of Dome 375 in the vicinity of the ventilation exhaust to prevent personnel exposure to exhausted gases.

[8] **NOTIFY** the TA-54 Operations Center of the SWB lid removal schedule.

[9] **ENSURE** a pre-job briefing for personnel involved in the performance of this procedure is performed in accordance with EWMO-AP-0112, EWMO Pre-Job Briefings.

NOTE 1 *Steps 4.1[10] through 4.1[16] are completed for each SWB.*

NOTE 2 *Appendix A provides a list of each SWB container ID and the associated RNS and other waste container IDs contained in the SWB.*

[10] **RECORD** the SWB waste container ID, RNS waste container ID(s), other waste container ID(s), date, and time on Attachment 1, TA-54 Area G RNS SWB Lid Removal Data Sheet.

[11] **($) (&) VERIFY** that headspace gas analysis was completed within 36 hours of anticipated lid removal, **CHECK** (√) SAT or UNSAT, and **RECORD** the date and time samples was collected and the expiration date and time on Attachment 1. (ESS-14-002, SAC 05)

[12] **($) (&) ENSURE** that headspace gas analysis results have been evaluated by the WD-WPE Representative, in accordance with AREAG-WO-DOP-1246, and determined acceptable in accordance with SAC 05 to proceed, **CHECK** (√) SAT or UNSAT, and **ATTACH** to Attachment 1 the source of verification. (ESS-14-002, SAC 05)

[13] **($) VERIFY** that the Perma-Con ambient temperature has been less than or equal to 75ºF for the two days previous to initiating overpack lid removal, **CHECK** (√) SAT or UNSAT and **RECORD** date and time on Attachment 1, and **ATTACH** to Attachment 1 the applicable Attachment(s) from AREAG-WO-DOP-1246 as verification. (LCO 3.ESS.5)

[14] **ENSURE** that calibrations are current for the direct reading air monitoring instrument(s) used to measure combustible gases, oxygen, CO, and NO_2 and **RECORD** the calibration information on Attachment 1.

4.1 Planning and Coordination (continued)

[15] **INSPECT** adjustable lift table for operability.

[16] **ENSURE** the visual inspection camera (borescope) operability, the date/time stamp is current, and memory card, with sufficient memory, is installed.

4.2 Materials and Equipment

Steps in this subsection may be completed in any order and/or concurrently.

These lists are <u>not</u> all inclusive. Additional tools and equipment may be used as needed.

4.2.1 Tools and Equipment

Waste Operator

[1] **ENSURE** that the following tools and equipment are available:

- Charged battery operated impact drill
- 1-1/2 in. socket
- Breaker/leverage bar
- Plastic wedges
- Calibrated direct reading air monitoring instrument(s) capable of measuring combustible gases, oxygen, CO, and NO_2
- Charged cordless inspection camera (borescope)
- Extra inspection camera batteries
- Extra inspection camera wands
- Electromagnetic Base Drill Press
- M.A. Ford 92100002–1” x ½” HSS 3 Flute 82º Aircraft countersink bits
- Carbide End Mill ½”, 4 flute bits
- Smart Cut™ Metalworking Fluid (cutting fluid)
- Magnet wand
- Electrical cords (12 AWG with GFCI)
- Adjustable lift table
- Magnetized lift handles
- MAC-21 air mover and trunk hoses
- Purge adaptor
- Protective tape for SWB bolt shafts
- Calibrated infrared thermometer

4.2.2 Consumables

Waste Operator

[1] **ENSURE** that the following consumables are available:

- Kimwipes or equivalent
- Yellow vinyl tape
- 6-mil plastic bags for secondary waste
- Pre-configured hazardous and/or non-hazardous waste labels and barcode labels

4.2.3 Personal Protective Equipment

Waste Operator

[1] **ENSURE** that the following PPE are available:

- Level 1 PPE specified in RWP
- Nitrile gloves or equivalent
- Cut-resistant gloves (e.g., leather gloves or HexArmor®)
- Full-face APR or PAPR equipped with OV/AG-HE cartridges or equivalent approved by IH&S

4.3 Secondary Waste Container Preparation

Secondary waste generated during SWB lid removal is recorded on Attachment 2, TA-54 Area G Secondary Waste Container Inventory Sheet. Each Attachment 2 is associated with a single secondary waste container that may contain secondary waste from multiple SWB lid removal evolutions.

Perform this section when secondary waste containers are needed.

PIC

[1] **ENSURE** that waste stream profile(s) are prepared in the Waste Compliance and Tracking System (WCATS) for secondary waste planned to be generated during SWB lid removal activities.

[2] **CREATE** a container in WCATS with assigned waste stream profile and **PRINT** appropriate labels.

Waste Operator

[3] **PREPARE** and **LABEL** a secondary waste collection container in accordance with the WCATS profile.

[4] **RECORD** the secondary waste container information on Attachment 2.

[5] **ENSURE** a prepared secondary waste collection container has been moved into the Perma-Con cells of Dome 375 where operations will be performed.

5. INSTRUCTIONS – SWB LID REMOVAL

Due to operating restrictions within the Perma-Con, Waste Operators may convey inspection information to personnel outside the Perma-Con for recording on the attachment(s).

Radiological surveys may be performed during the following subsections at any time as deemed necessary by the RCT. Air monitoring and donning of fresh PPE may be performed at any time as deemed necessary by the PIC/IH&S Representative. RCT must ensure that additional PPE is compliant with the RWP.

5.1 SWB Visual Examination

Waste Operators will don cut-resistant gloves prior to performing operations.

PIC

[1] **ENSURE** that Section 4 has been completed and **INITIAL** Attachment 1.

[2] **($) (&) VERIFY** that the headspace gas analysis expiration date and time are not exceeded and **INITIAL/Z#** on Attachment 1. (ESS-14-002, SAC 05)

Waste Operators

[3] **VERIFY** the container ID on the SWB is the same as the SWB container ID on Attachment 1 and **INITIAL/Z#** on Attachment 1.

[4] **($) VERIFY** that the ambient temperature verification, performed in Step 4.1[13], was completed within 4 hours and **INITIAL/Z#** on Attachment 1. (LCO 3.ESS.5)

[5] **($) VERIFY** the Perma-Con ambient air temperature is less than or equal to 75ºF and **CHECK** (√) SAT or UNSAT and **RECORD** ambient temperature, date, and time on Attachment 1.

5.1 SWB Visual Examination (continued)

[6] **($) MEASURE** the SWB lid temperature and **RECORD** the SWB waste container lid temperature, date, and time on Attachment 1.

[A] **IF** the SWB waste container lid temperature is greater than 10ºF higher than the Perma-Con cell ambient temperature,
THEN INITIATE abnormal response actions in accordance with EWMO-BEP-20048.

[B] **INITIAL/Z#** on Attachment 1 to confirm that the SWB waste container lid temperature is less than or equal to 10ºF higher than the Perma-Con cell ambient temperature. (ESS-14-002, SAC 06)

[7] **($) (&) VISUALLY INSPECT** the SWB exterior for signs of degradation or indications of an abnormal condition including an internal reaction (e.g., chemical/thermal) and/or loss of container integrity, including: (ESS-14-002, SAC 03) (Isolation Plan)

- Evidence of heating such as signs of discoloration, paint peeling, or yellowing.
- Evidence of pressurization such as expansion of side walls, rounded bottom (e.g., SWB is not level) or rounded top.
- Chemical reaction such as smoke or release of internal contents to atmosphere.
- Signs of smoke or fire.
- Loss of container integrity such as evidence of leakage or lid compromised.

[A] **IF** evidence of imminent thermal runaway including signs of heating, pressurization, chemical reaction, smoke, or fire is observed,
THEN INITIATE emergency response actions in accordance with EWMO-BEP-20048.

[B] **IF** container integrity/degradation issues are observed,
THEN INITIATE abnormal response actions in accordance with EWMO-BEP-20048.

[C] **INITIAL/Z#** and **RECORD** observations in Visual Examination Comments section on Attachment 1.

5.1 SWB Visual Examination (continued)

NOTE 1 *The thermocouple/transmitter is placed above the known or suspected location of the RNS waste container.*

NOTE 2 *The SWB has four ¾ inch openings, two on each flat side, near the top of the SWB. These openings may contain filter vents or plugs.*

[8] **REMOVE** a ¾ in. filter vent or plug, preferably the one closest to the RNS waste container(s).

[9] **TURN ON** the inspection camera and handset and **PRESS** the record button to start recording.

[10] **VIDEO** the SWB container ID on the outside of the SWB.

[11] **($) (&) INSERT** the inspection camera wand into the ¾ in. opening and **VISUALLY INSPECT** the RNS waste container(s) for signs of degradation or indications of an abnormal condition including an internal reaction (e.g., chemical/thermal) and/or loss of container integrity, including: (ESS-14-002, SAC 04) (Isolation Plan)

- Evidence of heating such as signs of discoloration, paint peeling, or yellowing.
- Evidence of pressurization such as expansion of side walls, rounded bottom (e.g., drum is not level) or rounded top.
- Chemical reaction such as smoke or release of internal contents to atmosphere.
- Signs of smoke or fire.
- Loss of container integrity such as evidence of leakage or lid compromised.

[A] **IF** evidence of imminent thermal runaway including signs of heating, pressurization, chemical reaction, smoke, or fire is observed,
THEN INITIATE emergency response actions in accordance with EWMO-BEP-20048.

[B] **IF** container integrity/degradation issues are observed,
THEN INITIATE abnormal response actions in accordance with EWMO-BEP-20048.

[C] **INITIAL/Z#** and **RECORD** observations in Visual Examination Comments section on Attachment 1.

[12] **TURN OFF** the camera and handset and **REMOVE** inspection camera wand.

5.2 SWB Gas Purging and Lid Bolt Removal

NOTE *Step 5.2[1] is performed concurrent with other steps in Section 5.2.*

Waste Operators

[1] **(&) DISCARD** waste in secondary waste container as necessary, keeping container lid closed between additions, and **RECORD** information on Attachment 2.

[2] **SCREW** the purge adaptor into the ¾ in. opening.

[3] **REMOVE** an additional filter vent or plug, diagonally opposite if possible.

[4] **CONFIRM** the flow on the MAC-21 and **ATTACH** to the purge adaptor.

[5] **RECORD** purge start time on Attachment 1.

NOTE *Appendix B provides the thermocouple/transmitter ID number(s) corresponding to each SWB container.*

[6] **RECORD** the National Instruments thermocouple/transmitter ID number on Attachment 1.

[7] **REMOVE** the thermocouple/transmitter from SWB lid and **SET ASIDE** for reuse on the RNS waste container.

[8] **ATTEMPT** to **REMOVE** the SWB bolts with a hexkey.

[9] **ATTEMPT** to **REMOVE** remaining bolts by **PRYING** the lid upward, using a plastic wedge and rubber mallet, to create tension on the bolt.

5.2 SWB Gas Purging and Lid Bolt Removal (continued)

[10] **IF** all bolts have been removed,
THEN GO TO Step 5.2[26].

WARNING

1. **Only one drill press may be operated on each SWB at a time to prevent the drill press from toppling if SWB lid pops.**
2. **Lifting and carrying the drill press requires two operators because it weighs greater than 50 lbs. One operator may position the drill press by sliding it across the SWB lid.**
3. **Drill press is moved using handles or at the base to keep hands clear of controls and prevent unintentional activation.**
4. **The drill press is unplugged when moving between SWBs and when bits are changed to prevent unintentional activation.**
5. **During bit change, a second operator supports the drill press to prevent movement or toppling.**

[11] **ENSURE** the drill press in unplugged.

[12] **SET UP** and **ALIGN** the drill press over bolt.

[13] **TURN** the drill speed initially to 2.

[14] **INSERT** the countersink bit and **ALIGN** directly over the center of the bolt depression.

[15] **ADD** cutting fluid to bolt depression initially and as needed throughout drilling.

[16] **PLUG IN** the drill press.

NOTE *The drill press will not operate unless the magnet button is pushed and the red indicator light is on.*

[17] **PERFORM** drilling, **ADJUSTING** speed as necessary, not to exceed 3.

[18] **STOP** drilling when the tip of the countersink bit comes in contact with the bottom of the bolt depression.

5.2 SWB Gas Purging and Lid Bolt Removal (continued)

[19] **PUSH** the "Drill Off" button.

[20] **UNPLUG** the drill press.

[21] **REMOVE** the countersink bit and **INSERT** the carbide bit.

[22] **ALIGN** the carbide bit over the bolt depression as necessary.

[23] **PLUG IN** drill press and activate magnetic base.

[24] **PERFORM** drilling, **ADJUSTING** speed if necessary, not to exceed 3, until the top of the bolt breaks free.

[25] **REPEAT** Steps 5.2[11] through 5.2[24] for each remaining bolt in the SWB.

[26] **NOTIFY** the PIC of SWB bolt removal, **INITIAL/Z#** on Attachment 1 for the completion of SWB bolt removal, and **RECORD** any comments on Attachment 1.

[27] **ENSURE** that a minimum of 30 minutes has elapsed since purge started.

[28] **DISCONNECT** the purging system.

[29] **PERFORM** air monitoring at the ¾ in. opening to determine if monitored constituents are within the acceptable limit below:

- less than 10 % LEL
- greater than 19.5 % and less than 23% oxygen
- less than 25 ppm CO
- less than 3 ppm NO_2

[A] **IF** air monitoring readings are within the acceptable limits,

[a] **REPORT** air monitoring levels to the PIC.

[b] **RECORD** post-purge readings and purge completion time on Attachment 1.

[c] **CHECK** (√) SAT on Attachment 1.

5.2 SWB Gas Purging and Lid Bolt Removal (continued)

[B] **IF** any air monitoring reading is outside of acceptable limits noted above, **THEN:**

[a] **RECONNECT** purging system.

[b] **PURGE** SWB an additional 10 minutes or as directed by the PIC or IH&S Representative.

[c] **DISCONNECT** the purge system and **PERFORM** air monitoring as directed by the IH&S Representative.

[d] **IF** air monitoring readings are within acceptable limits,
THEN CHECK (√) SAT and **RECORD** post-purge readings and purge completion time on Attachment 1.

[e] **IF** any air monitoring reading is still outside the acceptable limits,
THEN CHECK (√) UNSAT and **RECORD** post purge completion time on Attachment 1, **NOTIFY** the PIC, and **DOCUMENT** in the Comments section of Attachment 1.

[30] **REPLACE** the filter vents and/or plugs.

5.3 SWB Lid Removal

Waste Operators

[1] **IF** gas purging was completed greater than 2 hours ago,
THEN:

[A] **REMOVE** two filter vents or plugs, diagonally opposite if possible.

[B] **PERFORM** Steps 5.2[29] and 5.2[30].

[2] **ATTACH** the magnetized lift handles to the SWB lid.

WARNING
Due to the weight of the SWB lid, four Waste Operators are needed and proper lifting techniques must be used when removing the SWB lid.

[3] With four (4) Waste Operators, one at each corner, **PARTIALLY LIFT** and **MOVE** the SWB lid to allow radiological surveys to be performed by the RCT.

[4] **POSITION** and **ADJUST** the height of the lift table.

[5] **REMOVE** magnetized lift handles from the SWB lid.

[6] With four (4) Waste Operators, one on each corner, **LIFT** the lid slightly, enough to clear the bolt shafts, and **MOVE** the lid onto the lift table.

[7] **MOVE** the lift table to allow unobstructed access to the SWB.

5.3 SWB Lid Removal (continued)

[8] **($) (&) VISUALLY INSPECT** the RNS waste container(s) for signs of degradation or indications of an abnormal condition including an internal reaction (e.g., chemical/thermal) and/or loss of container integrity, including: (ESS-14-002, SAC 02-B) (Isolation Plan)

- Evidence of heating such as signs of discoloration, paint peeling, or yellowing.
- Evidence of pressurization such as expansion of side walls, rounded bottom (e.g., drum is not level) or rounded top.
- Chemical reaction such as smoke or release of internal contents to atmosphere.
- Signs of smoke or fire.
- Loss of container integrity such as evidence of leakage or lid compromised.

[A] **IF** evidence of imminent thermal runaway including signs of heating, pressurization, chemical reaction, smoke, or fire is observed,
THEN INITIATE emergency response actions in accordance with EWMO-BEP-20048.

[B] **IF** container integrity/degradation issues are observed,
THEN INITIATE abnormal response actions in accordance with EWMO-BEP-20048.

[C] **INITIAL/Z#** and **RECORD** observations in Visual Examination Comments section on Attachment 1.

[9] **ENSURING** the pathway is clear**, TRANSFER** the SWB lid to the designating staging area.

[10] With four (4) Waste Operators, one at each corner, **PLACE** the SWB lid in the designated staging area.

NOTE *Appendix A provides a summary of the RNS waste container IDs associated with each SWB.*

[11] **CONFIRM** the correct RNS waste container(s) inside the SWB by comparing the RNS waste container ID number(s) against the SWB container ID shown in Appendix A

5.3 SWB Lid Removal (continued)

[12] **IF** RNS waste container cannot be confirmed,
THEN:

[A] **STOP,**

[B] **NOTIFY** the PIC, and

[C] **DOCUMENT** in the Comments section of Attachment 1.

[13] **PLACE** protective tape on the remaining SWB bolt shafts.

[14] **REPLACE** the National Instruments thermocouple/transmitter on the RNS containers **ENSURING** correct placement based on thermocouple/transmitter ID recorded in Step 5.2[6] of Attachment 1.

[15] **(&) APPLY** the appropriate pre-configured label to each waste container in the SWB. (Isolation Plan)

[16] **IF** a dunnage drum has a lid installed,
THEN ENSURE the drum lid is labeled or marked “dunnage.”

[17] **IF** removing the lid from an additional SWB,
THEN GO TO Step 4.1[10].

6. POST-PERFORMANCE ACTIVITIES

6.1 Activity Closeout

NOTE *Steps 6.1[1] through 6.1[9] are performed at the completion of each work shift.*

Waste Operators

[1] **DOCUMENT** completion of SWB lid removal by completing applicable attachments with name, signature, Z number, and date.

PIC

[2] **VERIFY** the access control established outside of Dome 375 in the vicinity of the ventilation exhaust has been de-posted.

[3] **REVIEW** the procedure and attachments for accuracy and completeness.

[4] **ENSURE** that the video footage (SD memory card) is properly labeled with the current date and **SUBMIT** for classification review, if applicable.

[5] **IF** any administrative discrepancies are identified,
THEN WORK with the originator to correct the documentation.

[6] **IF** abnormal conditions were identified during the performance of this procedure,
THEN INITIATE actions to correct the deficiency/discrepancy, such as generating a Nonconformance Report or Performance Feedback and Improvement Tracking System, and **DOCUMENT** actions taken in the Comments Section of the applicable attachment.

[7] **DOCUMENT** name, signature, Z number, and date on applicable attachments.

[8] **NOTIFY** the Area G Operators Center that SWB lid removal activities have been completed and Attachment 1 has been completed satisfactorily for the RNS waste container.

[9] **ENSURE** WCATS is updated to reflect applicable information.

NOTE *Steps 6.1[10] through 6.1[20] may be performed at an operationally convenient time.*

[10] **PERFORM** a Post-Job Review in accordance with P300.

6.1 Activity Closeout (continued)

[11] **IF** the Post-Job Review identified any necessary changes to this procedure,
THEN INITIATE a revision to this procedure.

Cognizant System Engineer

[12] **REVIEW** the procedure and Attachment 1 for accuracy and completeness.

[13] **DOCUMENT** name, signature, Z number, and date on Attachment 1.

WD-WSS Group Leader

[14] **REVIEW** the procedure and applicable attachments for accuracy and completeness.

[15] **IF** any discrepancies are identified,
THEN WORK with the originator to correct the documentation.

[16] **DOCUMENT** name, signature, Z number, and date on applicable attachments.

[17] **SUBMIT** Attachment 1 and the video footage (SD memory card) to the TA-54 Operations Center for review and records disposition.

[18] **SUBMIT** completed Attachment 2 to the Waste Management Coordinator.

Shift Operations Manager

[19] **REVIEW** the procedure and Attachments 1 for accuracy and completeness.

[20] **DOCUMENT** name, signature, Z number, and date on Attachment 1 and **SUBMIT** for record processing.

6.2 Records Processing

Records generated while performing this procedure must be processed and maintained in accordance with EP-AP-10003, Records Management.

Record Name	QA Record	Non-QA Record
Attachment 1, TA-54 Area G RNS SWB Lid Removal Data Sheet	☒	☐
Video Record of SWB Visual Inspections	☐	☒
Attachment 2, TA-54 Area G Secondary Waste Container Inventory Sheet	☒	☐

7. REFERENCES

AREAG-ESS-14-002, Evaluation of the Safety of the Situation (ESS), Potential Inadequacy of the Safety Analysis (PISA) – TRU Waste Drums Containing Treated Nitrate Salts May Challenge the Safety Analysis

AREAG-FO-DOP-1249, TA-54 Area G Dome 375 Round Sheet

AREAG-WO-DOP-1246, TA-54 Area G RNS Waste Container Monitoring

Drawing C-57018, TA-54-375 As Found Drawing, SWB Storage

EP-AP-10003, Records Management

EP-AREAG-FO-DOP-1087, TA-54 Work Release Inspection Sheets

EP-AREAG-SO-1372, TA-54 Area G Operating Requirements

EWMO-AP-0112, EWMO Pre-Job Briefings

EWMO-AP-20253, EWMO General Site Hazards and Controls

EWMO-BEP-20048, EWMO Division Building Emergency Plan.

LANL Nitrate Salt-Bearing Waste Container Isolation Plan

Los Alamos National Laboratory Hazardous Waste Facility Permit, November 2010, attachments, and all revisions

NCS-CSED-16-015, Criticality Safety Evaluation for Opening Overpacks Containing RNS-bearing Drums in Dome 375 at TA-54

P300, Integrated Work Management

P322-4, Laboratory Performance Feedback and Improvement Process

P330-6, Nonconformance Reporting

APPENDIX A

Page 1 of 1

SWB and Associated RNS and Other Waste Container ID Matrix

Cell 1

Overpacked	PKG_ID	Salt Type
70503	68540	Nitrate
	68553	Nitrate
	Dunage 1 & 2	
SB02203	67137	NA
	92669	Nitrate
	92699	Miscellaneous
	Dunage 1	-
SB50069	54249	NA
	69208	Nitrate
	69288	NA
	69432	**NA**
SB50073	69079	Nitrate
	69184	Cemented
	69297	NA
	69443	NA
SB50431	54068	NA
	57353	NA
	69280	Nitrate
	Dunage 1	-
SB50452	57357	NA
	69076	Nitrate
	Dunage 1 & 2	
SB50522	57653	NA
	68799	NA
	69271	NA
	69490	Nitrate
RNSOP69641	69641	Nitrate
	Dunage 1, 2, & 3	
RNSOP69636	69636	Nitrate
	Dunage 1, 2, & 3	
RNSOP69620	69620	Nitrate
	Dunage 1, 2, & 3	
RNSOP69618	69618	Nitrate
	Dunage 1, 2, & 3	
RNSOP69616	69616	Nitrate
	Dunage 1, 2, & 3	
RNSOP69445	69445	Nitrate
	Dunage 1, 2, & 3	
RNSOP69298	69298	Nitrate
	Dunage 1, 2, & 3	
RNSOP68685	68685	Nitrate
	Dunage 1, 2, & 3	
RNSOP69520	69520	Nitrate
	Dunage 1, 2, & 3	
RNSOP69013	69013	Nitrate
	Dunage 1, 2, & 3	

Cell 2

Overpacked	PKG_ID	Salt Type
SB02198	68408	Nitrate
	69017	NA
	93915	Cemented
	Dunage 1	-
SB50442	68648	Nitrate
	69518	NA
	69605	NA
	Dunage 1	-
SB50443	54016	NA
	69183	Nitrate
	Dunage 1 & 2	
SB50559	59374	NA
	92459	Nitrate
	92472	Nitrate
	92522	Miscellaneous
RNSOP94227	94227	Nitrate
	Dunage 1, 2, & 3	
RNSOP69644	69644	Nitrate
	Dunage 1, 2, & 3	
RNSOP69642	69642	Nitrate
	Dunage 1, 2, & 3	
RNSOP69639	69639	Nitrate
	Dunage 1, 2, & 3	
RNSOP69638	69638	Nitrate
	Dunage 1, 2, & 3	
RNSOP69637	69637	Nitrate
	Dunage 1, 2, & 3	
RNSOP69635	69635	Nitrate
	Dunage 1, 2, & 3	
RNSOP69634	69634	Nitrate
	Dunage 1, 2, & 3	
RNSOP69633	69633	Nitrate
	Dunage 1, 2, & 3	
RNSOP69630	69630	Nitrate
	Dunage 1, 2, & 3	
RNSOP69615	69615	Nitrate
	Dunage 1, 2, & 3	
RNSOP69568	69568	Nitrate
	Dunage 1, 2, & 3	
RNSOP69553	69553	Nitrate
	Dunage 1, 2, & 3	
RNSOP68638	68638	Nitrate
	Dunage 1, 2, & 3	
RNSOP68631	68631	Nitrate
	Dunage 1, 2, & 3	
RNSOP68624	68624	Nitrate
	Dunage 1, 2, & 3	
RNSOP68567	68567	Nitrate
	Dunage 1, 2, & 3	
RNSOP69598	69598	Nitrate
	Dunage 1, 2, & 3	
RNSOP69015	69015	Nitrate
	Dunage 1, 2, & 3	
RNSOP68507	68507	Nitrate
	Dunage 1, 2, & 3	
RNSOP68430	68430	Nitrate
	Dunage 1, 2, & 3	

Cell 3

Overpacked	PKG_ID	Salt Type
SB50418	69320	NA
	69595	Nitrate
	69596	Cementec
	Dunage 1	-
SB50448	54014	NA
	69491	Nitrate
	Dunage 1 & 2	
SB50451	68980	NA
	69361	Nitrate
	69425	NA
	Dunage 1	-
SB50529	68665	Nitrate
	68866	NA
	68929	NA
	69544	NA
RNSOP94068	94068	Nitrate
	Dunage 1, 2, & 3	
RNSOP93605	93605	Nitrate
	Dunage 1, 2, & 3	
RNSOP69645	69645	Nitrate
	Dunage 1, 2, & 3	
RNSOP69559	69559	Nitrate
	Dunage 1, 2, & 3	
RNSOP69548	69548	Nitrate
	Dunage 1, 2, & 3	
RNSOP69036	69036	Nitrate
	Dunage 1, 2, & 3	
RNSOP69519	69519	Nitrate
	Dunage 1, 2, & 3	
RNSOP69604	69604	Nitrate
	Dunage 1, 2, & 3	

APPENDIX B

Page 1 of 2

SWB, RNS Waste Container, and Thermocouple/Transmitter ID Matrix

Perma-Con® Cell No.	SWB Container ID No.	RNS Container ID(s)	Thermocouple No.	Thermocouple Serial No.	Transmitter Serial No.
1	LASB50073	69079	1	104049	169DA79
1	LASB50069	69208	2	104048	16995D5
1	LASB02203	92669	3	104047	169DA8A
1	RNSOP69636	69636	4	104056	169DAB3
1	LASB50431	69280	5	104054	17038D0
1	RNSOP68685	68685	6	104055	169DA7B
1	RNSOP69298	69298	7	104053	1699F6B
1	RNSOP69616	69616	8	104051	169DA61
1	LASB50452	69076	9	104015	16F3104
1	70503	68540, 68553	10, 11	104016, 104013	16F30F0, 169DA84
1	RNSOP69641	69641	12	104014	16995F5
1	LASB50522	69490	14	104017	169DAF0
1	RNSOP 69445	69445	15	104022	169964B
1	RNSOP 69520	69520	16	104021	169DAA3
1	RNSOP 69620	69620	17	104020	169DA75
1	RNSOP 69013	69013	18	104019	16F30C1
1	RNSOP 69618	69618	19	104024	1699651
2	RNSOP 69598	69598	21	104023	16F30FF
2	RNSOP 69553	69553	22	104025	16F30DB
2	RNSOP 68567	68567	23	104011	169DAF1
2	RNSOP 69634	69634	24	104052	169DA B2
2	LASB02198	68408	25	104026	1687C8D
2	LASB50559	92459, 92472	26, 27	104027, 104050	16F30C6, 16F3107
2	RNSOP 69568	69568	28	104033	1699615
2	RNSOP94227	94227	29	104012	16995FB
2	RNSOP68631	68631	30	104010	169DADE
2	RNSOP68638	68638	31	104032	16995DA
2	RNSOP69015	69015	32	104044	17038D2
2	RNSOP68507	68507	33	104045	16F30EC
2	LASB50442	68648	34	103995	16995CD
2	RNSOP68430	68430	35	103993	1699612
2	RNSOP69615	69615	36	103994	16F30DD

APPENDIX B
Page 2 of 2

SWB, RNS Waste Containers, and Thermocouple/Transmitter ID Matrix

Perma-Con® Cell No.	SWB Container ID No.	RNS Container ID(s)	Thermocouple No.	Thermocouple Serial No.	Transmitter Serial No.
2	RNSOP69639	69639	37	104041	169964F
2	RNSOP68624	68624	38	103996	16F310C
2	RNSOP69644	69644	39	103997	1A7A511
2	RNSOP69633	69633	40	104043	16F30E9
2	RNSOP69635	69635	41	104046	169DA6F
2	RNSOP69637	69637	42	104038	16F3111
2	RNSOP69638	69638	43	104002	16F30ED
2	LASB50443	69183	44	104039	169DA8C
2	RNSOP69630	69630	45	104008	16F310B
2	RNSOP69642	69642	46	104037	169DA60
3	RNSOP69036	69036	48	104001	1699F35
3	LASB50418	69595	49	104003	169966A
3	RNSOP69519	69519	50	104000	16F3114
3	LASB50451	69361	51	103999	169DA66
3	LASB50529	68665	52	103998	17038DD
3	RNSOP69645	69645	53	104006	16F30EA
3	RNSOP69559	69559	54	104007	17038D7
3	RNSOP69604	69604	55	104009	169DA76
3	RNSOP94068	94068	56	104005	16F30F9
3	LASB50448	69491	57	104004	169DA71
3	RNSOP69548	69548	58	104035	16F30F5
3	RNSOP93605	93605	59	104040	169965B

ATTACHMENT 1

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TA-54 Area G RNS SWB Lid Removal Data Sheet

Planning and Coordination	
4.1[10] SWB [containing RNS Waste Container(s)] Waste Container ID: _______________ RNS Waste Container ID(s): ____ Other Waste Container ID(s): ____ Date: ____________________ Time: ____________________	
4.1[11]	**($) (&)** Headspace gas sample collected within 36 hours of anticipated lid removal? (ESS-14-002, SAC 05) ☐ SAT ☐ UNSAT Date/Time Collected: ______________ Expiration Date/Time: ______________
4.1[12]	**($) (&)** Headspace gas sample acceptable per SAC 05? ☐ SAT ☐ UNSAT (ESS-14-002, SAC 05)
4.1[13]	**($)** Perma-Con ambient temperature is less than or equal to 75ºF for two days previous to initiating SWB lid removal? (LCO 3.ESS.5) ☐ SAT ☐ UNSAT Date/Time Verified: ________________________________
4.1[14]	Calibrated air monitoring instrument(s) information: Instrument Name: ______________ ______________ Instrument No.: ______________ ______________ Cal. Expiration Date: ______________ ______________
Visual Examination with Inspection Camera/Borescope	
5.1[1]	Section 4 actions complete: ______________ Initial ______________ Z#
5.1[2]	**($) (&)** Headspace gas analysis expiration date and time not exceeded. (ESS-14-002, SAC 05) __________/__________Initials/Z#
5.1[3]	SWB and Attachment 1 Container ID the same. __________/__________Initials/Z#
5.1[4]	**($)** Step 4.1[13] performed within 4 hours. (LCO 3.ESS.5) __________/__________Initials/Z#

ATTACHMENT 1
Page 2 of 4

TA-54 Area G RNS SWB Lid Removal Data Sheet

Visual Examination with Inspection Camera/Borescope (continued)	
5.1[5]	Perma-Con ambient temperature less than or equal to 75ºF? ☐ SAT ☐ UNSAT Perma-Con ambient temperature: ________ºF Date: _________ Time: _________
5.1[6]	**($)** SWB lid temperature is less than or equal to 10ºF higher than Perma-Con cell ambient temperature? (ESS-14-002, SAC 06) ____________/___________Initials/Z# SWB Lid Temperature: ____________ºF Date: ___________ Time: ___________
5.1[7]	**($) (&)** Visual Inspection of SWB Exterior (ESS-14-002, SAC 03) (Isolation Plan) ______________/__________Initials/Z# Visual Examination Comments: ______________________________________ ____ ____
5.1[11]	**($) (&)** Visual inspection of SWB Interior / RNS container(s) (ESS-14-002, SAC 04) ______________/__________Initials/Z# Visual Examination Comments: ______________________________________ ____ ____
SWB Gas Purging and Lid Bolt Removal	
5.2[5]	Purge Start Time: _________________
5.2[6]	National Instruments Thermocouple/Transmitter ID: ____________ ____________
5.2[26]	All SWB bolts removed. ____________/____________Initials/Z#
5.2[29]	Post-Purge Air Sample Concentrations LEL: _____________ % < 10 % LEL ☐ SAT ☐ UNSAT O_2: _______________ % > 19.5 % and < 23% O_2 ☐ SAT ☐ UNSAT CO: ______________ ppm < 25 ppm CO ☐ SAT ☐ UNSAT NO_2: ___________ ppm < 3 ppm NO_2 ☐ SAT ☐ UNSAT Purge Complete Time: ________________________

ATTACHMENT 1

Page 3 of 4

TA-54 Area G RNS SWB Lid Removal Data Sheet

SWB Lid Removal	
5.3[8]	**($) (&)** Post-Lid Removal - Visual inspection of RNS container(s) (ESS-14-002, SAC 02-B)(Isolation Plan) ________________/__________Initials/Z# Visual Examination Comments: ____ ____ ____

Comments: ____

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ATTACHMENT 1

Page 4 of 4

TA-54 Area G RNS SWB Lid Removal Data Sheet

6.1[1] Performed By: ______________ / ______________ / ______ / ______
Waste Operator (Print) Signature Z # Date

6.1[1] Performed By: ______________ / ______________ / ______ / ______
Waste Operator (Print) Signature Z # Date

6.1[1] Performed By: ______________ / ______________ / ______ / ______
Waste Operator (Print) Signature Z # Date

6.1[1] Performed By: ______________ / ______________ / ______ / ______
Waste Operator (Print) Signature Z # Date

6.1[7] Reviewed By: ______________ / ______________ / ______ / ______
PIC (Print) Signature Z # Date

6.1[13] Reviewed By: ______________ / ______________ / ______ / ______
Cognizant System Engineer (Print) Signature Z # Date

6.1[16] Reviewed By: ______________ / ______________ / ______ / ______
WD-WSS Group Leader (Print) Signature Z # Date

6.1[20] Reviewed By: ______________ / ______________ / ______ / ______
Shift Operations Manager (Print) Signature Z # Date

ATTACHMENT 2

Page 1 of 2

TA-54 Area G Secondary Waste Container Inventory Sheet

Secondary Waste Container Information (4.3[4])			
Start Date:	Container Purchase Order Number:		Secondary Waste Container ID:
WCATS Waste Stream Profile:			
Waste Inventory			
Date Collected	Parent Waste Container ID	Detailed Description of Secondary Waste	Z Number

ATTACHMENT 2
Page 2 of 2

Waste Inventory (continued)			
Date Collected	Parent Waste Container ID	Detailed Description of Secondary Waste	Z Number
Comments:			

6.1[1] Performed By: ____________________ / ____________________ / ______ / ______
Waste Operator (Print) Signature Z # Date

6.1[7] Reviewed By: ____________________ / ____________________ / ______ / ______
PIC (Print) Signature Z # Date

6.1[16] Reviewed By: ____________________ / ____________________ / ______ / ______
WD-WSS Group Leader (Print) Signature Z # Date

Attachment 7

TA-54-0375 and RNS Waste Container Abnormal Conditions

Effective Date: December 21, 2016

Next Review Date: December 21, 2017

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
Quality Assurance
Radiation Protection
Safety Basis
Shift Operations Managers
TA-54 Operations Center SME
Emergency Management
WD-WPE Group Leader
Conduction of Operations SME

Classification Review: ☒ Unclassified ☐ UCNI ☐ Classified

Name (print)	Z#	Signature	Date
Patrice A. Stevens	106047	/s/ Patrice A. Stevens	11/29/16

Responsible Manager, EWMO Operations Manager

Name (print)	Z#	Signature	Date
Gail Helm	114849	/s/ Gail Helm	11/29/16

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

1.0 EMERGENCY CONDITIONS

IF visual inspection of RNS waste container indicates,

- Evidence of pressurization such as expansion of side walls or rounded top/bottom
- Signs of smoke or fire from a container
- Evidence of heating such as signs of discoloration, paint peeling, or yellowing

OR

Environmental monitoring CAM (ECAM) alarm, external to TA-54-0375 Perma-Con, is received from Air Quality - Environmental Compliance organization (EPC-CP).

THEN:

[A] **CALL 911** to notify the Los Alamos Fire Department.

[B] **NOTIFY** the Emergency Operations Support Center (EOSC) at 667-6211 of a potential issue.

[C] **EXIT** this procedure and **GO TO** EWMO-RM-ERP-20200, EWMO Area Emergency Response.

2.0 ENTRY CONDITIONS

2.1 Abnormal RNS Waste Container Conditions

Section 3.0 implements response actions to an abnormal RNS waste container condition.

- RNS waste container exhibits the following conditions:
  - Loss of container integrity, such as evidence of leakage, compromised lid, rust, chipped paint, dents, and/or pressure relief device with supplemental filtration (PRDwSF) rupture.

- RNS temperature monitoring indicates:
  - Container temperature is greater than 10ºF above the corresponding location ambient temperature.
  - Container temperature is greater than 85ºF.

- Headspace gas analysis indicates:
  - Gas concentration for hydrogen greater than or equal to 30,000 parts per million (ppm).
  - Gas concentration for any gas indicates a departure from expected trends that represents an adverse condition.

2.2 Abnormal Facility Conditions

Section 4.0 implements response actions to an abnormal facility condition.

- A portable Canberra CAM alarm activates within the Perma-Con

- Notification of a true (confirmed) ECAM alarm within the Perma-Con is received from EPC-CP.

2.3 Off-Normal Facility Conditions

Section 5.0 implements response actions to an off-normal facility condition.

- TA-54-0375 Refrigerator Temperature
  - Refrigerator air temperature is greater than 57ºF but less than or equal to 75ºF.
  - Refrigerator air temperature is greater than 75ºF.

- Perma-Con Ambient Condition
  - Perma-Con ambient temperature is greater than 75°F but less than or equal to 85ºF for a period greater than 24 hours.
  - Perma-Con ambient temperature is greater than 85°F.

3.0 ABNORMAL RNS WASTE CONTAINER CONDITIONS RESPONSE ACTIONS

3.1 <u>Immediate Actions</u>

√ or NA	Time/Date	#	ACTIONS
Operations Center / Operations Center Operator			
NOTE *Steps 1 and 2 may be performed in any order and will usually happen in parallel. Initial notification to personnel per Step 1 should be made with the information initially available and should not be delayed to gain additional information.*			
		1	**NOTIFY** personnel of condition status (e.g., Public address, 2-way radio, E-Pagers, cell phones, and/or face to face).
		2	**ENSURE** personnel have: [A] **SUSPENDED** work. [B] **WARNED** others. [C] **ISOLATED** the immediate area. [D] **MOVED-AWAY** from the area of concern.
		3	**REQUEST** an on-scene personnel accountability report.
		4	**GUARD** or **POST** the perimeter of the affected area to control access.
		5	**IF** the RNS Temperature Monitoring System is available, **THEN CONTACT** the WD-WPE Group Leader and request an **INCREASE** in the frequency of temperature monitoring of the container.
		6	Based on location of the container, **CONTACT** Engineering and request maximization of cooling supplied by the HVAC/supplemental cooling systems or refrigeration unit while maintaining temperature greater than 32°F.
		7	**NOTIFY** the Shift Operation Manager.

3.2 Subsequent Actions

<table>
<tr><th>√ or NA</th><th>Time/Date</th><th>#</th><th>ACTIONS</th></tr>
<tr><td colspan="4">NOTE 1 This subsection is executed to gather additional information that may assist in planning emergency action or investigation/corrective action efforts.</td></tr>
<tr><td colspan="4">NOTE 2 Steps in this section may be performed out of sequence.</td></tr>
<tr><td colspan="4">NOTE 3 The Facility Lead position is defined in EWMO-BEP-20048.</td></tr>
<tr><td colspan="4">Shift Operations Manager (SOM) / Facility Lead</td></tr>
<tr><td></td><td></td><td>1</td><td>OBTAIN and DOCUMENT any additional information (specific questions are contained on Attachment 1) of the entry condition.</td></tr>
<tr><td colspan="4">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.</td></tr>
<tr><td></td><td></td><td>2</td><td>NOTIFY the Operations Manager of the event and REQUEST the Operations Manager to contact the following as needed:
• Facilities Operations Director (FOD),
• Associate Director of Nuclear and High Hazard Operations (ADNHHO), and
• Associate Directorate of Environmental Management (ADEM).</td></tr>
<tr><td></td><td></td><td>3</td><td>NOTIFY the following of the event and REQUEST assistance to evaluate the condition:
• Deployed Environmental Safety Health Services (DESHS) Manager
• EWMO Engineering Manager
• WD-WPE Group Leader
DOCUMENT the date/time of the notification and the name of the person contacted on Attachment 1.</td></tr>
</table>

3.2 Subsequent Actions (continued)

√ or NA	Time/Date	#	ACTIONS
		4	Based on the evaluation, **CONSIDER** the following: ▪ **IF** the Perma-Con can be entered, **THEN**: [A] **INCREASE** monitoring (visual, temperature, headspace gas). [B] **IF** the refrigerator is available and the container is denested but not in the refrigerator, **THEN MOVE** the container into the refrigerator. [C] **IF** the refrigerator is not available or the container is not denested, **THEN PLACE** a cooling jacket around the container, changing out gel packs as needed, to maximize cooling. ▪ Recommendations from DESHS Manager, EWMO Engineering Manager, WD-WPE Group Leader.
		5	**REVIEW** Attachment 1 to ensure information is complete, notifications have been made, **SIGN**, and **DATE**.

3.3 Post Performance Activities

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

4.0 ABNORMAL FACILITY CONDITIONS RESPONSE ACTIONS

4.1 Immediate Actions

√ or NA	Time/Date	#	ACTIONS
Operations Center / Operations Center Operator			
		1	**NOTIFY** personnel of condition status (e.g., Public address, 2-way radio, E-Pagers, cell phones, and/or face to face).
		2	**ENSURE** personnel have: [A] **SUSPENDED** work. [B] **WARNED** others. [C] **ISOLATED** the immediate area. [D] **MOVED-AWAY** from the area of concern.
		3	**REQUEST** an on-scene personnel accountability report.
		4	**GUARD** or **POST** the perimeter of the affected area to prevent access.
		5	**NOTIFY** the Shift Operations Manager.

4.2 Subsequent Actions

√ or NA	Time/Date	#	ACTIONS
NOTE 1 *This subsection is executed to gather additional information that may assist in planning emergency action or investigation/corrective action efforts.*			
NOTE 2 *Steps in this section may be performed out of sequence.*			
NOTE 3 *The Facility Lead position is defined in EWMO-BEP-20048.*			
Shift Operations Manager (SOM)/Facility Lead (FL)			
		1	**OBTAIN** and **DOCUMENT** any additional information (specific questions are contained on Attachment 1) of the entry condition.
		2A	**($) IF** Canberra CAM alarm is reported, **THEN:** [A] **CONTACT** Radiation Protection (RP) to determine whether alarm is a true (confirmed) CAM alarm. [B] **IF** RP determines it is not a true (confirmed) CAM alarm, **THEN DOCUMENT** the determination on Attachment 1, Narrative/Comments for a TA-54-375 Abnormal Event Response, and **EXIT** this procedure. [C] **IF** RP determines it is a true (confirmed) CAM alarm, **THEN NOTIFY** the EOSC at 667-6211. (AREAG-ESS-14-002, SAC 11).
		2B	**($) IF** an internal Perma-Con ECAM notification is received from RP-1, **THEN NOTIFY** the EOSC. (AREAG-ESS-14-002, SAC 11). **CONSIDER** the following: [A] **IF** the RNS Temperature Monitoring System is available, **THEN** increase the frequency of temperature monitoring of the container. [B] **INVESTIGATE** conditions in the Perma-Con by visual inspection from outside the Perma-Con.

4.2 Subsequent Actions (continued)

√	Time/Date	#	ACTIONS
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.*		
		3	**NOTIFY** the Operations Manager of the event and **REQUEST** the Operations Manager to contact the following, as needed: • FOD, • ADNHHO, and • ADEM.
		4	**NOTIFY** the following of the event and **REQUEST** assistance to evaluate the condition: • DESHS Manager • EWMO Engineering Manager • WD-WPE Group Leader **DOCUMENT** the date/time of the notification and the name of the person contacted on Attachment 1.
		5	**CONSIDER** recommendations from DESHS Manager, EWMO Engineering Manager, WD-WPE Group Leader.
		6	**REVIEW** Attachment 1 to ensure information is complete, notifications have been made, **SIGN**, and **DATE**.

4.3 Post Performance Activities

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

5.0 OFF-NORMAL FACILITY CONDITIONS RESPONSE ACTIONS

5.1 Immediate Actions

√ or NA	Time/Date	#	ACTIONS
Operations Center / Operations Center Operator			
		1	**IF** the RNS Temperature Monitoring System is available, **THEN INCREASE** the frequency of temperature monitoring of the container.
		2	Based on location of the container, **CONTACT** Engineering and request maximization of cooling supplied by the HVAC/supplemental cooling systems or refrigeration unit while maintaining temperature greater than 32°F.
		3	**NOTIFY** the Shift Operations Manager.

5.2 Subsequent Actions

√ or NA	Time/Date	#	ACTIONS
NOTE 1 *This subsection is executed to gather additional information that may assist in planning action or investigation/corrective action efforts.*			
NOTE 2 *Steps in this section may be performed out of sequence.*			
NOTE 3 *The Facility Lead position is defined in EWMO-BEP-20048.*			
Shift Operations Manager (SOM)/Facility Lead (FL)			
		1	**NOTIFY** personnel of condition status (e.g., Public address, 2-way radio, E-Pagers, cell phones, and/or face to face).
		2	**OBTAIN** and **DOCUMENT** any additional information (specific questions are contained on Attachment 1) of the entry condition.
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.*			
		3	**NOTIFY** the Operations Manager of the event and **REQUEST** the Operations Manager to contact the FOD and the following, as applicable: • ADNHHO and • ADEM.

5.2 Subsequent Actions (continued)

√ or NA	Time/Date	#	# ACTIONS
		4	**NOTIFY** the following of the event and **REQUEST** assistance to evaluate the condition, if applicable: • DESHS Manager • EWMO Engineering Manager • WD-WPE Group Leader **DOCUMENT** the date/time of the notification and the name of the person contacted on Attachment 1.
		5	**($) IF** Perma-Con Ambient Temperature Condition, **THEN:** [A] **EVALUATE** entry into LCO 3.ESS.5. [B] **IF** loss of power, **ENSURE** backup power is online if available**.**
		6	**($) IF** TA-54-0375 Dome Refrigerator Temperature Condition, **THEN:** [A] **EVALUATE** entry into LCO 3.6.2. [B] **IF** the temperature is greater than 75°F, **PLACE** the drum in the refrigerator in a SAFE CONFIGURATION considering the following safe configurations listed in order of preference: [A] **IF** Perma-Con is colder than refrigerator and refrigerator is less than 85°F, **MAINTAIN** the drum in refrigerator with door open. [B] **IF** Perma-Con is not colder than refrigerator and refrigerator is less than 85°F, **MAINTAIN** the drum in refrigerator with door closed. [C] **IF** the refrigerator is greater than 85°F, **MAINTAIN** the drum in refrigerator with door closed and **PLACE** a cooling jacket on the drum. [D] **IF** a single drum is greater than 85°F, **PLACE** a fire blanket over adjacent drums.

5.2 Subsequent Actions (continued)

√ or NA	Time/Date	#	# ACTIONS
		7	**CONSIDER** recommendations from DESHS Manager, EWMO Engineering Manager, WD-WPE Group Leader.
		8	**REVIEW** Attachment 1 to ensure information is complete, notifications have been made, **SIGN**, and **DATE**.

5.3 Post Performance Activities

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

ATTACHMENT 1
Page 1 of 3
Narrative/Comments for a TA-54-0375 Abnormal/Off-Normal Event Response

Notifier's Name/Organization:

Date/Time:

Location of Event:

Assembly Area/Muster Area:

Container ID: Cell ID:

Condition Status Notification: Date: Time:

Any injuries? NO ☐ YES ☐ If Yes, describe:

Any alarms? NO ☐ YES ☐ If Yes, describe:

Any area contamination? NO ☐ YES ☐ If Yes, describe:

ATTACHMENT 1

Page 2 of 3

Narrative/Comments for a TA-54-0375 Abnormal/Off-Normal Event Response

Any personnel contamination? NO ☐ YES ☐ If Yes, describe:

Describe operations occurring at time of event:

All personnel accounted for? NO ☐ YES ☐ If No, describe:

Notifications		
LAFD:	Date:	Time:
EOSC:	Date:	Time:
Shift Operations Manager:	Date:	Time:
Operations Manager:	Date:	Time:
DESHS Manager:	Date:	Time:
EWMO Engineering Manager:	Date:	Time:
WD-WPE Group Leader:	Date:	Time:
HPFC:	Date:	Time:
Industrial Hygienist:	Date:	Time:
FOD:	Date:	Time:
ADNHHO:	Date:	Time:
ADEM:	Date:	Time:
ECP-CP-RCRA Compliance:	Date:	Time:
DOE:	Date:	Time:

ATTACHMENT 1

Page 3 of 3

Narrative/Comments for a TA-54-375 Abnormal/Off-Normal Event Response

Additional Narrative/Comments

Completed By:

Printed Name /	Signature /	Z# /	Date/Time

Attachment 8

EWMO Division Building Emergency Plan (BEP)

Effective Date: April 10, 2017

Next Review Date: April 10, 2020

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.

EWMO Shift Operations Managers	Safety Basis
Engineering	Deployed Security Officer
Environmental Compliance Programs	Fire Protection
Industrial Hygiene & Safety	Operations Center Subject Matter Expert
Quality Assurance	Criticality Safety
Radiation Protection	Shift Operations Supervisors
Emergency Management	WD Operations

Classification Review: ☒ Unclassified ☐ UCNI ☐ Classified

Name (print)	Z#	Signature	Date
Patrice Stevens	106047	/s/ Patrice Stevens	04/06/2017

Responsible Manager, EWMO Facility Operations Director

Name (print)	Z#	Signature	Date
Leslie K. Sonnenberg	290408	/s/ Leslie K. Sonnenberg	04/07/2017

Working Copy / Information Only (circle one)

Initials / Date: _______/_______

REVISION HISTORY

A comprehensive log of changes made to this procedure, including superseded documents and complete revision descriptions, is accessible through the Electronic Document Management System (EDMS). The following log is abridged to one page and includes only the latest revisions.

Document/Rev No.	Issue Date	Action	Description
EP-DIV-BEP-20048, R.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.
EP-DIV-BEP-20048, R.2	September 22, 2015	Major Revision	Revised to meet PFITS actions 2015-421-3, 2015-421-6, 2015-424-1, and 2015-421-2. Also updated per P1201-4, LANL Emergency Procedures and Protective Actions. Removed all SWANS Radio references including Appendix 2.
EWMO-BEP-20048, R.0	August 29, 2016	Major Revision	Revised plan as part of WCRRF Resumption activities. Changed “Assembly/Muster Area” to “Assembly Area” throughout. Changed “off-normal” to “abnormal” throughout. Made minor editorial changes. The above global changes are not marked with revision bars. Added information on operator response cards in Section 3. Added 375 PermaCon Nitrate Salt Container Abnormal Response procedure to table in Section 5.3.2. Updated titles in response tables in Sections 5.3.1 and 5.3.2. Moved paragraph in Section 8 for consistency. Updated Sections 12 and 13. Updated Appendixes 1, 3, 7, and 9. Added new Appendixes 10–13. This procedure is a complete rewrite; no revisions bars were used. Replaced “EP-DIV” with “EWMO” in procedure number.
EWMO-BEP-20048, R.1	April 10, 2017	Major Revision	Revised Section 5.8 to include after-hours notification process. Revised Assembly Area Accountability Report from Appendix to Attachment. Updated figures in Appendices. Added applicable channels to Appendix J. Added EOP descriptions where applicable.

TABLE OF CONTENTS

1. PURPOSE

The Environmental and Waste Management Operations (EWMO) Building Emergency Plan (BEP) captures the Site Emergency Management and Response program requirements from Los Alamos National Laboratory (LANL) 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 Areas G, H, J, L and TA-54 Administrative Areas; and (3) TA-54 Radioassay and Nondestructive Testing (RANT) Building 54-38 complex.

The plan also addresses the requirements of the LANL Hazardous Waste Facility Permit. Areas covered by this plan include permitted units that are required to have a Contingency Plan in case of an emergency.

2. SCOPE

EWMO BEP requirements apply to all personnel, subcontractors, tenants, and visitors entering TA-54 Areas G, H, J, L, TA-54 Administrative Areas, RANT, and the WCRRF complex.

This plan does not apply to non-occupied locations at TA-21 and Nuclear Environmental Sites (NES). All work performed at TA-21 and NES will be approved by the Shift Operations Manager (SOM)/Operations Manager (OM) and be scheduled on the Environmental Remediation (ER) Plan of the Day. Accountability and communications will be performed in accordance with the ER Standing Order.

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 Areas, area-specific alarms, and response procedures) necessary to respond appropriately in the event of an abnormal or emergency situation. Management has the overall responsibility for personnel accountability during an abnormal/emergency event.

The EWMO 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.

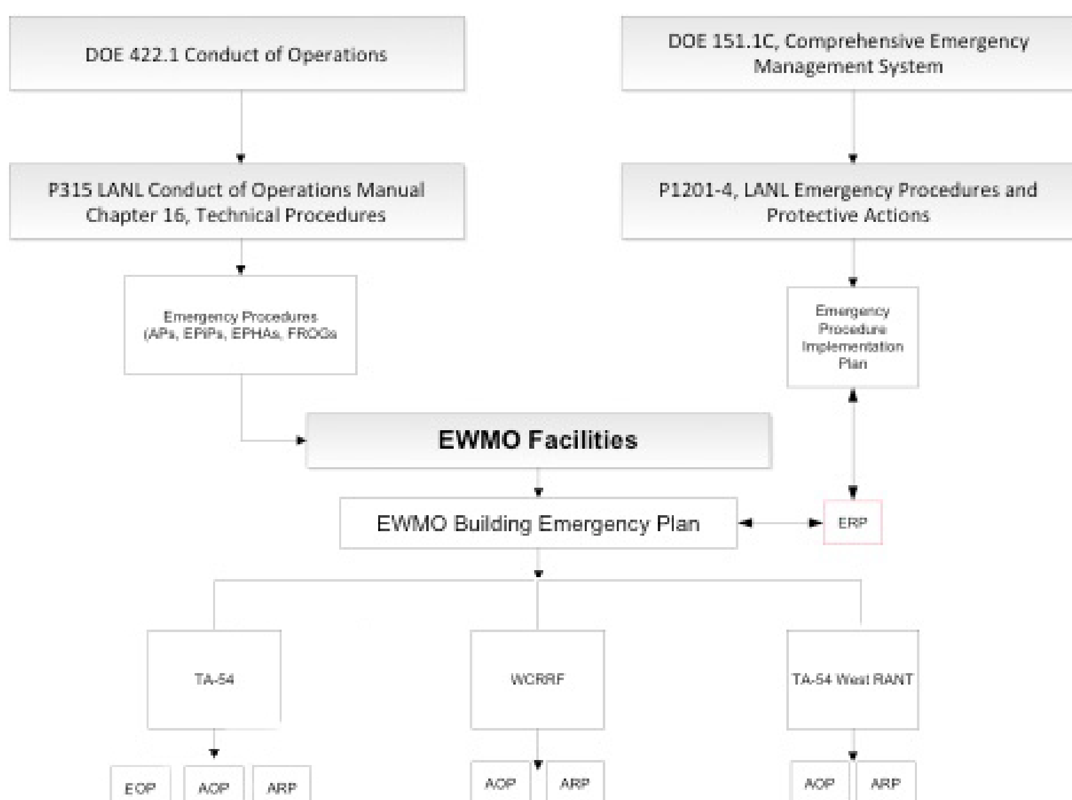
3. OVERVIEW

The EWMO 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, and RANT. 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 abnormal/emergency situations arise. Section 5, BEP Requirements, provides the requirements, roles, protective equipment, and standardized responses (i.e., Notification, Abnormal, and Emergency) for employees working in EWMO facilities. Sections 6 through 8 provide building/area-specific requirements for WCRRF, TA-54, and RANT.

The standardized responses (Notification, Abnormal, and Emergency) provided in Section 5 are also available in abbreviated format as an operator response card. Appendix I, Abnormal/Emergency Response Card, provides an example of the card that workers may carry with them when working in a EWMO facility.

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 (i.e., first person at the scene of an abnormal/emergency event) at the awareness level has the following responsibilities:

- Stops or suspends work
- Activates the appropriate alarm (i.e., fire alarm; evacuation alarm, where available), as necessary
- Warns others in the immediate area of the abnormal/emergency event
- Secures the incident area to prevent others from entering
- Notifies the Operations Centers, Emergency Operations and Support Center (EOSC) at 7-6211, and/or 911 as appropriate

4.2 Shift Operations Manager/Facility Lead

NOTE *In EWMO facilities, the 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 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 abnormal/emergency event and/or up until transfer to the Incident Commander (IC).

The SOM/FL has the following responsibilities:

- Coordinates with the Assembly Area Leader for personnel accountability, conditions, 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 (continued)

- Available on-call outside normal working hours including nights, weekends, and holidays when assigned
- Determines appropriate actions for mitigation and notifications during an abnormal event
- Ensures appropriate actions are completed to protect the safety of workers, facility, equipment, records, and the environment
- Authorizes elevation of an abnormal event to an emergency event as necessary
- Makes notifications in accordance with applicable 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, and then becomes a support function to the IC

4.3 Incident Commander

A trained and qualified emergency professional from emergency management, Centerra 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.

- 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 (SOS)

- Assists the SOM/FL to determine appropriate actions for mitigation and notifications during abnormal events
- Serves as a resource for the FL/IC and offsite responders during abnormal/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 abnormal/emergency activities at WCRRF, TA-54, and TA-54 West RANT.
- Notifies adjacent facilities of abnormal/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 Areas
- Assists in directing emergency response personnel and equipment to emergency site/areas
- Maintains a written log of abnormal and/or emergency events in the Operations Center log book
- Develops and maintains the Emergency Contact List at the respective Operations Center (Appendices B and D)
- Provides information from the Waste Compliance and Tracking System as needed.

4.6 Support Personnel (Environment, Safety, and Health)

- Receives notification from the Operations Center and/or SOM/FL when an abnormal/emergency event arises as necessary

- Acts as a subject matter expert in their field of expertise (e.g., Industrial Hygiene and Safety) during abnormal/emergency events

- Supports IC or SOM/FL in developing remedial and recovery plans

4.7 Assembly Area Leader

- Assumes command of Assembly Area

- Collects and gathers information from personnel who were at the incident site

- Acts as liaison between the applicable Operations Center and personnel

- Initiates the accountability of personnel

- Makes notification to the applicable 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 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

- Collects all information from Assembly Area (e.g., rosters, notes generated) and provides to the Operations Center and SOM

4.8 Facility Resident

- Notifies the applicable Operations Center of abnormal/emergency events
- Notifies the applicable Operations Center, EOSC 7-6211, and/or 911 for emergency events
- Responds to abnormal/emergency events in accordance with the requirements of this plan and the facility-specific abnormal/emergency response procedures
- Performs assigned duties from Assembly Area Leader
- Performs escort responsibilities if assigned

4.9 Visitor

- Responds to alarms and notifications in the event of an abnormal/emergency event
- Stays with their designated escort during abnormal/emergency events

5. BEP REQUIREMENTS

5.1 Site Events

The Laboratory has identified the 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 and are listed in Table 1, General Site Events and References.

NOTE *Unless otherwise recommended or directed by EWMO management, events listed in Table 1 are specific events with associated response actions provided in the referenced document.*

TABLE 1, GENERAL SITE EVENTS AND REFERENCES

Event	Reference
Bomb Threat	P1201-4, LANL Emergency Procedures and Protective Actions
Continuity of Operations (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	P1201-4
Lock Down/Hide Out	P1201-4

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 at EWMO facilities 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 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.

5.2.4 Emergency Operating Procedure (EOP)

Provide instructions for responding to events that result in operation outside the safety envelope.

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 through the applicable Operations Center.

The notification response action is as follows:

1. **NOTIFY** the Operations Center.
2. **WARN** others.
3. **WAIT** for directions 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 Perma-Con Low D/P Alarm • 375 Perma-Con Low Cell D/P Alarm • Inadequate Fire Department Manning • Severe Weather • Wildland Fire	• Loss of Electronic Badge Reader • Inadequate Fire Department Manning • Severe Weather	• Loss of Electronic Badge Reader • Inadequate Fire Department Manning • WCRRF Loss of Confinement Ventilation System (CVS) • WCRRF Waste Characterization Glovebox (WCG) Fire Suppression Inadvertent Initiation • WCRRF WCG High Pressure Alarms • WCRRF CVS Low Flow Alarms • WCRRF CVS Room 102 High Pressure Alarms • WCRRF CVS HEPA Filter Alarms • WCRRF CVS Glovebox Enclosure High Pressure Alarms • WCRRF TE/TI-001 and 002 Low Temperature Alarms • WCRRF CVS HVA-001 Low Flow Alarm • Severe Weather

5.3.2 Abnormal Response

An abnormal response is an action taken by the worker in a timely manner to ensure she/he backs away from the immediate area (i.e., 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 abnormal response steps are:

1. **SUSPEND** work.
2. **WARN** others.
3. **ISOLATE** the immediate area.
4. **MOVE AWAY** upwind from the area of concern.
5. **NOTIFY** the Operations Center.

5.3.2 Abnormal Response (continued)

For Nuclear Criticality Safety Non-Compliance, the following additional response steps **SHALL** be performed by the operator during an abnormal response in accordance with EWMO-RM-AOP-20124, EWMO Nuclear Criticality Safety Requirement Non-Compliance.

1. **DO NOT ATTEMPT** to recover the situation.
2. **CONTROL** access to the area.
3. **MAINTAIN** a minimum distance of at least 15 feet from the incident area.

Management (i.e., Operations Responsible Supervisor and/or Operations Responsible Manager) must work with the Nuclear Criticality Safety Division (NCSD) and other relevant personnel to assess the situation and take no actions until the situation is assessed in accordance with SD130, Nuclear Criticality Safety Program.

Once the worker has performed the abnormal 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 through the applicable Operations Center.

The following list provides events that have been categorized as requiring an abnormal 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 • Nuclear Criticality Safety Non-Compliance • Dome 375 Perma-Con and Remediated Nitrate Salt Waste Container Abnormal Conditions	• Discovery of an Airborne, Liquid or Solid Material Release or Spill • Unplanned Loss of Electrical Power • Waste Container Questionable Integrity • Nuclear Criticality Safety 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 • Nuclear Criticality Safety Non-Compliance

5.3.3 Emergency Response

An emergency response are 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 through 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 Assembly Area upwind from the incident.
5. **NOTIFY** 911 and the Operations Center.

TA-54 Area G	RANT	WCRRF
• EWMO Area Emergency Response – Visual observation of fire or smoke – Audible fire alarm – Utility outage or leaks – Chemical reactions such as smoke, fire, or release of a container's internal contents to the atmosphere	• EWMO Area Emergency Response – Visual observation of fire or smoke – Audible fire alarm – Utility outage or leaks – Chemical reactions such as smoke, fire, or release of a container's internal contents to the atmosphere	• EWMO Area Emergency Response – Visual observation of fire or smoke – Audible fire alarm – Utility outage or leaks – Chemical reactions such as smoke, fire, or release of a container's internal contents to the atmosphere

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, communication systems) to members of the Operations Center. The SOM's primary duty during an abnormal/emergency event is to act as the FL 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 Operations Center Operator 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 Assembly Areas

Assembly 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 Areas can be Shelter in Place (SIP) locations, identified in buildings or outside, identified by a large yellow metal box and an orange and white striped wind sock on a pole. Assembly Area maps for WCRRF, TA-54, and RANT are illustrated in the appendices of this procedure. Assembling to a secondary location after initial evacuation, if necessary, is directed by the Operations Center/SOM/FL and/or the IC.

NOTE *Assembly Area equipment and supplies are inspected weekly in accordance with EWMO-DOP-20215, EWMO RCRA Inspections and Notifications.*

Assembly Areas contain at a minimum the following equipment and supplies for use during abnormal/emergency events:

- A clipboard with Assembly Area Accountability Report (see Attachment 1) and two-way radio instructions (Appendix J)
- A copy of this Building Emergency Plan
- Assembly Area lead vest (blue)
- Assembly Area Leader Checklist (instructions for the Assembly Area Leader are shown in Appendix K)
- First aid kit
- Two-way radio
- Wind sock (i.e., orange and white stripes)
- Orange vest (for personnel performing traffic control)

The first person to arrive at the Assembly Area during an emergency who is knowledgeable and willing to perform the duties assigned, acts as the Assembly Area Leader. A checklist is available at each Assembly Area that provides actions to be performed by the Assembly Area Leader. Any rosters, checklists, or other documents completed by the Assembly Area Leader should be turned over to the SOM/FL for records processing after the emergency has ended.

5.6 Accountability

Each worker has the primary responsibility to report to the Assembly Area Leader for accountability.

In EWMO organizations, there are three methods for obtaining personnel accountability during an abnormal/emergency event:

- Badge reader
- Sweep process
- Assembly Area Accountability Reports at Assembly Areas (see Attachment 1)

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 Areas 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 Area Leader. Once employees assemble at the Assembly 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) Instructions

Employees follow protective actions provided in P1201-4 in additions to the following response at TA-54 Area G:
Personnel in vehicles should roll up windows and close vents that draw in outside air (including heater and air-conditioning vents, if applicable), remain at the location, and notify the Operations Center. Do not leave the location until cleared by IC. Additional instructions for SIP are provided in Appendix L.

The Operations Center will document a call back number for personnel in the buildings and vehicles where SIP is conducted.

5.7.2 Stay Put

Employees follow Stay Put guidance in P1201-4 in addition to the following responses if lightning is sighted:

- Follow the 30/30 rule
- Seek shelter if lightning is within 6 miles (flash to bang count is 30 seconds)
- 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 (e.g., trees), take cover in a vehicle or building
- Shelter for at least 30 minutes after the last lightning strike within 6 miles
- Notify the Operations Center of actions and location

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 abnormal/emergency event.

The FL (e.g., SOM, OM) directs the initial command and control during an abnormal/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 abnormal/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. The TA-54 and WCRRF Operations Centers act as a liaison between EWMO management, Facility Lead, IC, Security Emergency and Operations – Emergency Management, and the workers. The TA-54 and WCRRF Operations Centers are staffed during normal operations.

5.8 Chain of Command Process (continued)

The notification process for after-hours is performed through the EWMO on-call list and EOSC 7-6211. EWMO maintains a list of after-hours on-call personnel. On-call personnel include a duty officer (SOM), maintenance coordinator, health and safety professionals, and radiological control technicians (RCTs). EWMO maintains an on-call list of radiation protection supervisors and RCTs who have facility knowledge and access. Requests for after-hours RCT support is managed through the duty officer who coordinates with the RCT supervisor. There are typically 2 or 3 RCTs on call in addition to a supervisor. If the facility RCT resources are not sufficient, additional RCTs may be requested through a central pool managed by radiation protection; however, facility familiarity may be limited.

Additionally, the Emergency Operations Center maintains 24/7 coverage through the EOSC as well as on-call Emergency Managers and other support staff. The County maintains emergency response capability (fire/police department, etc.) which responds 24/7. The protective force also maintains 24/7 coverage and are available to support after-hours emergency response.

FIGURE 2, CHAIN OF COMMAND MODEL

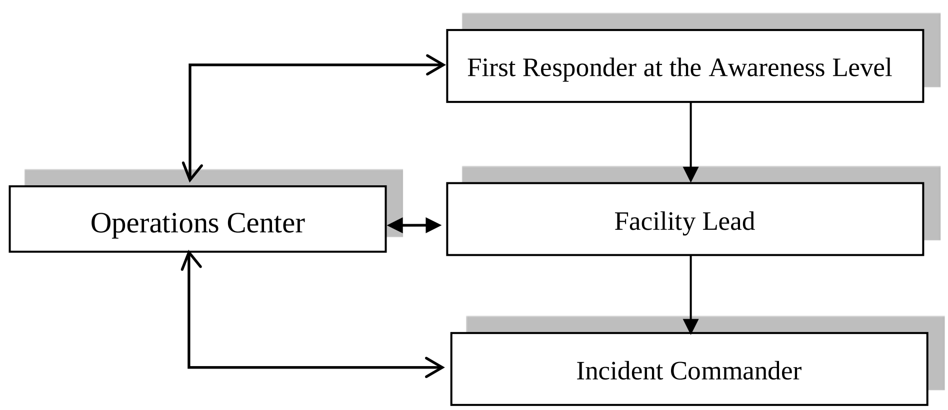
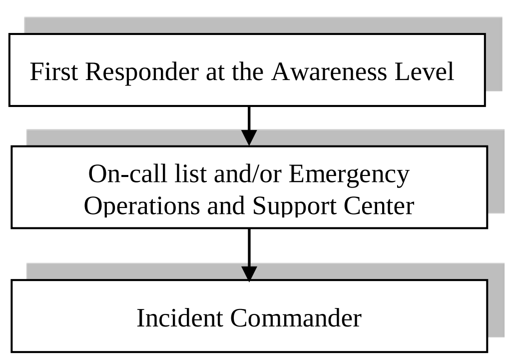


FIGURE 3, CHAIN OF COMMAND MODEL AFTER-HOURS



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 abnormal/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 abnormal/emergency event.

Conventional Telephones – Conventional telephones and land lines may be used to notify the Operations Center, EOSC, and 911 in the event of an abnormal/emergency event.

Continuous Air Monitor (CAM) – CAMs are used in areas where there is a potential for airborne radioactivity. If airborne radioactivity reaches the alarm set point, the CAM will produce an audible and visual alarm warning personnel that airborne radioactivity is present thus requiring personnel not wearing respiratory protection to exit the area and follow the instructions of a supporting 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 Area. An evacuation alarm system is available at TA-54 Areas 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 in Appendix F, TA-54 Areas G and L Evacuation Alarm Button Locations, and Appendix H, RANT Evacuation Alarm Button Locations. Any worker who determines an emergency situation may endanger workers in the area may activate the evacuation alarm. The evacuation alarm is a local alarm and is not connected to Station 7.

5.9 EWMO Communication Equipment and Warning Systems (continued)

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 Area and the alarm transmits and signals to Station 7. See Sections 6, 7, and 8 for area-specific fire system information.

Public Address (PA) System – PA systems are installed in the TA-54 and RANT facilities to provide a means for broadcasting audio communication to employees for abnormal/emergency events. Use of the PA for non-emergency announcements SHALL require approval from the Operations Center and the SOM.

Two-Way Radios – Two-way radios are another method to communicate between Assembly Areas, SOS, Operations Center, SOM/FL and EOSC. Each Assembly Area is equipped with a two-way radio.

Wind Sock – Wind socks are 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 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 n their field who assist the SOM/FL or IC during an abnormal/emergency event as necessary.

The following personnel groups may support the FL/IC in an abnormal/emergency event:

- Industrial Safety and Hygiene
- Radiation Protection

Additional organizations that may provide assistance are below:

- Criticality Safety Analyst*
- Criticality Safety Officer*
- Emergency Management
- Engineering
- Environmental
- Hazardous Waste
- Maintenance
- NCSD*

5.10 Support Personnel (continued)

- On-Site Transportation
- Operations Manager
- Safety Basis
- Security
- Utilities
- Waste Coordinator

* If an abnormal/emergency event that involves a potential or real criticality safety infraction, SOM/FL or IC is required to contact NCSD to provide assistance with development of emergency actions.

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

Abnormal/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 abnormal/emergency event, the initial notification from the first responder to the Operations Center and/or 911 initiates the process. The Operations Center will in turn notify the SOM.

The SOM/FL is responsible for notifying the OM who in turn will at a minimum notify the FOD; Environmental, Safety, and Health Manager; and the Project Manager.

Communications up the chain of command are required in accordance with P322-3.

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 emergency and hazards involved; extent of damage to facility, equipment, and environment; cause of the emergency; and actions required to prevent a re-occurrence. For an abnormal event, the SOM/FL has the authorization to return operations to normal.

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 Area may be released individually
- Some Assembly Areas may be released prior to others if the hazards are localized
- Assembly 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 abnormal/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 Areas – The Assembly Areas are illustrated on Appendix C, WCRRF Assembly 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 Station 7. 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 Los Alamos Fire Department (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 (two-way radio, e-pagers, cell phones, and/or face to face).

Additional requirements when an abnormal or emergency event occurs:

- If wearing a respirator, do <u>not</u> attempt to remove the respirator until given direction by an 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 Area Lead and Supervisor of the situation.
- When working in a facility/structure that is designed with a CVS (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 abnormal event, follow the instructions of an RCT.
- During an emergency event, all personnel who may be potentially contaminated, e.g., wearing Anti-C clothing, should <u>not</u> commingle with other personnel at the Assembly 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 and 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 665-2735. When notifying the TA-54 Operations Center of an abnormal/emergency event, personnel **SHALL** call **665-1288**. 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.

Fire Alarms – The fire alarms are zoned into five areas in TA-54, which operate independently.

TABLE 2, DIGITAL ALARM COMMUNICATION SYSTEMS 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, 54-321, 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)	Structure 54-215 (Area L), Admin. Bldgs. 54-37, 54-51, 54-60, 54-245, 54-246, 54-247
Zone 5, Fire Alarm Control Panel DACS 6144 (-1), Structure 54-38	Structure 54-38

7. TA-54 SPECIFIC REQUIREMENTS (continued)

Buildings 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 are followed during an abnormal 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 abnormal event, follow the instructions of an RCT.
- During an emergency event, all personnel who may be potentially contaminated, e.g., wearing Anti-C clothing, should not commingle with other personnel at the Assembly 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 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 Perma-Con, and TA-54-0375 Perma-Con), employees **SHALL** ensure that all doors to the contamination control enclosure remain closed upon exiting.

Assembly Areas – TA-54 is divided into eight response zones that correspond to locations where the fire alarm was initiated or activated (see Appendix E, TA-54 Zone Borders, Pickup Points, and Assembly Area Locations). 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 Area and to provide pertinent information to the TA-54 Operations Center for the zone in which the alarm was activated.

7. TA-54 SPECIFIC REQUIREMENTS (continued)

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 Area (see Appendix G, RANT Assembly Area Locations). This alarm is not connected to Station 7.

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 DACS which in turn will communicate the alarm with Station 7. There is one DACS panel for Building 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 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 (e.g., PA, two-way radio, e-pagers, cell phones, and/or face to face).

Additional RANT requirements are followed during an abnormal or emergency event:

- Workers in a facility/structure that is designed with ventilation (e.g., TA-54-38) for the purpose of personnel comfort (e.g., heating, cooling) **SHALL** ensure that exterior doors of the facility are closed upon exiting during an abnormal event.
- Alarms are considered actual unless notified by TA-54 Operations Center or FL.
- 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 abnormal 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 Area prior to being surveyed by an RCT.

9. 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.

10. RECORD PROCESSING

Records generated while performing this procedure must be processed and maintained in accordance with EP-AP-10003, Records Management.

Record Name	QA Record	Non-QA Record
Assembly Area Rosters	☒	☐
Assembly Area Checklists	☒	☐

11. REFERENCES

EP-AP-10003, Records Management

EWMO-DOP-20215, EWMO RCRA Inspections and Notifications

LANL Hazardous Waste Facility Permit, Section 2.11, Contingency Plan, and Attachment D, Contingency Plan

P101-7, Vehicle 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

SD130, Nuclear Criticality Safety Program

APPENDIX A

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DEFINITIONS AND ACRONYMS

Definitions

Assembly Areas – A designated rallying point away from the work area equipped with communication equipment and first aid supplies. Personnel evacuate to the upwind Assembly Areas in response to emergency situations.

Chain of Command – The chain of command is the formal process of establishing authority to manage an abnormal 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 runs the 24/7 EOSC 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 abnormal or unusual circumstances.

Facility Leader – The FL is the 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, Centerra 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.

Shelter-in-Place – A protective action taken by personnel to isolate themselves from a hazard.

Spill – An intentional or unintentional release of oil, polycarbonate byphenyls, liquid hazardous substances, or liquid radioactive substances to the environment that is not permitted under Laboratory, state, or federal permits.

Technical Area 54 – Technical Area 54 comprises process and administrative support areas, which includes Areas G, H, J, L, Administrative Areas, and RANT.

Visitor – Any individual, including Laboratory employees or subcontractors, who requires access to a facility but does not have authorized access to the specific area she/he wishes to enter.

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DEFINITIONS AND ACRONYMS

Acronyms

AOP	Abnormal Operations Procedure
ARP	Alarm Response Procedure
BEP	Building Emergency Plan
CAM	Continuous Air Monitor
CVS	Confinement Ventilation System
DACS	Digital Alarm Communication System
EOC	Emergency Operations Procedure
ERP	Emergency Response Procedure
EOSC	Emergency Operations and Support Center
ER	Environmental Remediation
EWMO	Environmental and Waste Management Operations
FL	Facility Leader
FOD	Facility Operations Director
IC	Incident Commander
LAFD	Los Alamos Fire Department
MOC	Maintenance On-Call
NCSD	Nuclear Criticality Safety Division
NES	Nuclear Environmental Sites
OM	Operations Manager
PA	Public Address
RANT	Radioassay and Nondestructive Testing Facility
RCT	Radiological Control Technician
SIP	Shelter in Place
SOM	Shift Operations Manager
SOS	Shift Operations Superviosr
TA	Technical Area
WCG	Waste Characterization Glovebox
WCRRF	Waste Characterization, Reduction, and Repackaging Facility

APPENDIX B

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WCRRF TA-50-69 EMERGENCY CONTACT LIST

Organizations	Contact(s)	Phone Numbers(s)
Emergency Operations Support Center		7-6211
Engineering		
Deployed Environmental Professional		
EWMO FOD		
Fire/Ambulance		
Fire Protection Engineer		
Health Physics Field Coordinator (HPFC)		
Industrial Hygiene and Safety		
Maintenance Manager		
Nuclear Criticality Safety Division		
Nuclear Criticality Safety Officer		
Nuclear Criticality Safety Analyst		
On-call list		
Occupational Medicine Nurse's Station		
Operations Manager		
Radiation Protection		
Security		
Shift Operations Manager		
Transportation		
Utilities		
Waste Management Coordinator		
*Surrounding facilities contacts		

* Identify surrounding facilities for performing notifications of an abnormal/emergency event

APPENDIX C

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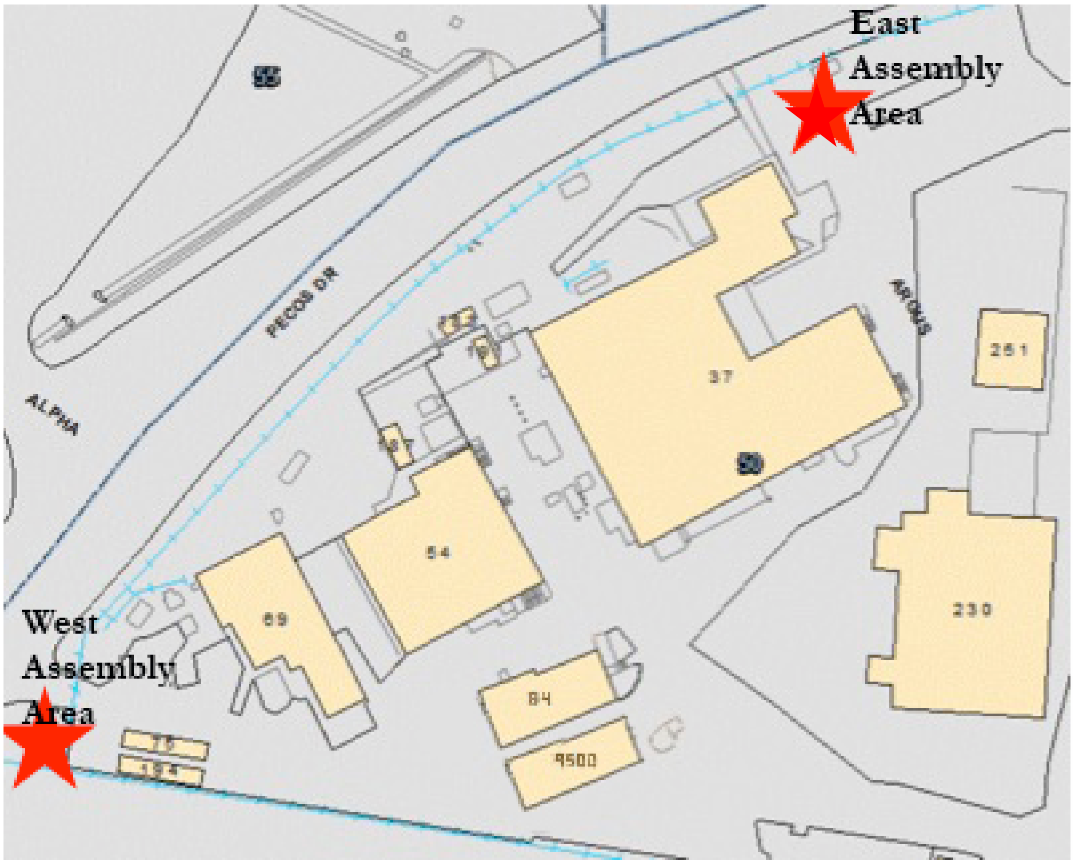
WCRRF ASSEMBLY AREA LOCATIONS AND EVACUATION ROUTES



Large star denotes Assembly Areas

APPENDIX C

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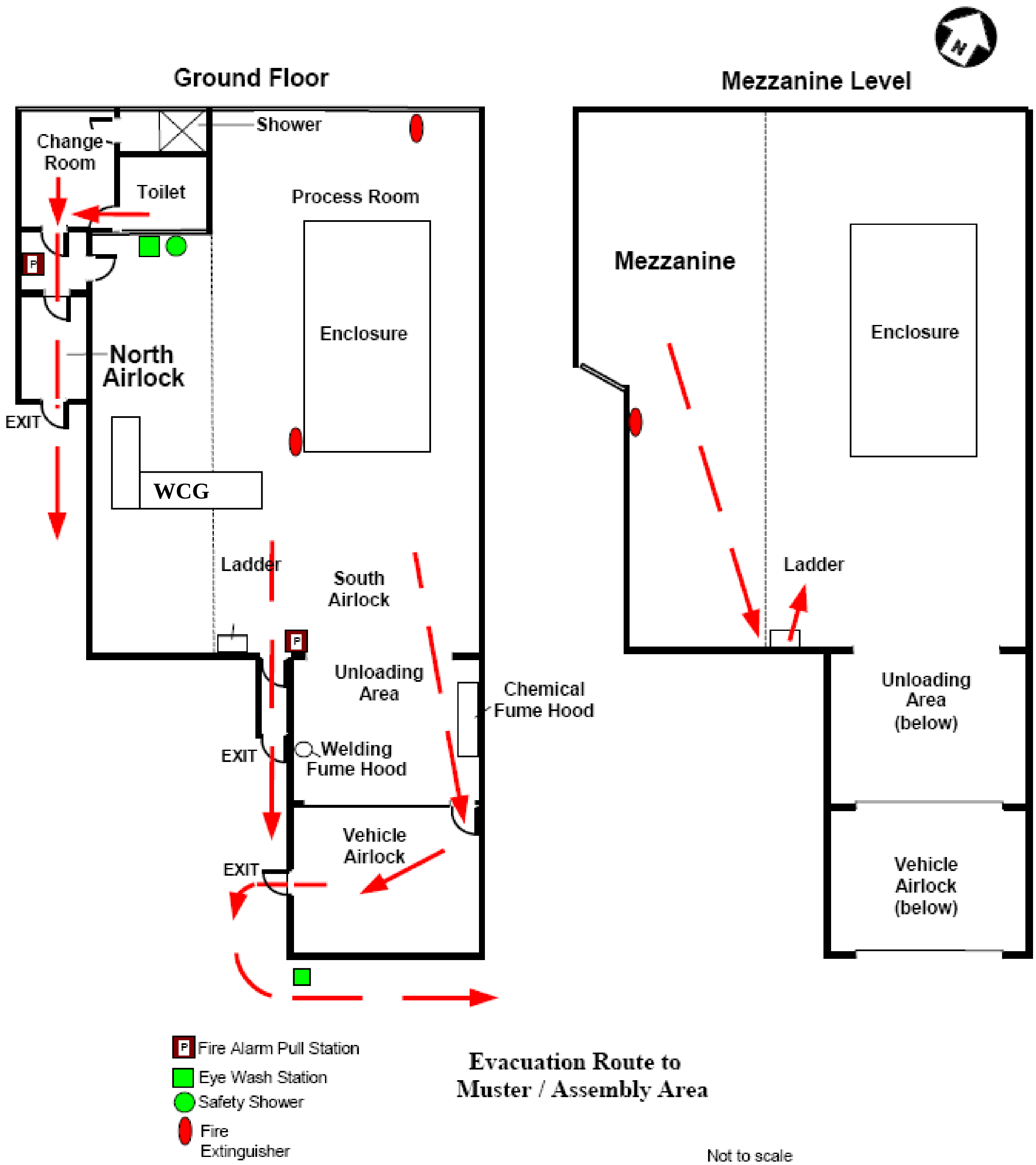

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TA-54 AND RANT EMERGENCY CONTACT LIST

Organizations	Contact(s)	Phone Number(s)
Emergency Operations Support Center		7-6211
Engineering		
Deployed Environmental Professional		
EWMO FOD		
Fire/Ambulance		
Fire Protection Engineer		
Health Physics Field Coordinator (HPFC)		
Industrial Hygiene and Safety		
Maintenance Manager		
Nuclear Criticality Safety Division		
Nuclear Criticality Safety Officer		
Nuclear Criticality Safety Analyst		
On-call list		
Occupational Medicine Nurse's Station		
Operations Manager		
Radiation Protection		
Security		
Shift Operations Manager		
Transportation		
Utilities		
Waste Management Coordinator		
*Surrounding facilities contacts		

* Identify surrounding facilities for performing notifications of an abnormal/emergency event

APPENDIX E
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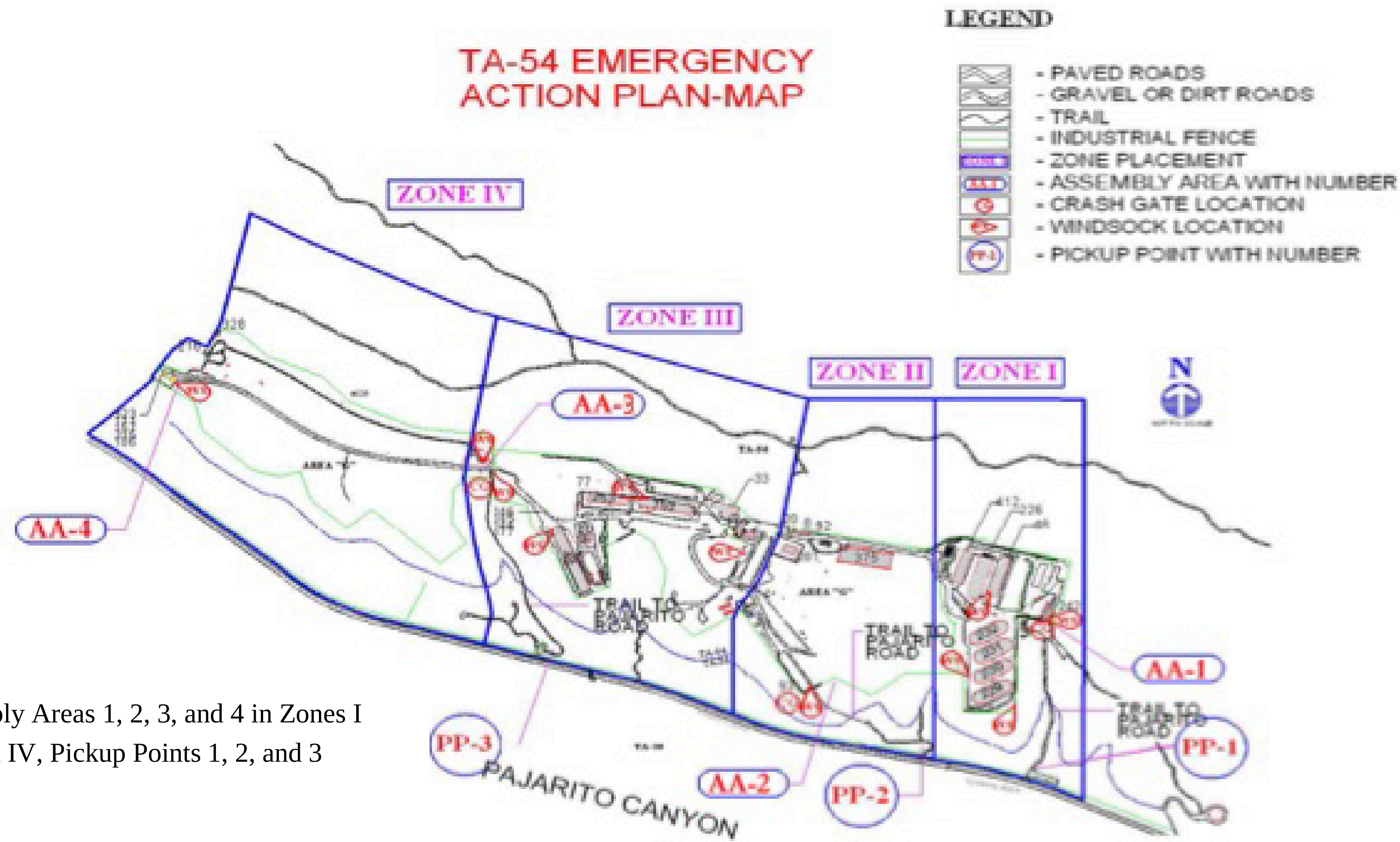
TA-54 ZONE BORDERS, PICKUP POINTS, AND ASSEMBLY AREA LOCATIONS



Assembly Areas 1, 2, 3, and 4 in Zones I through IV, Pickup Points 1, 2, and 3

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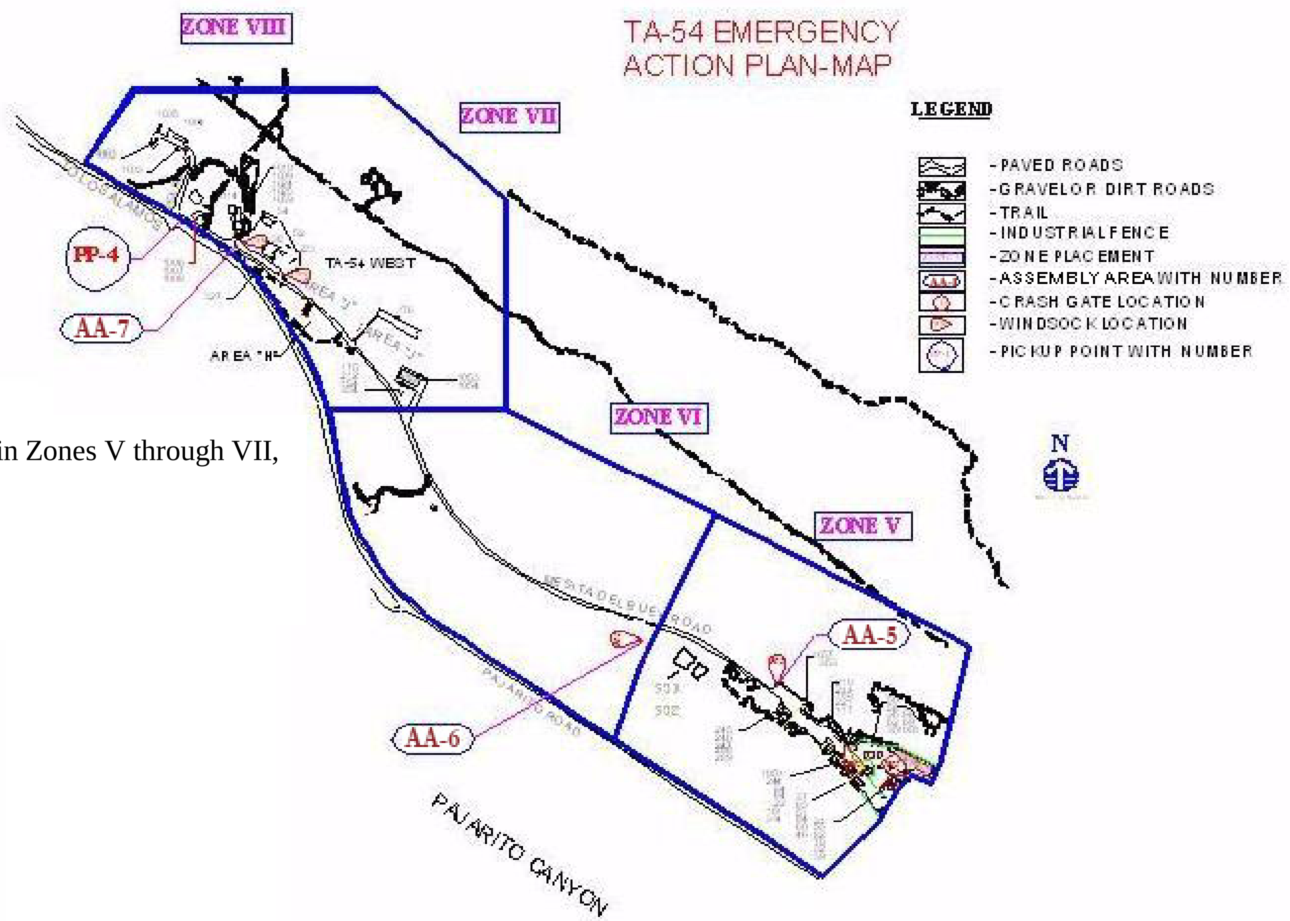

Assembly Areas 5 and 7 in Zones V through VII, Pickup Point 4

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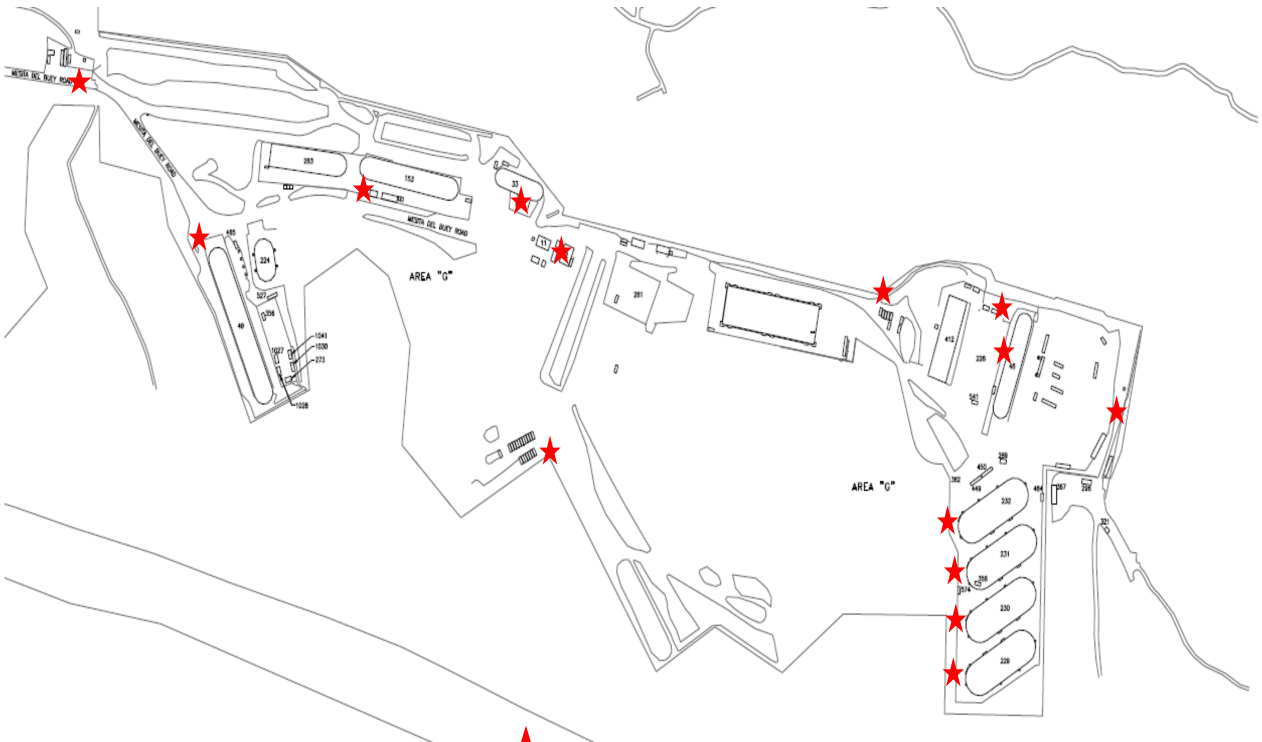
TA-54 AREAS G AND L EVACUATION ALARM BUTTON LOCATIONS



★ Small star denotes evacuation alarm locations

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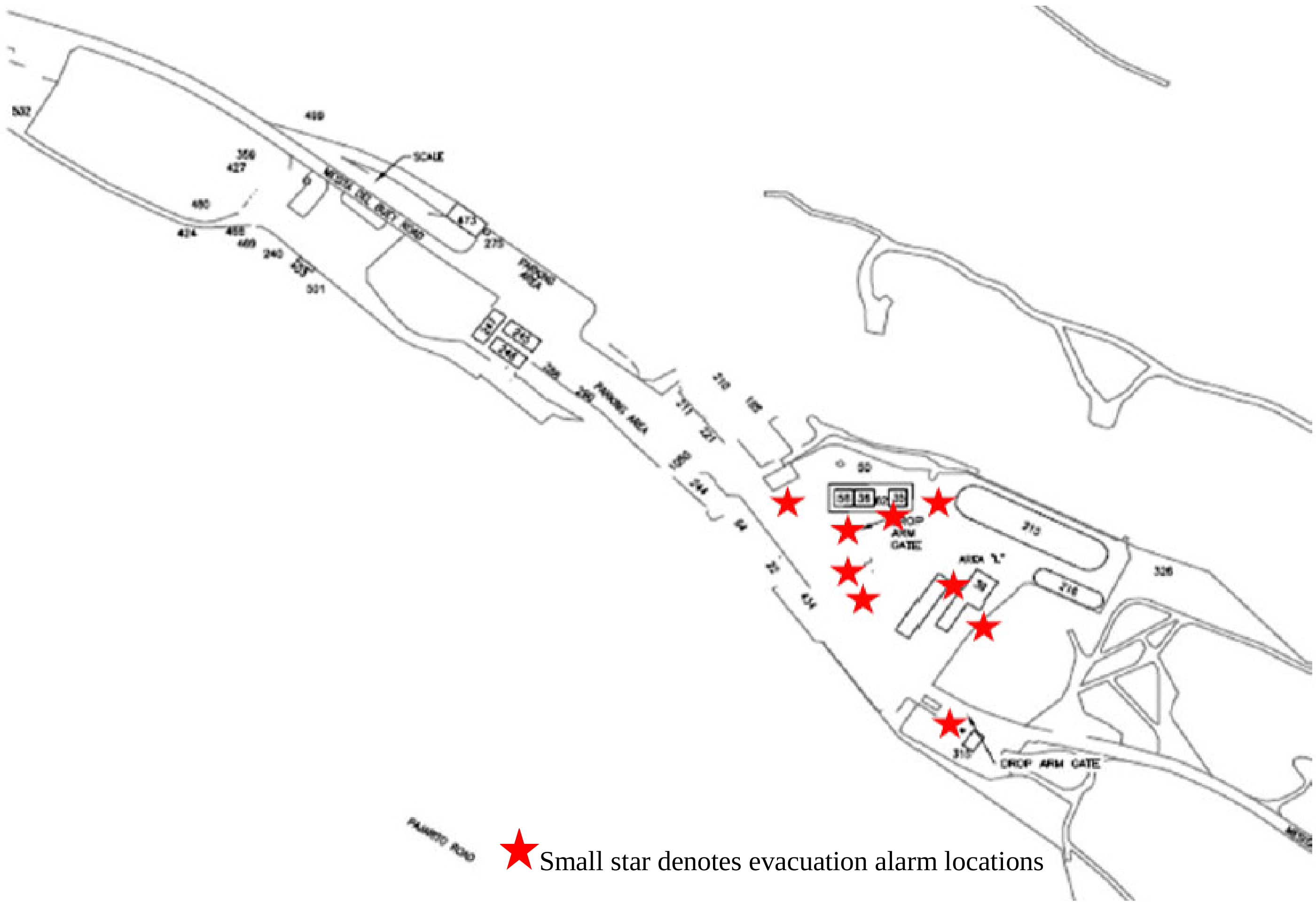
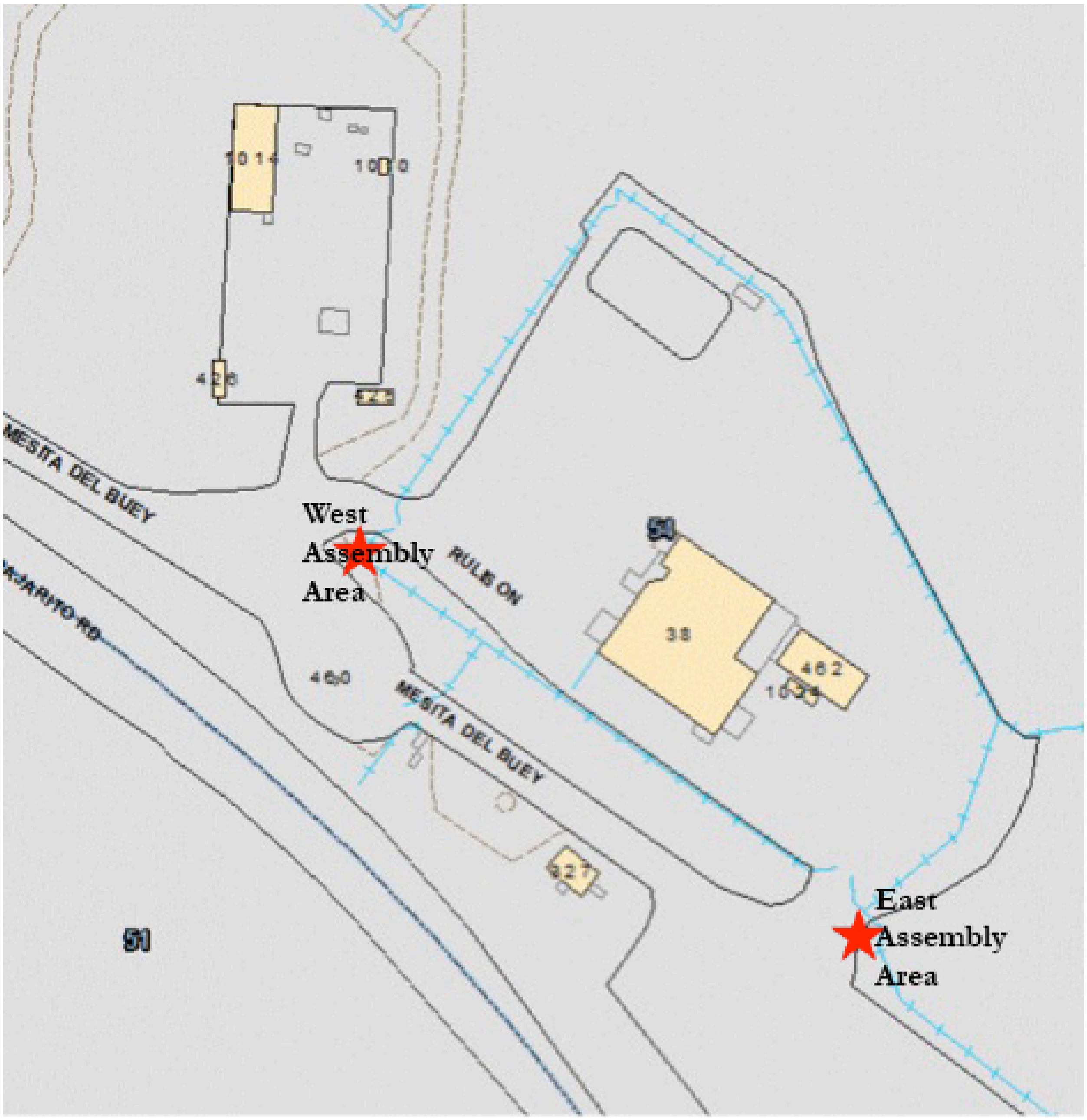


★ Small star denotes evacuation alarm locations

APPENDIX G
Page 1 of 1

RANT ASSEMBLY AREA LOCATIONS

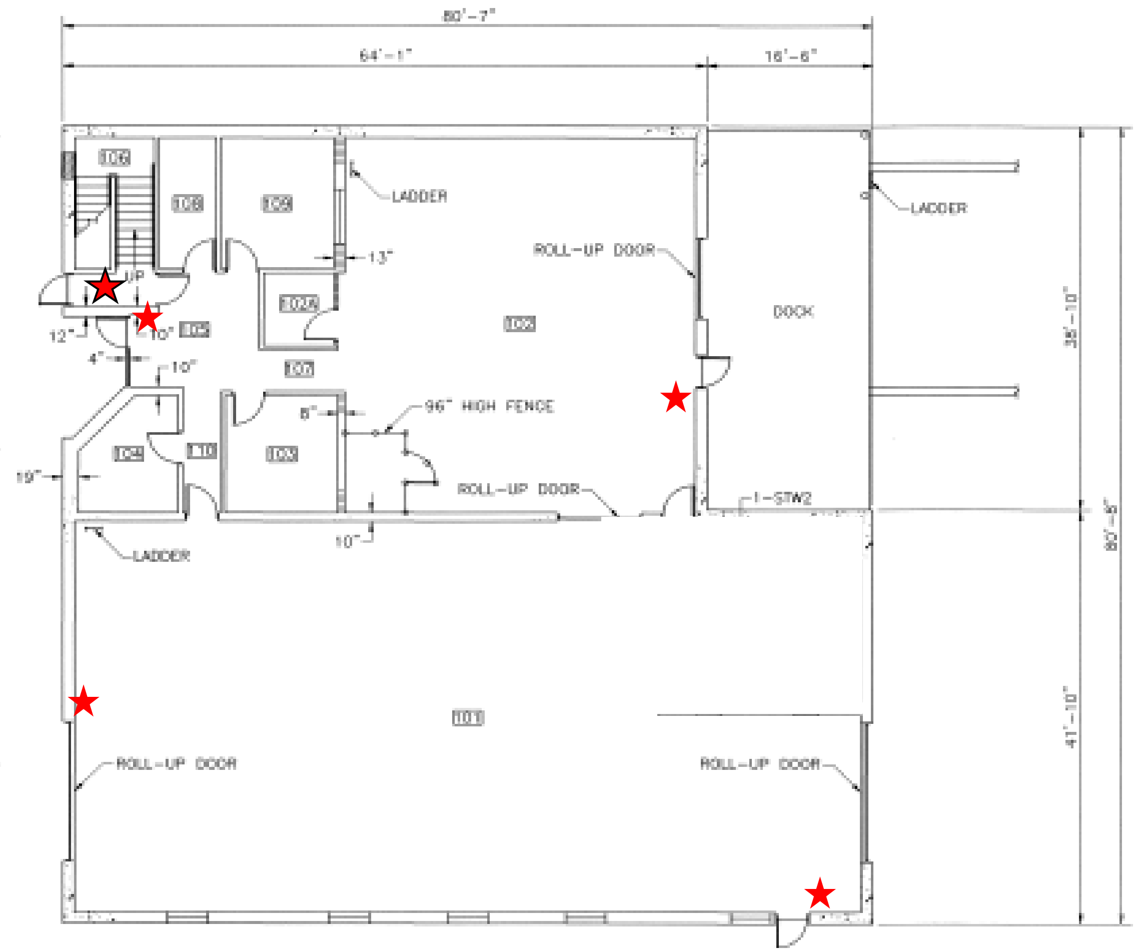


★ Large star denotes Assembly Areas

APPENDIX H

Page 1 of 1

RANT EVACUATION ALARM BUTTON LOCATIONS



★Small star denotes evacuation alarm locations

APPENDIX I

Page 1 of 1

ABNORMAL/EMERGENCY RESPONSE CARD

Front of card:

Abnormal/Emergency Response Immediate Actions *TA-54 Area G: 5-1288 WCRRF: 5-2797 EOSC: 7-6211*		
Notification Event	***Abnormal Event***	***Emergency Event***
*1. **NOTIFY** the Operations Center of the event.* *2. **WARN** others.* *3. **WAIT** for direction from the Operations Center and Facility Lead/ Incident Commander.*	*1. **SUSPEND** work.* *2. **WARN** others.* *3. **ISOLATE** immediate area.* *4. **MOVE AWAY** upwind from the area of concern.* *5. **NOTIFY** the Operations Center of the event.*	*1. **SUSPEND** work.* *2. **WARN** others.* *3. **ISOLATE** immediate area.* *4. **EVACUATE** to an Assembly Area upwind from the incident.* *5. **NOTIFY** 911 and the Operations Center of the event.*
EWMO-BEP-20048, EWMO Division Building Emergency Plan (BEP) Card		

Back of card:

Examples of Abnormal/Emergency Events TA-54 Area G: 5-1288 WCRRF: 5-2797 EOSC: 7-6211		
Notification Event	**Abnormal Event**	**Emergency Event**
Severe Weather	Waste Container of Questionable Integrity	Visual Observation of Fire or Audible Fire Alarm
Dangerous Wildlife Sighting	Spill or Release of Airborne, Liquid, or Solid Material	Major Utility Outage or Leak
Unsafe Road Conditions	Criticality Safety Non-Compliance	Explosion
Loss of Badge Reader	Unplanned Loss of Electrical Power	Dangerous Situation
Unsafe Work Observed	CAM Alarm Activation	RNS Container Exhibiting Chemical Reaction
		Rev. 4 – 08/29/2016

APPENDIX J

ASSEMBLY AREA TWO-WAY RADIO INSTRUCTIONS

When using an Assembly Area two-way radio, repeat-backs are required. A repeat-back consists of the receiving station repeating back the information so that the sender will know that the information has been correctly received. Routine radio traffic is monitored from Operation Centers.

[1] **TURN** the radio on.

[2] **SWITCH** the radio to appropriate Operations Center channel as follows:

- At TA-54 (including RANT), use Channel 1 (54-OPS)
- At WCRRF, use Channel 2 (WCRRF)
- At TWF, use Channel 3 (TWF-OPS)

[3] **DEPRESS** the large button on the side of the radio to transmit.

[4] **ESTABLISH** communication with the Operation 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** communication is established,
THEN transmit your name and Assembly Area location and **WAIT** for the Operation Center to ask for additional information.

[7] **UPON** request from the Operation Center,
THEN transmit the names and condition of personnel at your Assembly Area (only relevant and essential information should be given; Z# are NOT required to be transmitted unless there is confusion).

NOTE: The Operations Center may request shifting to a separate channel to report accountability information. If so, then return to the regular channel when accountability report has been made.

APPENDIX K

Page 1 of 1

ASSEMBLY AREA LEADER INSTRUCTIONS

NOTE 1 *The first person to arrive at the Assembly Area during an emergency who is knowledgeable and willing to perform the duties assigned, acts as the Assembly Area Leader.*

NOTE 2 *Instructions for using the two-way radio are provided in the Assembly Area box.*

- **DON** the blue vest located in the Assembly Area box.
- **INFORM** personnel that you are the Assembly Area Leader.
- **ENSURE** that potentially contaminated personnel are segregated.
- **RECORD** the name and Z number of all personnel on Attachment 1, Assembly Area Accountability Report.
- **QUESTION** all personnel about personnel accountability and if anyone is believed to be missing.
- **GATHER** information about the emergency event (such as configuration of equipment, smoke, water, medical emergencies, strange odors, etc.) from all personnel.
- **NOTIFY** the applicable Operations Center via landline, cell phone, or radio and **REPORT** the following:
  - Your name
  - Your location
  - Status of personnel (e.g., contamination, injuries)
  - Pertinent information gathered during the evacuation
  - Potentially unaccounted for personnel
  - Wind direction at the Assembly Area
- **MONITOR** the windsock for changes in wind direction.
- **ENSURE** that personnel do not reenter buildings or work areas.
- **ENSURE** that personnel remain at the Assembly Area until the "all clear" is given.
- **TAKE** the Assembly Area Accountability Report to the applicable Operations Center.

Contact Information:

TA-54 Operations Center: **505-665-1288**

WCRRF Operations Center: **505-665-2797**

APPENDIX L

Page 1 of 1

SHELTER IN PLACE INSTRUCTIONS

Shelter in Place

Sheltering is a temporary protective action and should last only a few (1–3) hours at the most.

Upon Notification to Shelter in Place:

- Assign workers to shut all windows (if any) and doors and assemble in a location away from windows and doors (hallway) for Shelter in Place (SIP).
- Turn building thermostats off to stop outside airflow into building. If airflow cannot be stopped, report to the applicable Operations Center/EOSC that airflow is not shut off.
- Isolate workers who enter from the outside at the exits inside the building.
- Do not attempt to relocate unless instructed to relocate by EOSC. (Vehicles in Area G with windows up and air movement turned off are SIP locations.)
- Complete Attachment 1, Assembly Area Accountability Report, and report results to the applicable Operations Center [TA-54 Operations Center: **505-665-1288;** WCRRF Operations Center: **505-665-2797)**/EOSC (7-6211)]. Note: Although Z#'s are recorded for completeness on Attachment 1, only personnel names need to be reported to the Operations Center.
- Follow up with the applicable Operations Center/EOSC every 30 minutes until the event is considered safe.
- Remain in shelter location until the applicable Operations Center/EOSC announces it is safe and the sheltering order has been given the All Clear.

Shelter in Place Order is All Clear:

- Send Attachment 1, Assembly Area Accountability Report, to the applicable Operations Center or SOM/FL.

ATTACHMENT 1

Page 1 of 1

ASSEMBLY AREA ACCOUNTABILITY REPORT

Date:	**Time:**	**Assembly Location:**
Assembly Area Leader:		
Reason for Accountability (Fire, SIP, Stay Put, Lock Down/Hide out):		

Print Name	**Z number**
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
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26.	
27.	
28.	
29.	
30.	

Send Roster to the applicable Operations Center Page ___ of ___

Attachment 9

EWMO-RM-ERP-20200, R.2

EWMO Area Emergency Response

Effective Date: April 12, 2017

Next Review Date: April 12, 2018

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

TA-54 Operations Manager	TA-54 Shift Operations Manager
WCRRF Operations Manager	WCRRF Shift Operations Manager
Safety Basis	Engineering
Deployed Environmental Professional	WPE Process Engineering
Environmental Compliance Programs	Operations Center Operator SME
Industrial Hygiene & Safety	Quality Assurance
Radiation Protection	Security and Emergency Operations
WD-WT Operations	Criticality Safety Officer
WD-WSS Operations	

Classification Review: ☒ Unclassified ☐ UCNI ☐ Classified

Name (print)	Z#	Signature	Date
Patrice Stevens	106047	/s/ Patrice Stevens	04/12/17

Responsible Manager, EWMO Deputy Facility Operations Director (FOD)

Name (print)	Z#	Signature	Date
David Solms	278703	/s/ David Solms	04/12/2017

Working Copy / Information Only (circle one)

Initials / Date: ______/______

1.0 ENTRY CONDITIONS

- Request is made for Emergency Response personnel in support of an emergency
- Visual observation of fire or smoke
- Audible fire alarm
- Manual fire pull station activated
- Utility (water, gas, electricity) outages or leaks (water, fuel, sewer, oil) with significant impact to the facility or the environment
- Situation with the likely potential for involvement of more than one emergency response element
- Chemical reaction, such as smoke, fire, or release of a waste container’s internal contents to the atmosphere
- Major injury
- A nitrate salt waste container exhibiting the following conditions:
  - Evidence of heating such as signs of discoloration, paint peeling, or yellowing
  - Evidence of pressurization such as expansion of side walls or rounded bottom or top
  - Signs of smoke or fire from a container
- Notification of an emergency condition from the Emergency Operations Center (EOC), including an after-hours notification

2.0 IMMEDIATE RESPONSE ACTIONS

✓	TIME/DATE	#	ACTIONS
Operations Center			
NOTE *Steps 2.1 and 2.2 may be performed in any order and will usually happen in parallel. Initial notification to personnel per Step 2.2 should be made with the information initially available and should not be delayed to gain additional information.* **NOTE** *If this procedure is entered due to an after-hours emergency, the Shift Operations Manager (SOM) will be the initial person notified and will direct accomplishment of this procedure as appropriate.*			
		2.1	**ENSURE** that personnel have completed the <u>Emergency Response</u> in accordance with EWMO-BEP-20048, EWMO Division Building Emergency Plan: 1. **SUSPEND** work. 2. **WARN** others. 3. **ISOLATE** the immediate area. 4. **EVACUATE** to assembly area upwind from the incident. 5. **NOTIFY** 911, as appropriate. **AND OBTAIN** incident information from the caller (e.g., location, entry condition, inside or outside of a structure). **AND DOCUMENT** the information on Attachment 1, Narrative/Comments for EWMO Area Emergency Response.
		2.2	**NOTIFY** personnel of incident and/or protective actions using available and appropriate methods including: • the public address system, • two-way radio, • E-pager, • cell phone, and/or • face to face.
NOTE *Steps 2.3 through 2.7 may be performed out of sequence.*			
		2.3	**NOTIFY** the SOM. Name of SOM Notified:______________________________
		2.4	**ENSURE** that the Emergency Operations and Support Center (7-6211), Fire Department, and/or 911 are notified and contact information for the SOM/Facility Lead is provided.

2.0 IMMEDIATE RESPONSE ACTIONS (continued)

✓	TIME/DATE	#	ACTIONS
		2.5	**OBTAIN** meteorological data (e.g., wind direction) and, based on emergency conditions, **PROVIDE** directions on appropriate Assembly Area usage.
		2.6	**DISPATCH** an Operator to meet the Emergency Response vehicles and **OPEN** access gates if safe to do so.
		2.7	**PERFORM** accountability of personnel in affected area.
NOTE *Steps 2.8 through 2.14 may be performed out of sequence.*			
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.*			
SOM/Facility Lead			
		2.8	**ISSUE** protective actions as warranted by the type and severity of the emergency.
		2.9	**ENSURE** adjacent facilities are notified of the event, including protective actions issued to EWMO facilities. Note: the EOC may have already accomplished notification of adjacent facilities.
		2.10	**NOTIFY** the Operations Manager of the event and **REQUEST** the Operations Manager to contact the following as needed: • Facilities Operations Director (FOD), • Associate Director of Nuclear and High Hazard Operations (ADNHHO), and • Associate Directorate of Environmental Management (ADEM).

Adjacent facilities table (step 2.9):

Adjacent facilities for WCRRF:		
	TA55, RLUOB, RLW (includes construction project)	7-3330 (TA-55 Ops Center)
Adjacent facilities for RANT:		
	TA-54 Bldgs 1001, 1002, 1003, 1004, 1005	699-7452 (UI Duty Officer)
	TA-51 Bldgs 11, 12, 23, 25/26/27, 80/81/82	699-7452 (UI Duty Officer)
Adjacent facilities for TA-54 (except RANT)		
	None	n/a

2.0 IMMEDIATE RESPONSE ACTIONS (continued)

✓	TIME/DATE	#	ACTIONS
		2.11	**NOTIFY** the following of the event, as applicable, and **REQUEST** assistance to evaluate the condition: • Deployed Environmental Safety Health Services (DESHS) Manager • EWMO Engineering Manager • WD Division Leader and WD-WPE, WD-WT, and/or WD-WSS Group Leaders **NOTE** *If responding to an after-hours event, the SOM will use the EWMO On Call list as necessary to make notifications and direct resources.* **DOCUMENT** the date/time of the notification and the name of the person contacted on Attachment 1.
		2.12	**BRIEF** support personnel and the emergency responders upon arrival to incident site.
		2.13	**CONDUCT** formal transfer of command and control to the Incident Commander.
		2.14	**PROVIDE** EWMO resources to support the Incident Commander as requested.

3.0 SUBSEQUENT ACTIONS

SOM/Facility Lead			
✓	**TIME/DATE**	**#**	**ACTIONS**
		3.1	**ENSURE** that a formal transfer of command and control from the Incident Commander is performed once the emergency has been downgraded.
Operations Center			
		3.2	**IF** actions were developed after transfer from the Incident Commander, **THEN IMPLEMENT** actions to return area/operations to normal **AND DOCUMENT** actions in the Narrative/Comments section of Attachment 1.
		3.3	**ATTACH** any notes or other documentation generated during the performance of this document to Attachment 1 (e.g., photo of the white board).
		3.4	**REVIEW** Attachment 1 to ensure all necessary information is complete and **SIGN** and **DATE** the attachment.
		3.5	**IF** there was a solid/liquid/gas spilled or released to the environment, **THEN PROVIDE** a copy of Attachment 1 to the Deployed Environmental Professional (EWMO-DEP).
		3.6	**PROCESS** the procedure as a quality record in accordance with EP-AP-10003, Records Management.

ATTACHMENT 1
Page 1 of 3
Narrative/Comments for EWMO Area Emergency Response

Notifier's Name/Organization:

Date/Time:

Location of Event:

Assembly Area/Muster Area:

Container ID:

Condition Status Notification: Date: Time:

Any injuries? NO ☐ YES ☐ If Yes, describe:

Any alarms? NO ☐ YES ☐ If Yes, describe:

Any area contamination? NO ☐ YES ☐ If Yes, describe:

ATTACHMENT 1

Page 2 of 3

Narrative/Comments for EWMO Area Emergency Response

Any personnel contamination? NO ☐ YES ☐ If Yes, describe:

Describe operations occurring at time of event:

All personnel accounted for? NO ☐ YES ☐ If No, describe:

Notifications		
LAFD:	Date:	Time:
EOSC:	Date:	Time:
Shift Operations Manager:	Date:	Time:
Operations Manager:	Date:	Time:
EDESH-EWMS:	Date:	Time:
Emergency Management:	Date:	Time:
EWMO Engineering Manager:	Date:	Time:
WD Division Leader:	Date:	Time:
WD-WPE Group Leader:	Date:	Time:
WD-WSS Group Leader:	Date:	Time:
WD-WT Group Leader:	Date:	Time:
Health Physics Field Coordinator:	Date:	Time:
Industrial Hygienist:	Date:	Time:
FOD:	Date:	Time:
ADNHHO:	Date:	Time:
ADEM:	Date:	Time:
ECP-CP RCRA Compliance:	Date:	Time:
DOE:	Date:	Time:

ATTACHMENT 1
Page 3 of 3
Narrative/Comments for EWMO Area Emergency Response

Additional Narrative/Comments

Completed By:

______________ / ______________ / ______________ / ______________
Printed Name Signature Z# Date/Time

Attachment 10

Discovery of an Airborne, Liquid, and/or Solid Material Release or Spill

Effective Date: 9/1/2016

Next Review Date: 9/1/2017

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

- EWMO Operations
- Engineering
- Environmental Compliance Programs
- Industrial Hygiene & Safety
- Radiation Protection
- WD Operations
- WD Waste Storage & Shipping
- Safety Basis
- Deployed Environmental Professional
- Operator SME
- Quality Assurance
- Criticality Safety
- Security and Emergency Operations

Classification Review: ☒ Unclassified ☐ UCNI ☐ Classified

Name (print)	Z#	Signature	Date
Art Crawford	/ 080070	/ /s/ Art Crawford	/ 8/30/2016

Responsible Manager, EWMO Deputy Facility Operations Director (FOD)

Name (print)	Z#	Signature	Date
David Solms	/278703	/ /s/ David Solms	/ 8/31/2016

Working Copy / Information Only (circle one)

Initials / Date: ______/______

1.0 ENTRY CONDITIONS

- Discovery of an airborne, liquid, and/or solid material release
- Uncontrolled release of hazardous and/or radioactive material into the environment
- Strong chemical odor (e.g., acid, ammonia, liquefied petroleum, gasoline)

2.0 IMMEDIATE RESPONSE ACTIONS

✓	TIME/DATE	#	ACTIONS
Operations Center			
		2.1	**ENSURE** that personnel have completed the Abnormal Response in accordance with EWMO-BEP-20048, EWMO Division Building Emergency Plan: 1. **SUSPEND** work 2. **WARN** others 3. **ISOLATE** the immediate area 4. **MOVE AWAY** upwind from the area of concern 5. **NOTIFY** the Operations Center **AND OBTAIN** event information from the caller (e.g., location, odor, gas, liquid, amount, inside/outside the building or structure. **AND DOCUMENT** the information on Attachment 1, Narrative/Comments for Discovery of an Airborne, Liquid, and/or Solid Material Release or Spill.
		2.2	**NOTIFY** personnel of event using the public address system, two-way radio, E-pager, cell phone, and/or 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** support personnel to assist Shift Operations Manager.
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.*			
		2.5	**NOTIFY** the applicable Operations Manager of the event, and **REQUEST** the Operations Manager to notify the FOD.

2.0 IMMEDIATE RESPONSE ACTIONS (continued)

✓	TIME/DATE	#	ACTIONS
		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	**EVALUATE** the event and **DEVELOP** actions, as applicable **AND DOCUMENT** actions in the Narrative/Comments section of Attachment 1.
		2.8	**IF** Emergency Response personnel are required, **THEN GO TO** EWMO-RM-ERP-20200, EWMO Area Emergency Response and **EXIT** this procedure.

3.0 SUBSEQUENT ACTIONS

Operations Center			
		3.1	**IF** actions were developed, **THEN IMPLEMENT** actions to return area/operations to normal **AND DOCUMENT** actions in the Narrative/Comments section of Attachment 1.
		3.2	**REVIEW** Attachment 1 to ensure all necessary information is complete, and **SIGN** and **DATE** the attachment.
		3.3	**PROCESS** the procedure as a quality record in accordance with EP-AP-10003, Records Management.

ATTACHMENT 1

Page 1 of 3

Narrative/Comments for Discovery of an Airborne, Liquid, and/or Solid Material Release or Spill

Notifier's Name/Organization:

Date/Time:

Location of Event:

Assembly Area/Muster Area:

Container ID:

Condition Status Notification: Date: Time:

Any injuries? NO ☐ YES ☐ If Yes, describe:

Any alarms? NO ☐ YES ☐ If Yes, describe:

Any contamination? NO ☐ YES ☐ If Yes, describe:

ATTACHMENT 1

Page 2 of 3

Narrative/Comments for Discovery of an Airborne, Liquid, and/or Solid Material Release or Spill

Any personnel contamination? NO ☐ YES ☐ If Yes, describe:

Describe operations occurring at time of event:

All personnel accounted for? NO ☐ YES ☐ If No, describe:

Notifications		
LAFD:	Date:	Time:
EOSC:	Date:	Time:
Shift Operations Manager:	Date:	Time:
Operations Manager:	Date:	Time:
DSESH Manager:	Date:	Time:
EWMO Engineering Manager:	Date:	Time:
WD-WPE Group Leader:	Date:	Time:
RP-1 Manager:	Date:	Time:
Industrial Hygienist:	Date:	Time:
FOD:	Date:	Time:
ADNHHO:	Date:	Time:
ADEM:	Date:	Time:
ECP-CP:	Date:	Time:
DOE:	Date:	Time

Completed By:

/ / /

Printed Name | Signature | Z# | Date/Time

ATTACHMENT 1

Page 3 of 3

Narrative/Comments for Discovery of an Airborne, Liquid, and/or Solid Material Release or Spill

Additional Narrative/Comments

Attachment 11

EWMO-RM-AOP-20204, R.0

Waste Container Questionable Integrity

Effective Date: 9/9/2016

Next Review Date: 9/9/2017

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

EWMO Operations
Engineering
Environmental Compliance Programs
Industrial Hygiene & Safety
Radiation Protection
WD Operations
WD Waste Storage & Shipping
Safety Basis
Deployed Environmental Professional
Operator SME
Quality Assurance
Security and Emergency Operations
Criticality Safety Officer

Classification Review: ☒ Unclassified ☐ UCNI ☐ Classified

Art Crawford	/ 080070	/ /s/ Art Crawford	/ 9/8/2016
Name (print)	Z#	Signature	Date

Responsible Manager, EWMO Deputy Facility Operations Director (FOD)

David Solms	/ 278703	/ /s/ David Solms	/ 9/8/2016
Name (print)	Z#	Signature	Date

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

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, for example; missing or broken filter, puncture, excessive corrosion, missing drum locking ring, external contamination (i.e., chemical or radioactive)
- 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** that personnel have completed the Abnormal Response in accordance with EWMO-BEP-20048, EWMO Division Building Emergency Plan:, 1. **SUSPEND** work 2. **WARN** others 3. **ISOLATE** the immediate area 4. **MOVE AWAY** upwind from the area of concern 5. **NOTIFY** the Operations Center **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). **AND DOCUMENT** the information on Attachment 1, Narrative/Comments for Waste Container Questionable Integrity.
		2.2	**NOTIFY** personnel of event using available communications systems such as the public address system, two-way radio, E-pager, cell phone, and/or 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** support personnel to assist Shift Operations Manager. (e.g., Environmental, Safety and Health, Engineering, and Waste Coordinator)

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.*			
		2.5	**NOTIFY** the applicable Operations Manager of the event, and **REQUEST** the Operations Manager to notify the FOD.
		2.6	**CONDUCT** information gathering, such as the following applicable items: • Container number and contents • Spills/release • Temporary Limited Area • Weather conditions
		2.7	**EVALUATE** the event and **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** EWMO-RM-ERP-20200, EWMO Area Emergency Response and **EXIT** this procedure.
Operations Center			
		3.1	**IF** actions were developed, **THEN IMPLEMENT** actions to return area/operations to normal **AND DOCUMENT** the actions in the Narrative/Comments section of Attachment 1.
		3.2	**REVIEW** Attachment 1 to ensure all necessary information is complete, and **SIGN** and **DATE** the attachment.
		3.3	**IF** there was a solid/liquid/gas spilled or released to the environment, **THEN PROVIDE** a copy of Attachment 1 to the Deployed Environmental Professional (EWMO-DEP).
		3.4	**PROCESS** the procedure as a quality record in accordance with EP-AP-10003, Records Management.

ATTACHMENT 1

Page 1 of 3

Narrative/Comments for Waste Container Questionable Integrity

Notifier's Name/Organization:

Date/Time:

Location of Event:

Assembly Area/Muster Area:

Container ID:

Condition Status Notification: Date: Time:

Any injuries? NO ☐ YES ☐ If Yes, describe:

Any alarms? NO ☐ YES ☐ If Yes, describe:

Any contamination? NO ☐ YES ☐ If Yes, describe:

ATTACHMENT 1

Page 2 of 3

Narrative/Comments for Waste Container Questionable Integrity

Any personnel contamination? NO ☐ YES ☐ If Yes, describe:

Describe operations occurring at time of event:

All personnel accounted for? NO ☐ YES ☐ If No, describe:

Notifications		
LAFD:	Date:	Time:
EOSC:	Date:	Time:
Shift Operations Manager:	Date:	Time:
Operations Manager:	Date:	Time:
DSESH Manager:	Date:	Time:
EWMO Engineering Manager:	Date:	Time:
WD-WPE Group Leader:	Date:	Time:
RP-1 Manager:	Date:	Time:
Industrial Hygienist:	Date:	Time:
FOD:	Date:	Time:
ADNHHO:	Date:	Time:
ADEM:	Date:	Time:
ECP-CP:	Date:	Time:
DOE:	Date:	Time

Completed By:

Printed Name /	Signature /	Z# /	Date/Time

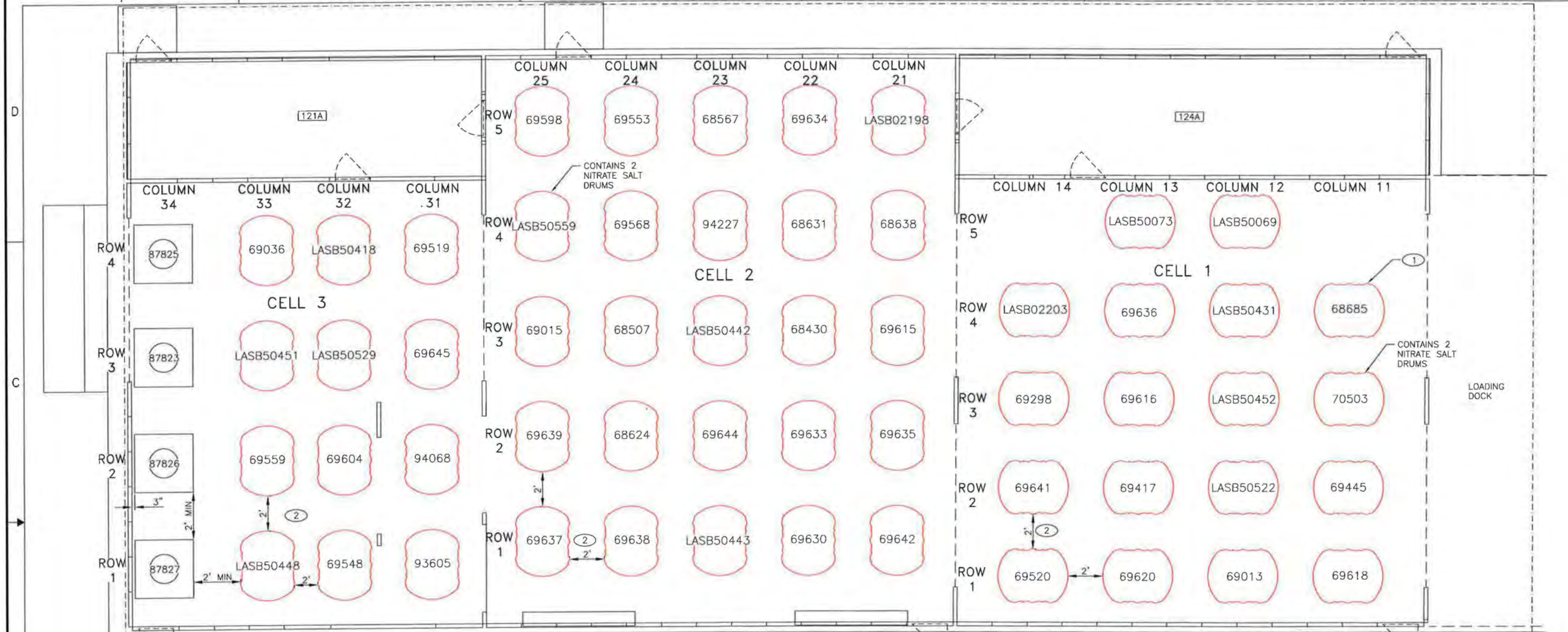
ATTACHMENT 1

Page 3 of 3

Narrative/Comments for Waste Container Questionable Integrity

Additional Narrative/Comments

Attachment 12



TA-54-375 SWB STORAGE PLAN

NOT TO SCALE

GENERAL NOTES

1. THIS STORAGE PLAN DEPICTS THE LOCATION OF 55 STANDARD WASTE BOXES (SWB) STORED IN 375 PERMACON. THE NUMBER ON EACH SWB IS A CONTAINER ID.
2. FIVE DIGIT CONTAINER NUMBERS BEGIN WITH THE PREFIX LA000000 WHICH HAS BEEN ELIMINATED HERE FOR BREVITY.
3. FOUR CONTAINERS IN CELL 3, COLUMN 34, ARE PIPE OVER-PACK COMPONENTS (POC). THE POCs ARE PLACED ON SECONDARY CONTAINMENT.

KEYED NOTES

(1) DRUM 68685 HAS THE SAME PARENT AS DRUM 68660.

(2) THE MINIMUM DISTANCE BETWEEN SWBs IS APPROXIMATELY 2 FEET.

LEGEND

[box] CONTAINS DRUM 68685 WHICH HAS THE SAME PARENT AS DRUM 68660.

POC/SWB PECi TABLE - CELL 3

CONTAINER ID	ROW	COLUMN	PECi
87825	4	34	2.06
69036	4	33	10.31
LASB50418	4	32	28.62
69519	4	31	17.19
87823	3	34	0.93
LASB50451	3	33	9.78
LASB50529	3	32	10.21
69645	3	31	16.09
87826	2	34	0.93
69559	2	33	14.03
69604	2	32	11.57
94068	2	31	28.99
87827	1	34	0.93
LASB50448	1	33	33.94
69548	1	32	0.94
93605	1	31	14.76

SWB PECi TABLE - CELL 2

CONTAINER ID	ROW	COLUMN	PECi
69598	5	25	2.04
69553	5	24	12.47
68567	5	23	1.31
69634	5	22	10.96
LASB02198	5	21	23.94
LASB50559	4	25	11.98
69568	4	24	4.52
94227	4	23	1.30
68631	4	22	1.52
68638	4	21	0.41
69015	3	25	3.01
68507	3	24	4.77
LASB50442	3	23	16.73
68430	3	22	11.23
69615	3	21	13.30
69639	2	25	4.42
68624	2	24	0.95
69644	2	23	9.32
69633	2	22	20.18
69635	2	21	4.38
69637	1	25	6.69
69638	1	24	8.11
LASB50443	1	23	34.80
69630	1	22	20.43
69642	1	21	4.91

SWB PECi TABLE - CELL 1

CONTAINER ID	ROW	COLUMN	PECi
LASB50073	5	13	42.56
LASB50069	5	12	51.80
LASB02203	4	14	22.07
69636	4	13	15.07
LASB50431	4	12	61.58
68685	4	11	8.54
69298	3	14	23.18
69616	3	13	9.75
LASB50452	3	12	37.84
70503	3	11	2.17
69641	2	14	9.11
69417	2	13	0.009
LASB50522	2	12	42.60
69445	2	11	5.15
69520	1	14	5.09
69620	1	13	20.42
69013	1	12	0.67
69618	1	11	4.13

NO	DATE	CLASS REV	DC	DESCRIPTION	DWN	DSGN	CHKD	SUB	APP
3	05-28-15	U	TT (tt)	CORRECTED MISLABELED KEYED NOTE IN CELL 1, SWB #68685: CHANGED TO READ "KEYED NOTE #1"	TC	VR	GF	JMH	RA
2	05-12-15	U	TT	ADDED 4 POCS TO CELL 3 AND RESPECTIVE TABLE. ADJUSTED SWB LOCATIONS IN CELL 3	TC	VR	GF	JMH	RA
1	11-06-14	U	CP	REVISED SWB LA00000070503 AND KEYED NOTES; REMOVED KEYED NOTE #3; ADDED LEGEND.	TC	RG	VR	JMH	RA

ENGINEERING SERVICES

TA-54-375 AS FOUND DRAWING, SWB STORAGE

SWB STORAGE LAYOUT PLAN

TA-54 BLDG 375

DRAWN	T. LAWRENCE
DESIGN	R. GRIFFIS
CHECKED	L. MOORE
DATE	06-17-14

SUBMITTED DAR, CHRISTOPHER PILCHER

APPROVED FOR RELEASE J. MINTON-HUGHES FOR FOD, STEVE HENRY

Los Alamos NATIONAL LABORATORY
PO Box 1663
Los Alamos, New Mexico 87545

SHEET 0-1001

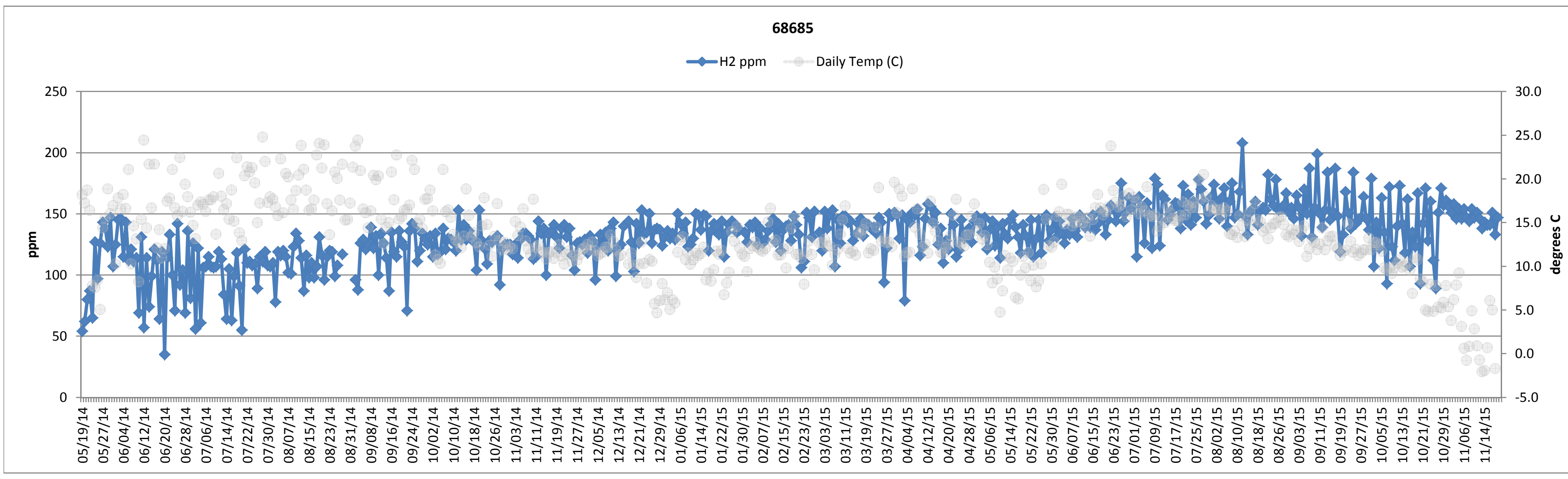
1 OF 1

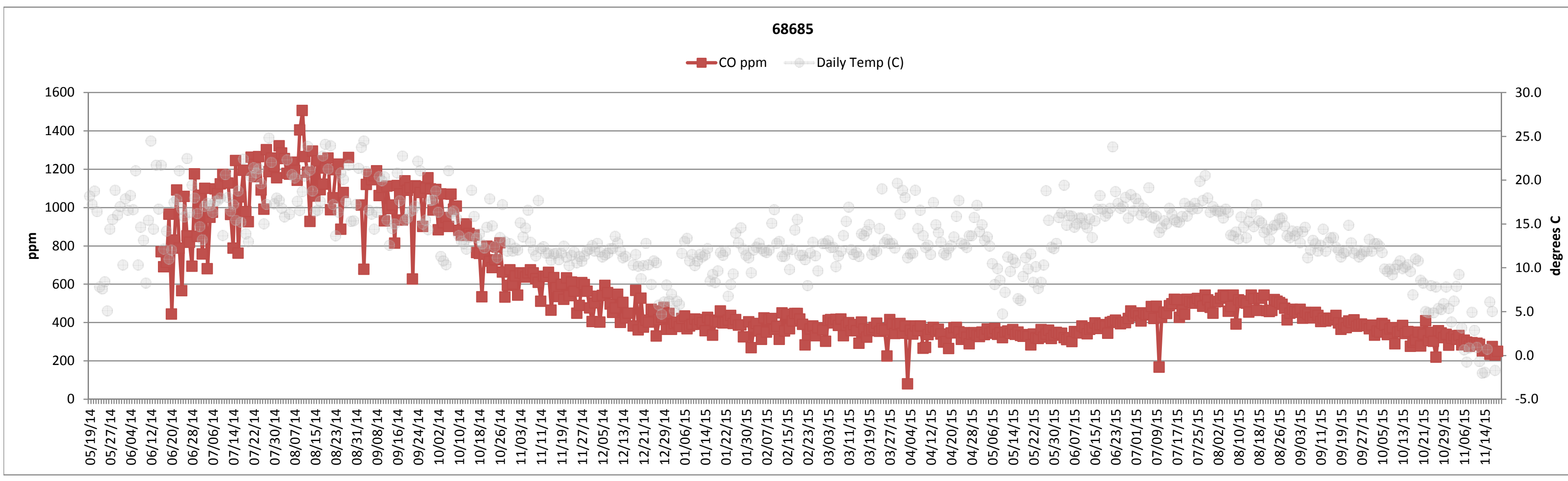
D.C.: U | REVIEWER: C. PILCHER | BASIS: NA | DATE: 06-23-14

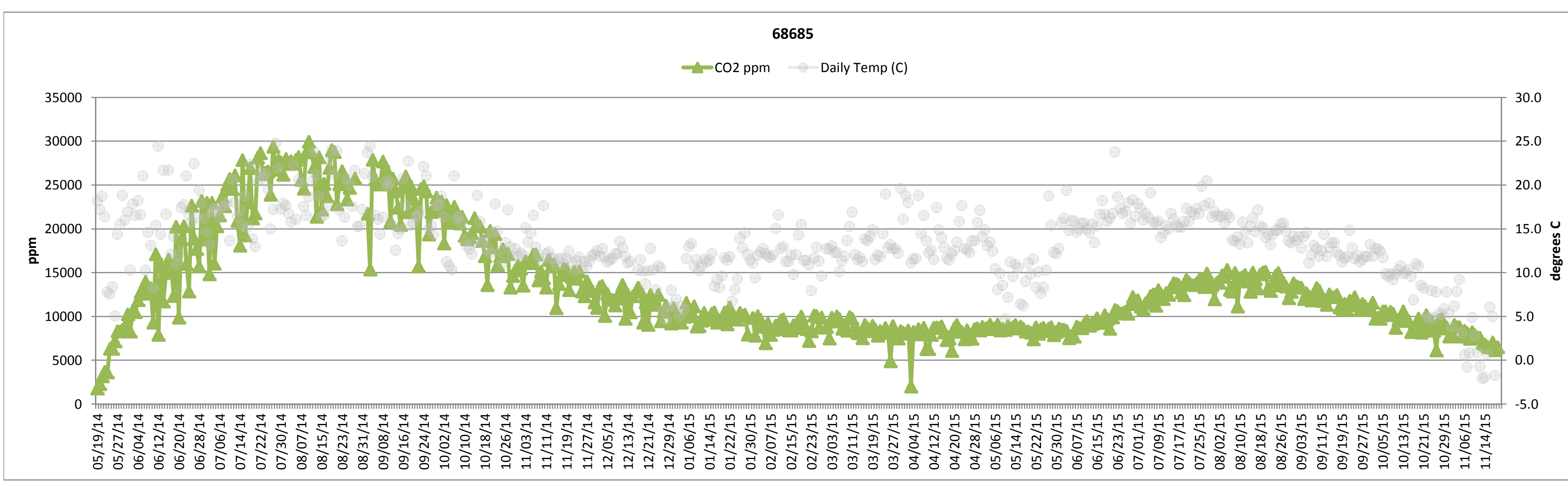
PROJECT ID NA | DRAWING NO C-57018 | ESR NO.: NA | REV 3

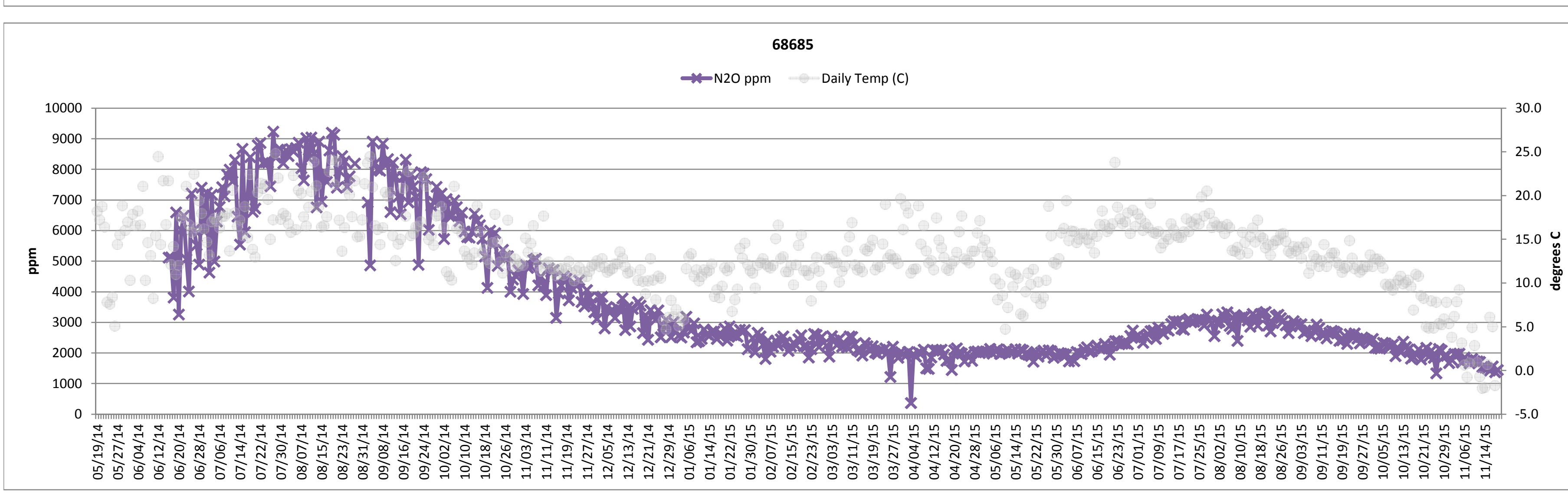
Attachment 13

Remediated Nitrate Salt Container Headspace Gas and Temperature

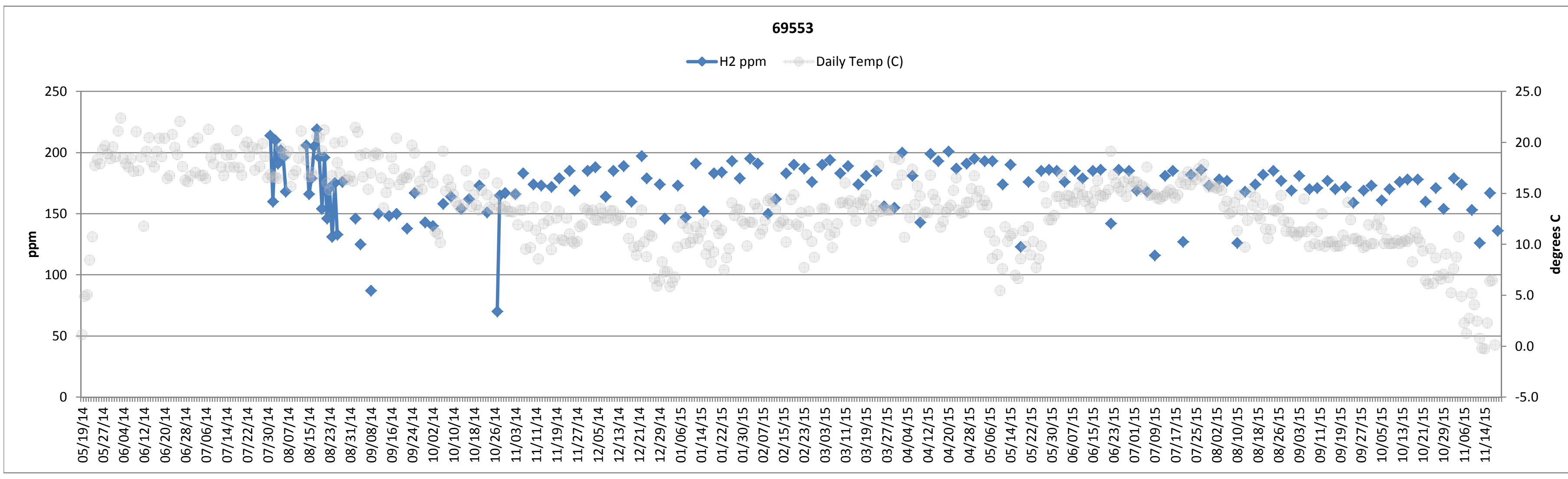


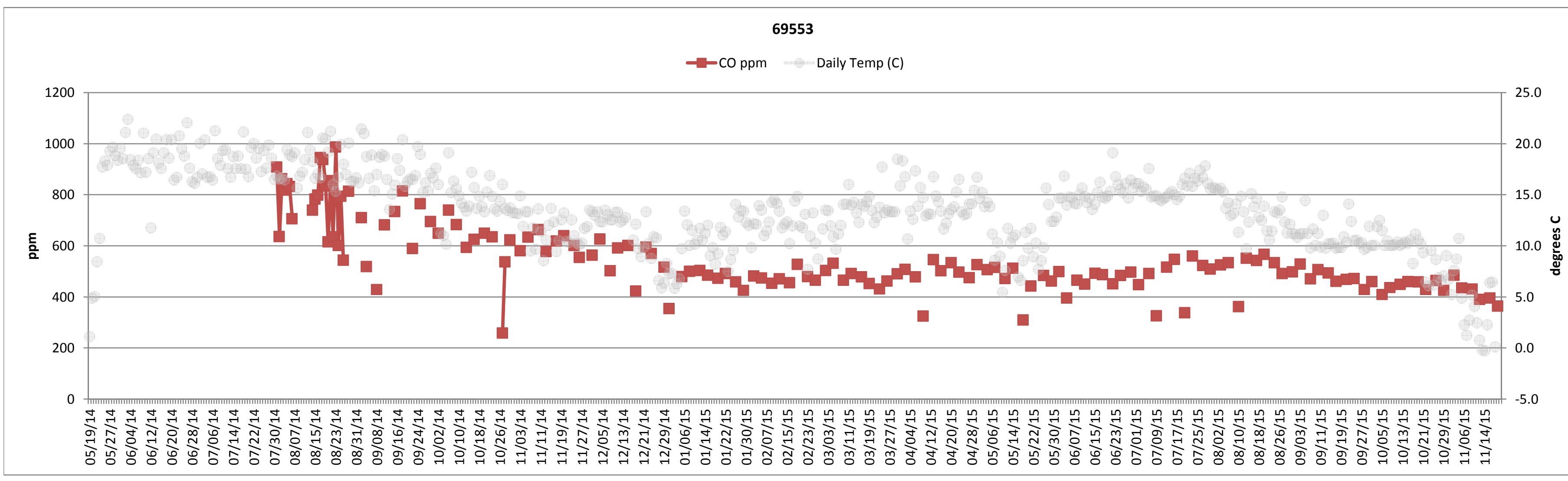


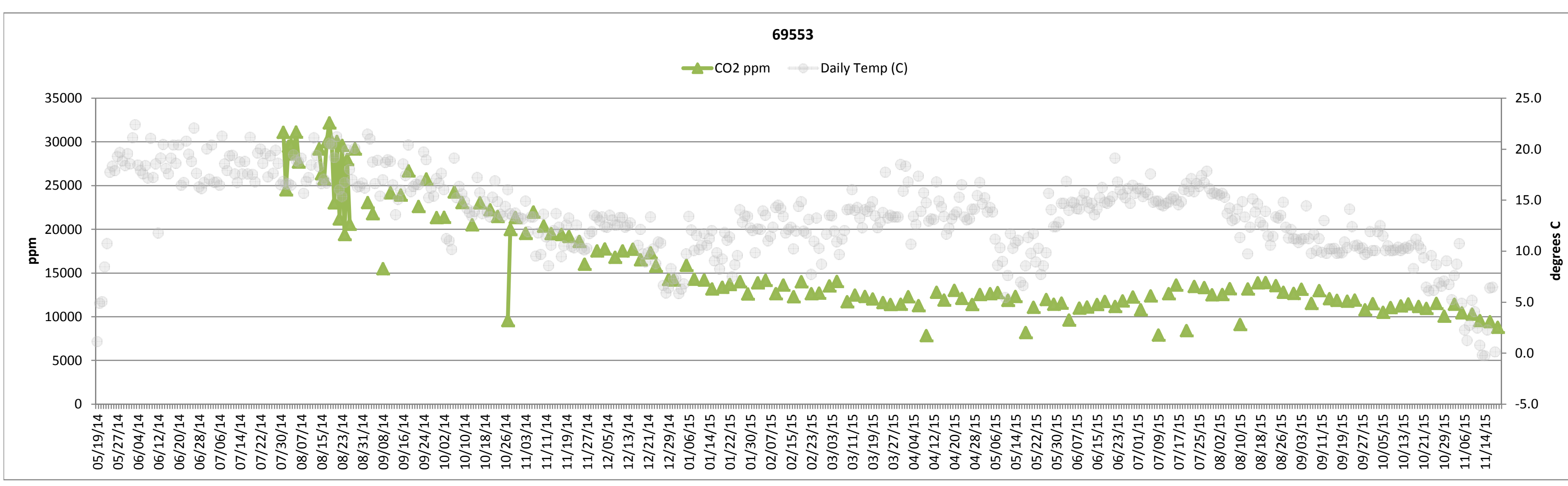


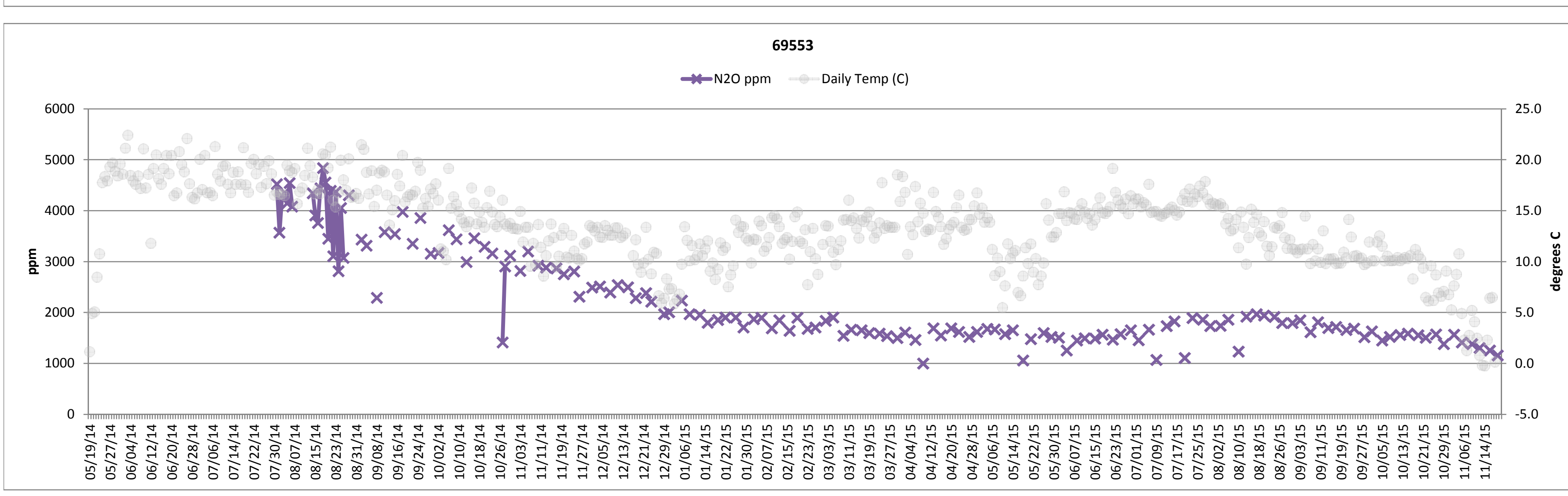


Remediated Nitrate Salt Container Headspace Gas and Temperature

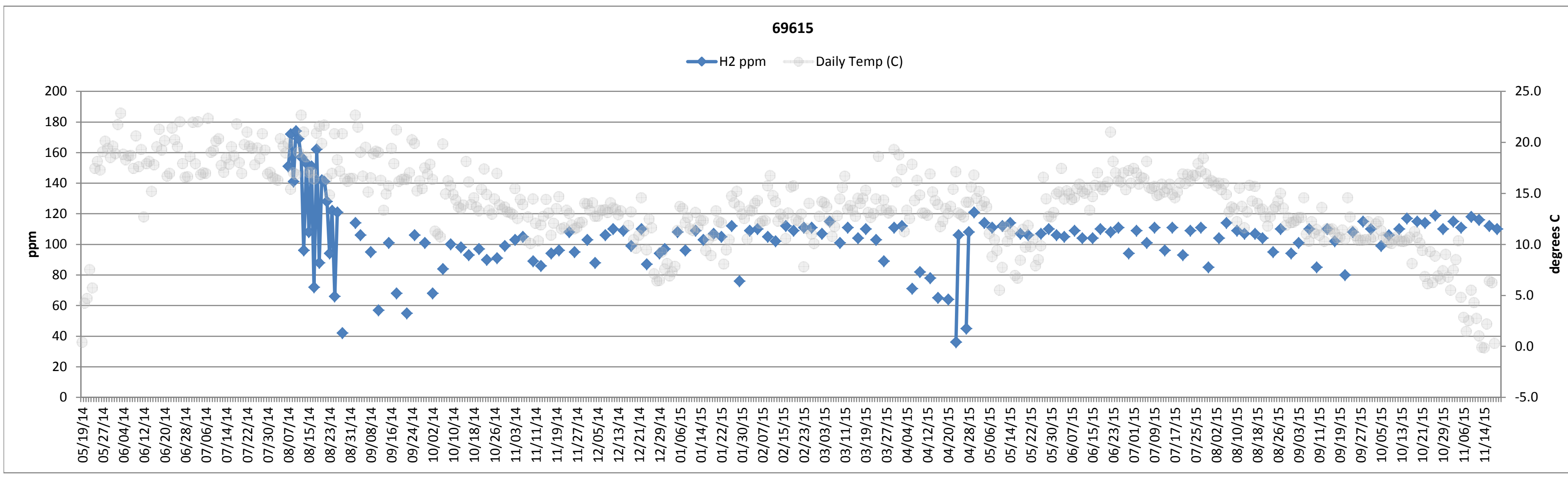


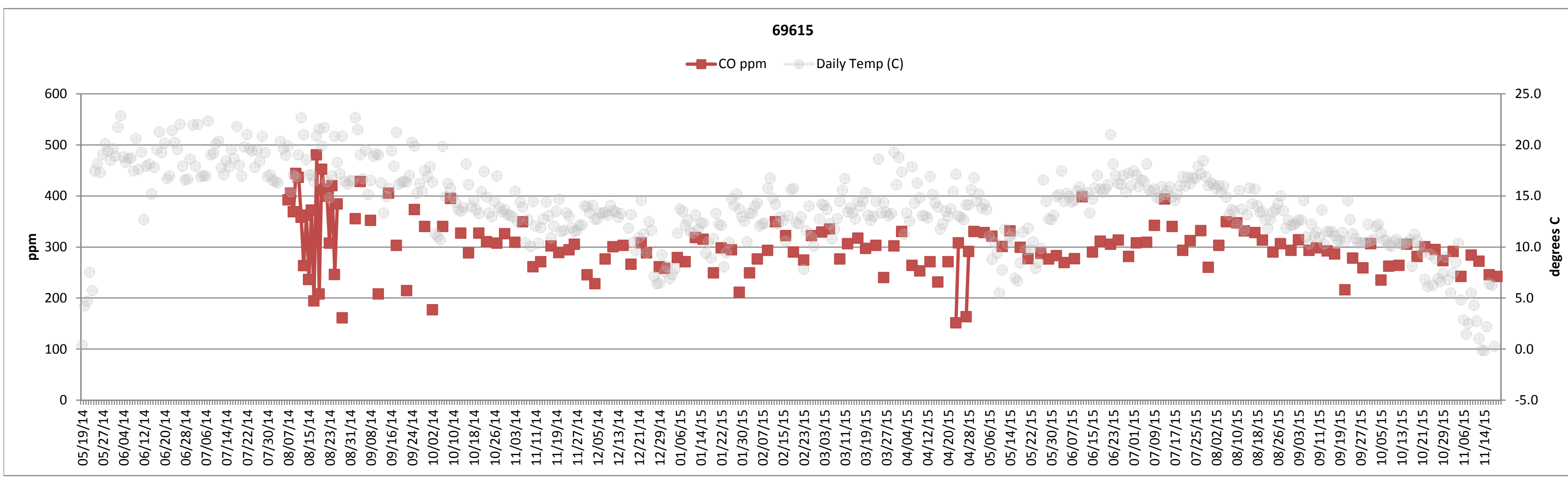


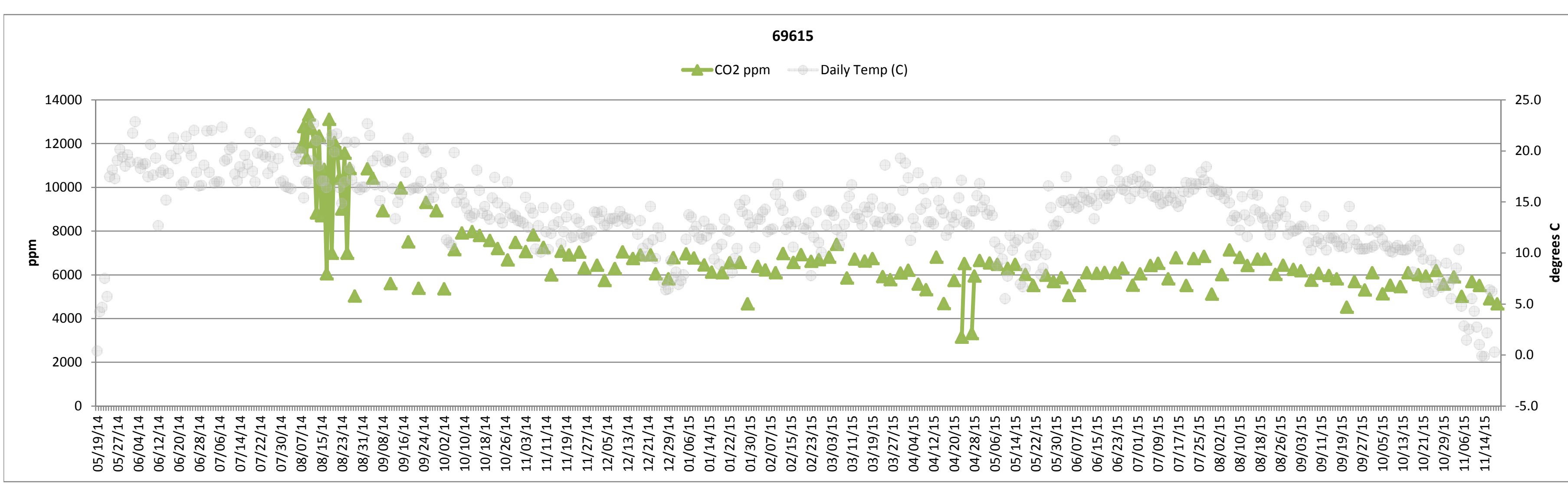


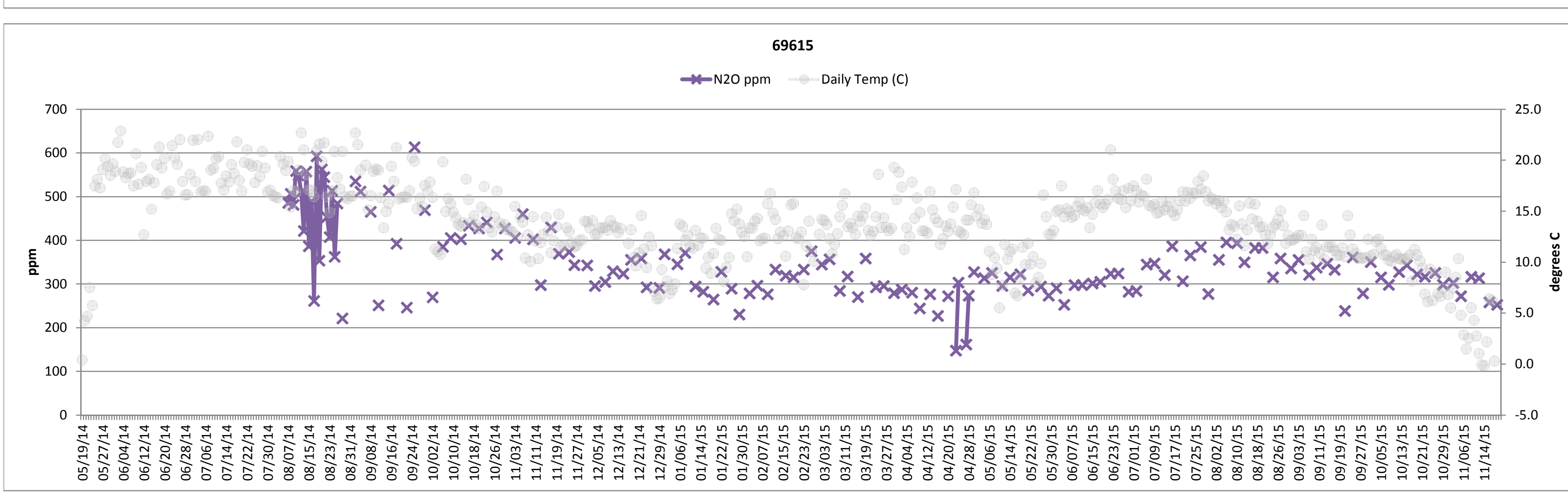


Remediated Nitrate Salt Container Headspace Gas and Temperature

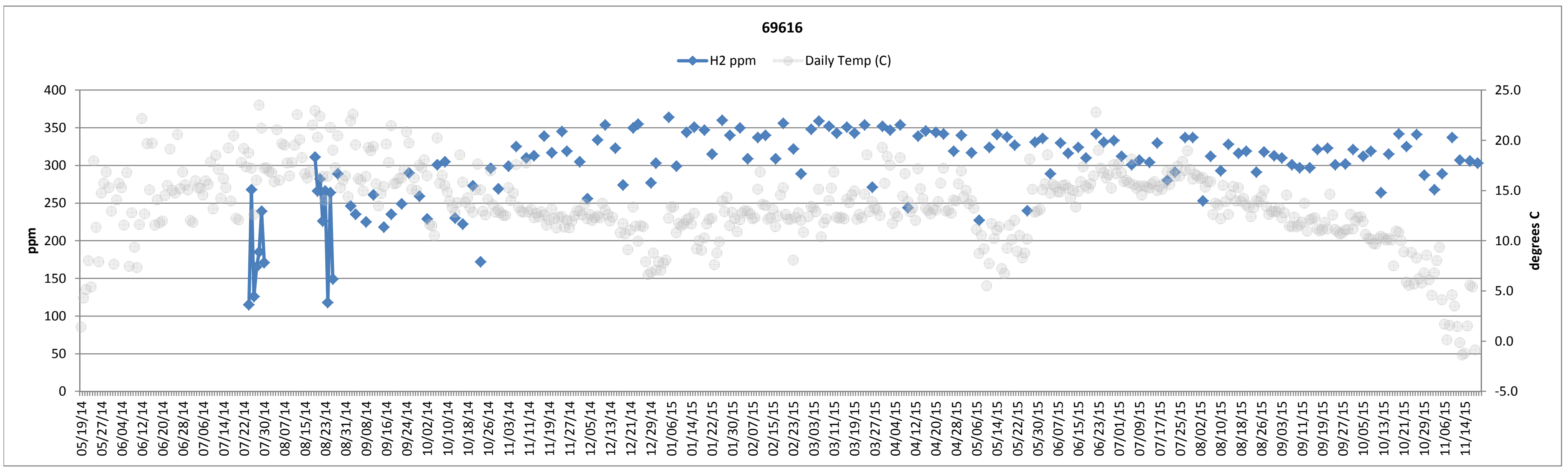


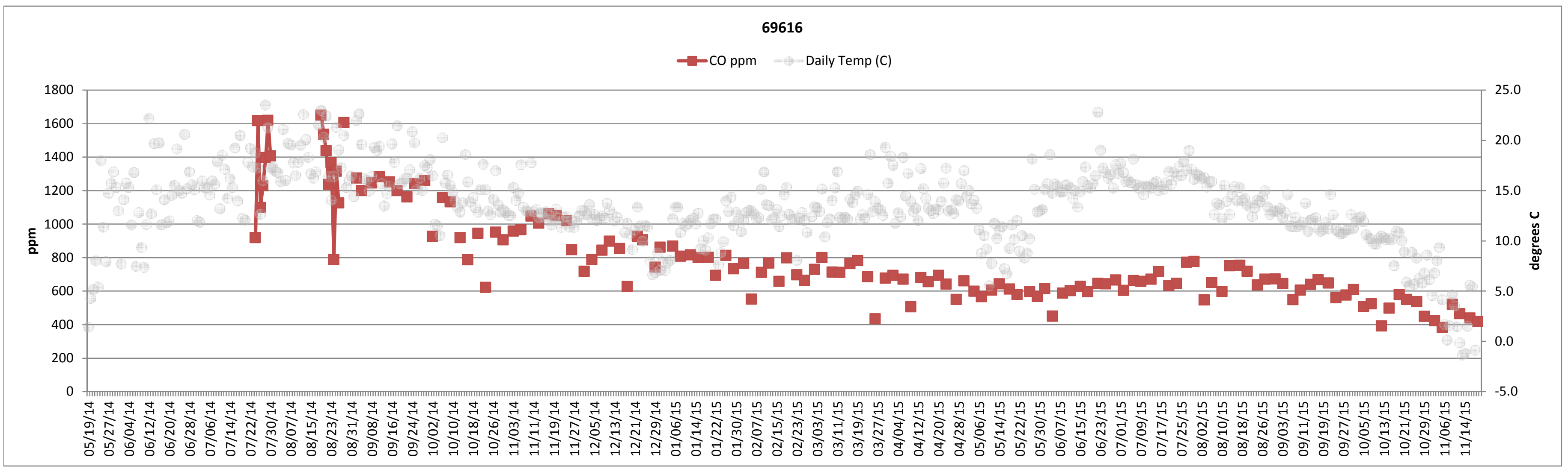


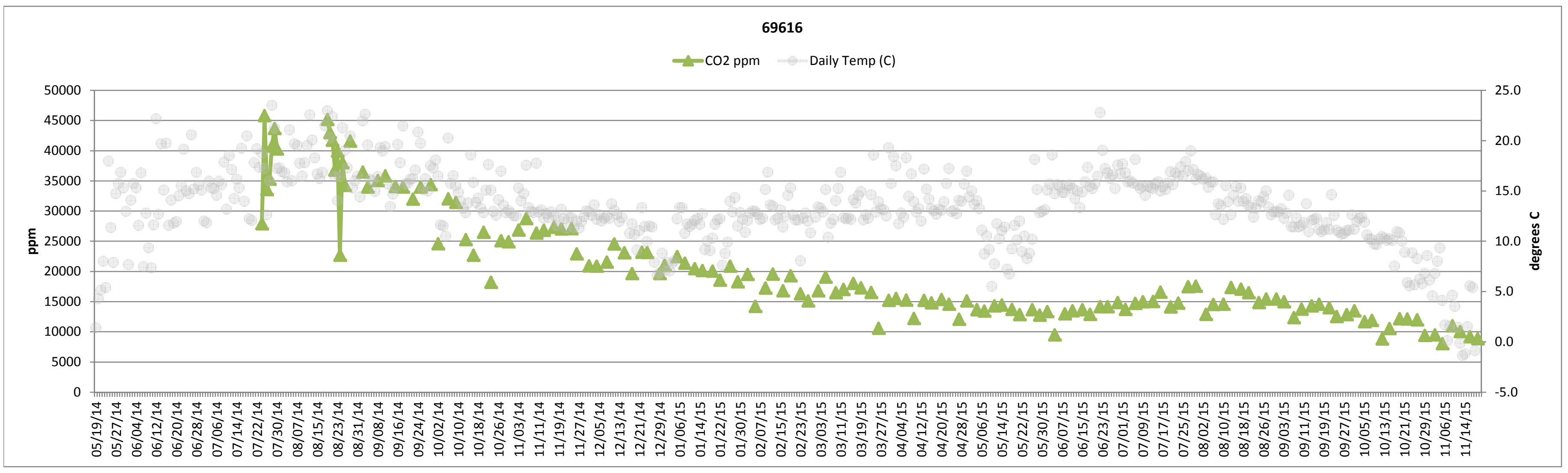


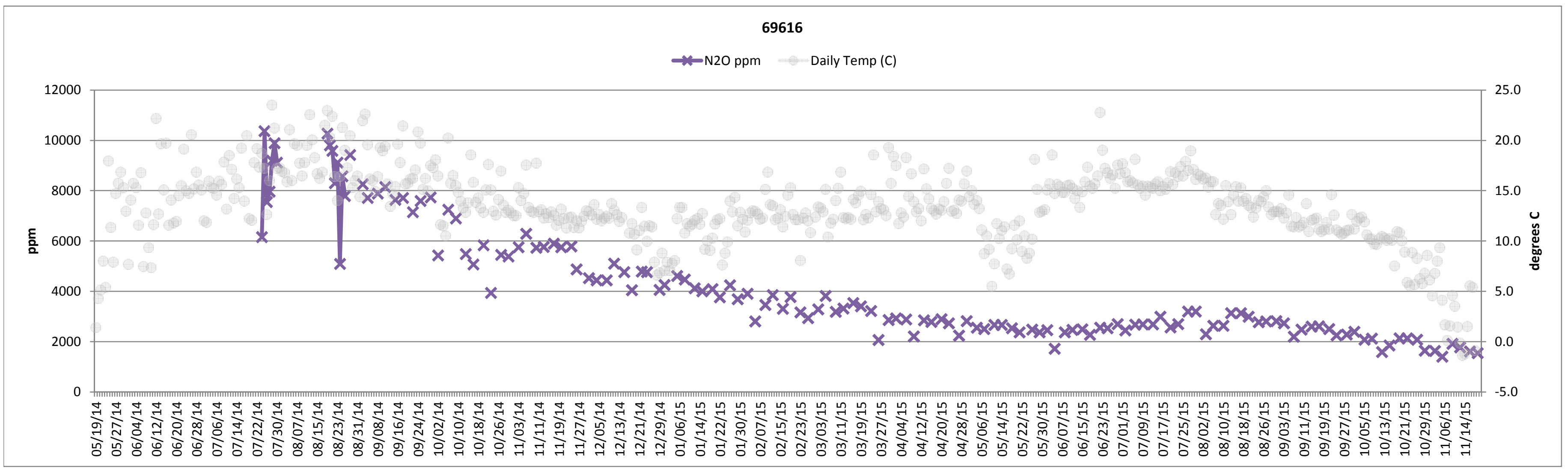


Remediated Nitrate Salt Container Headspace Gas and Temperature

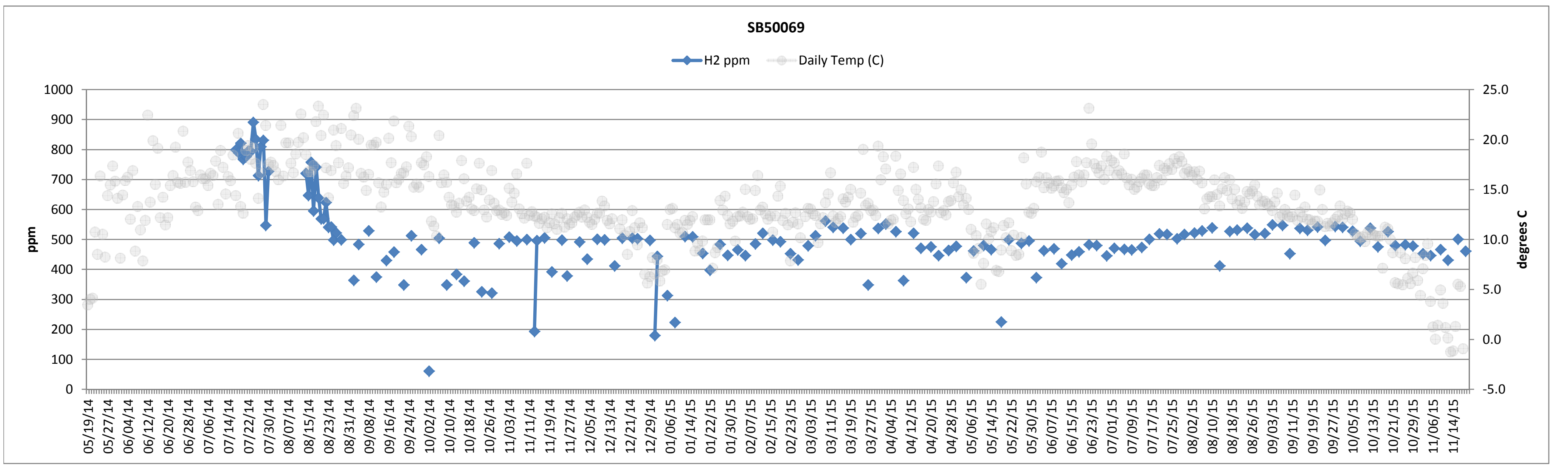


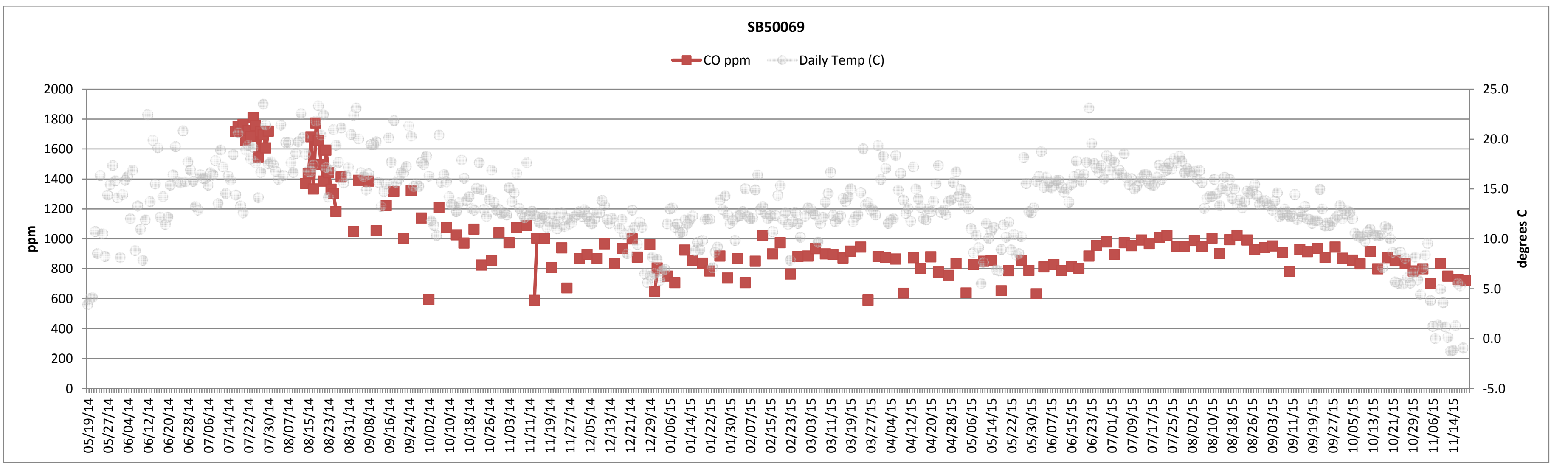


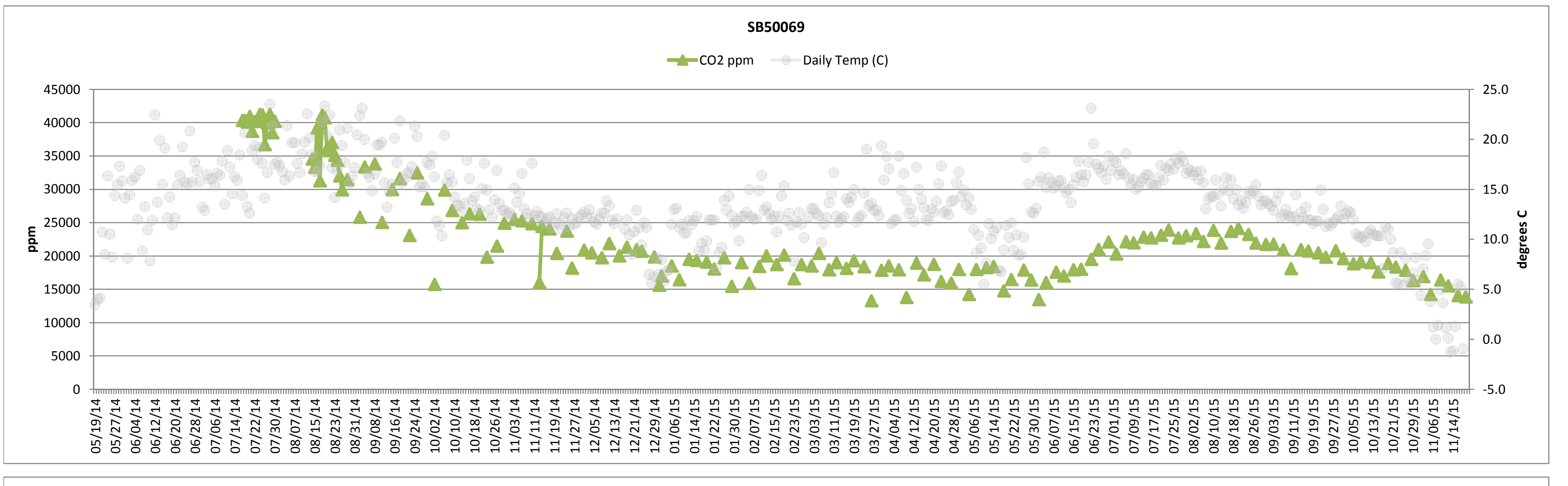


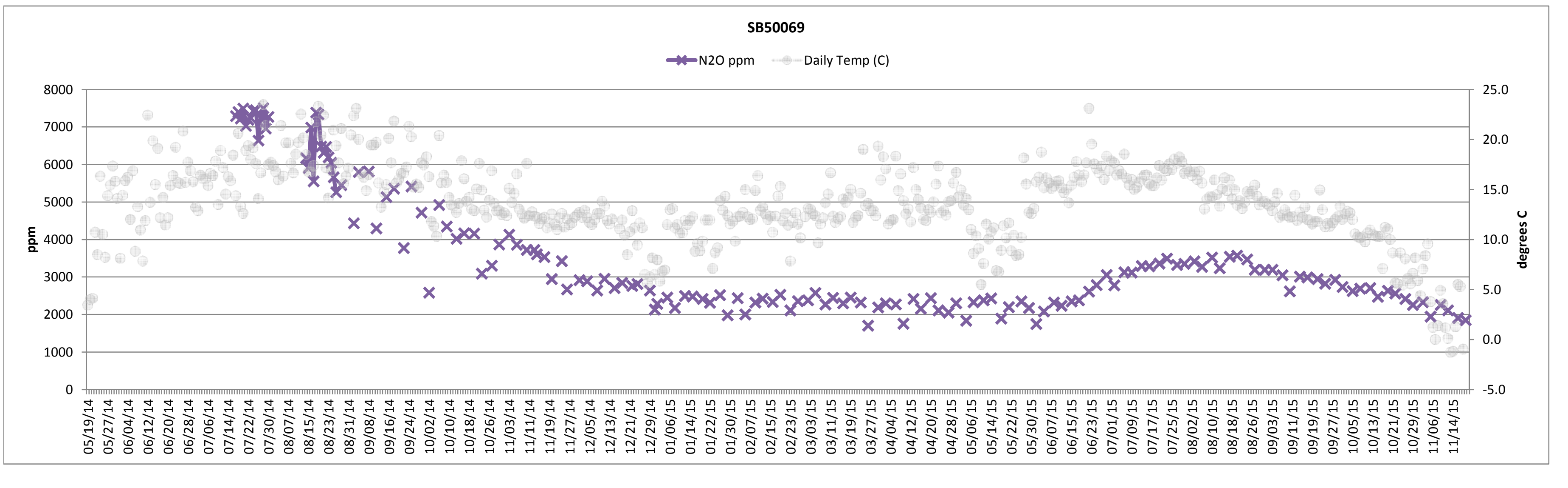


Remediated Nitrate Salt Container Headspace Gas and Temperature









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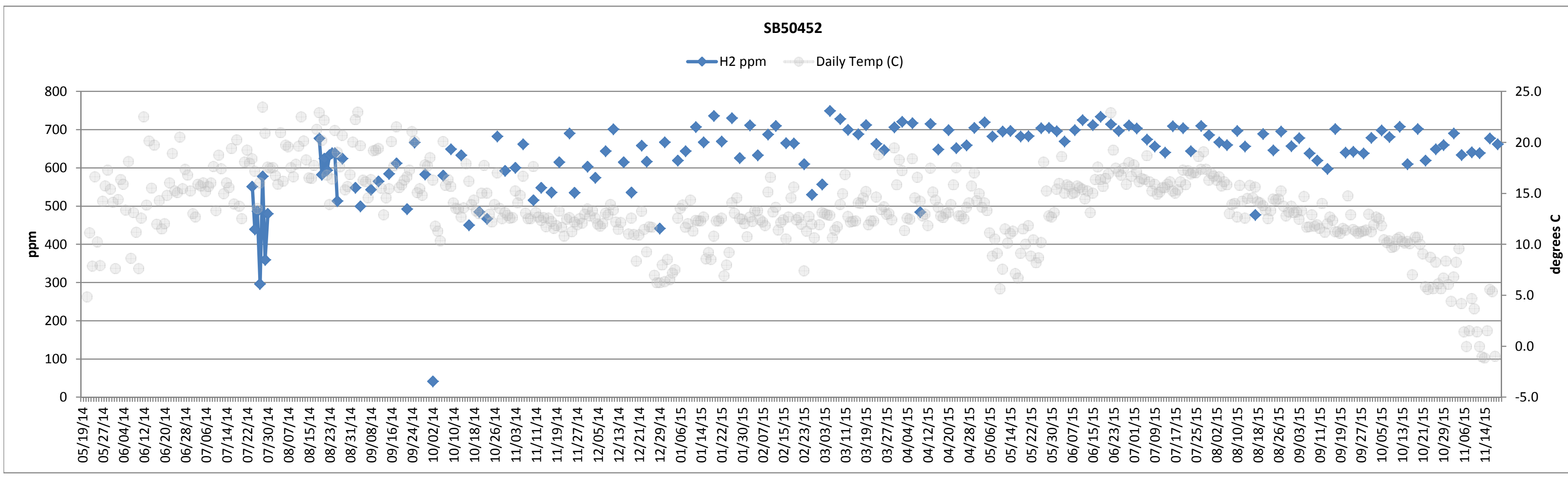
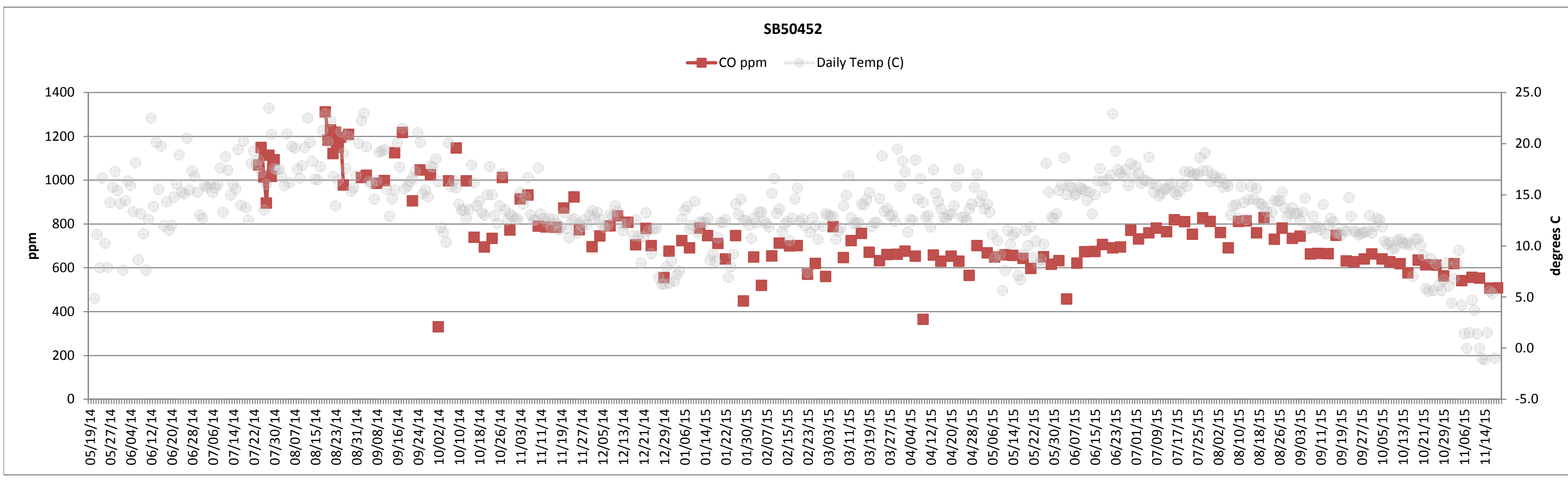
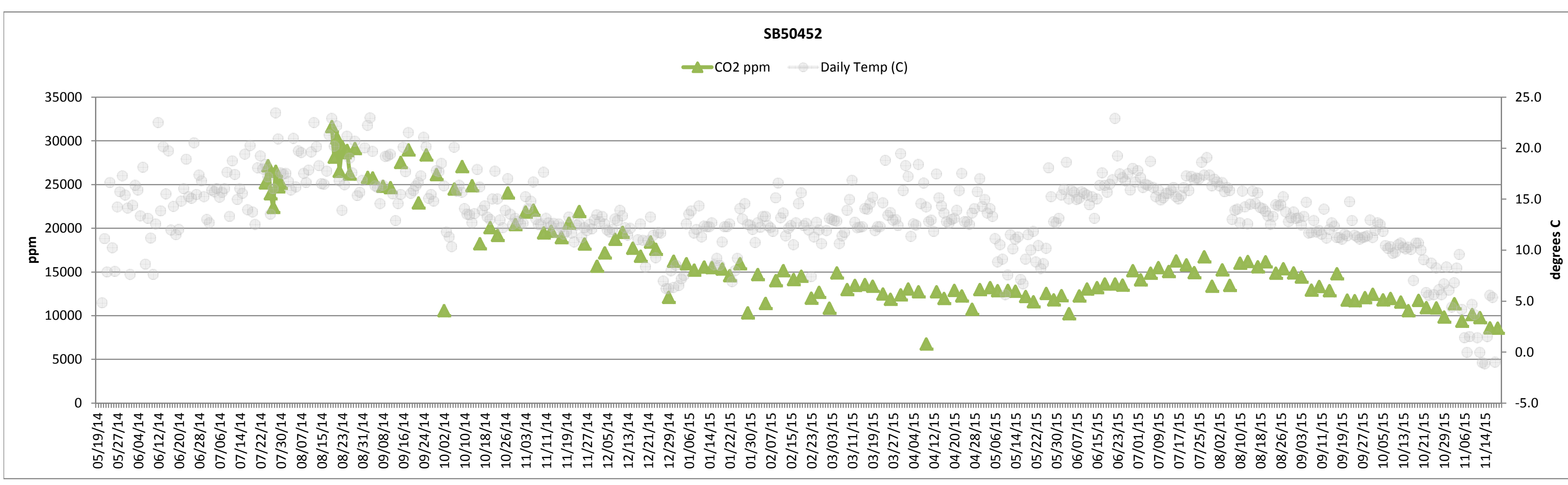
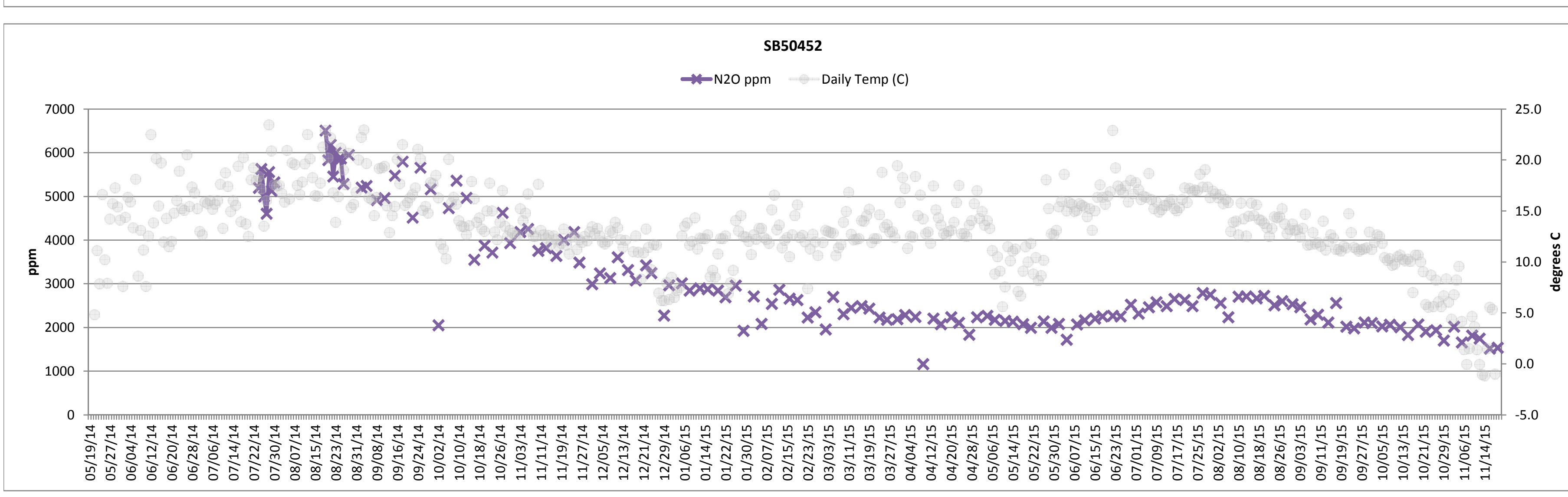
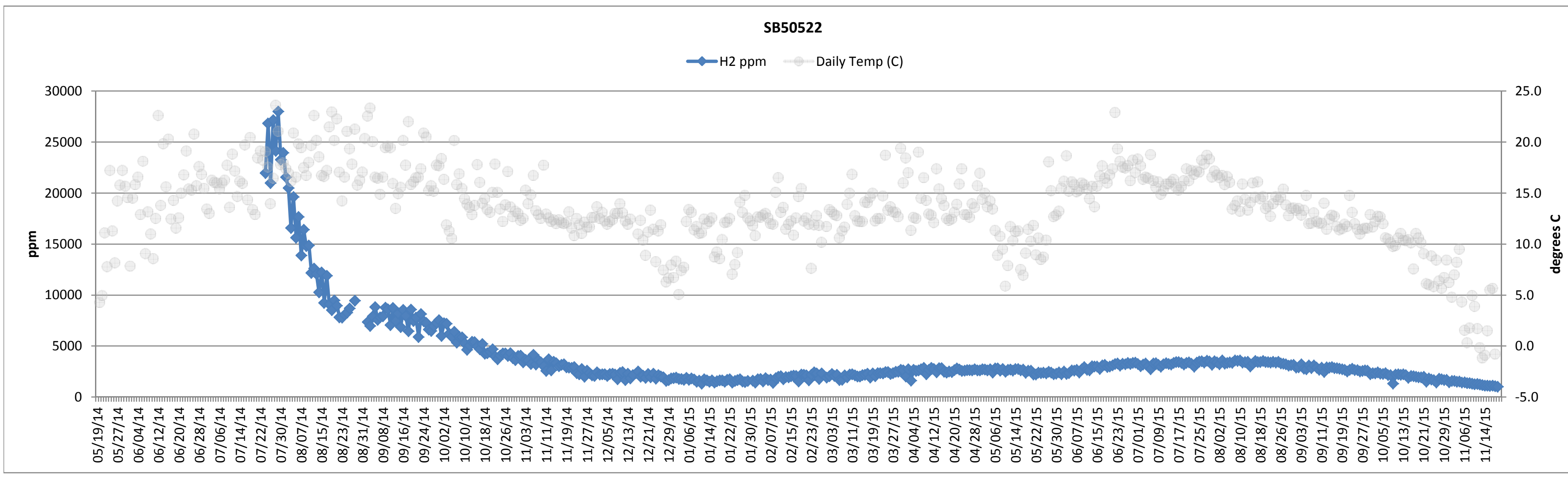


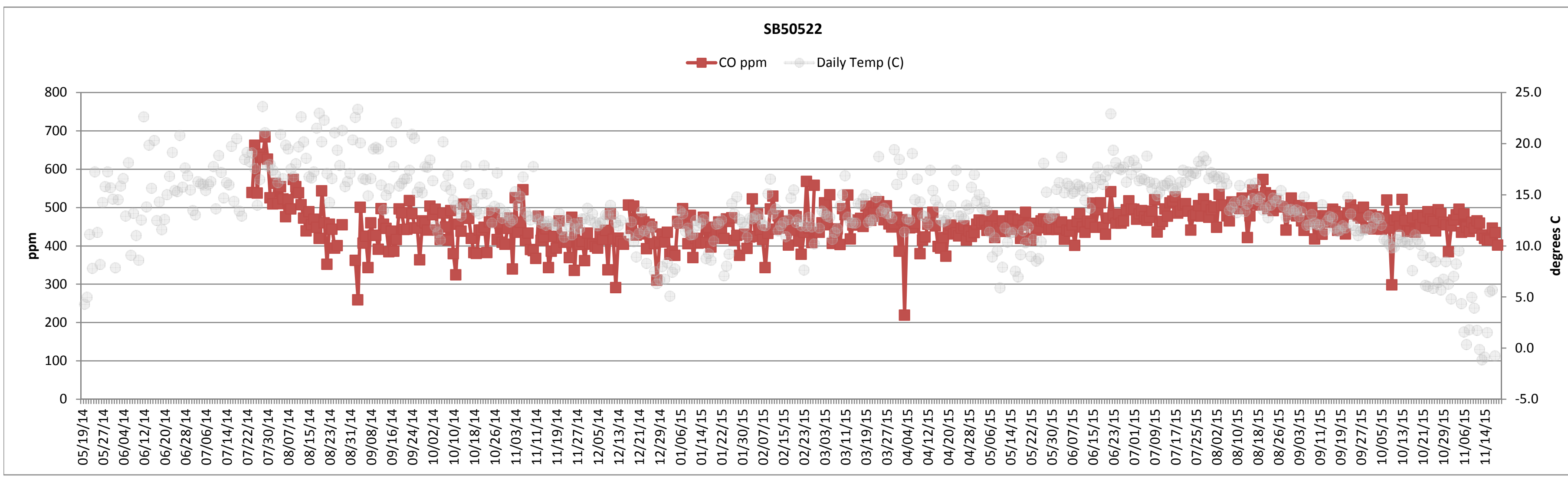


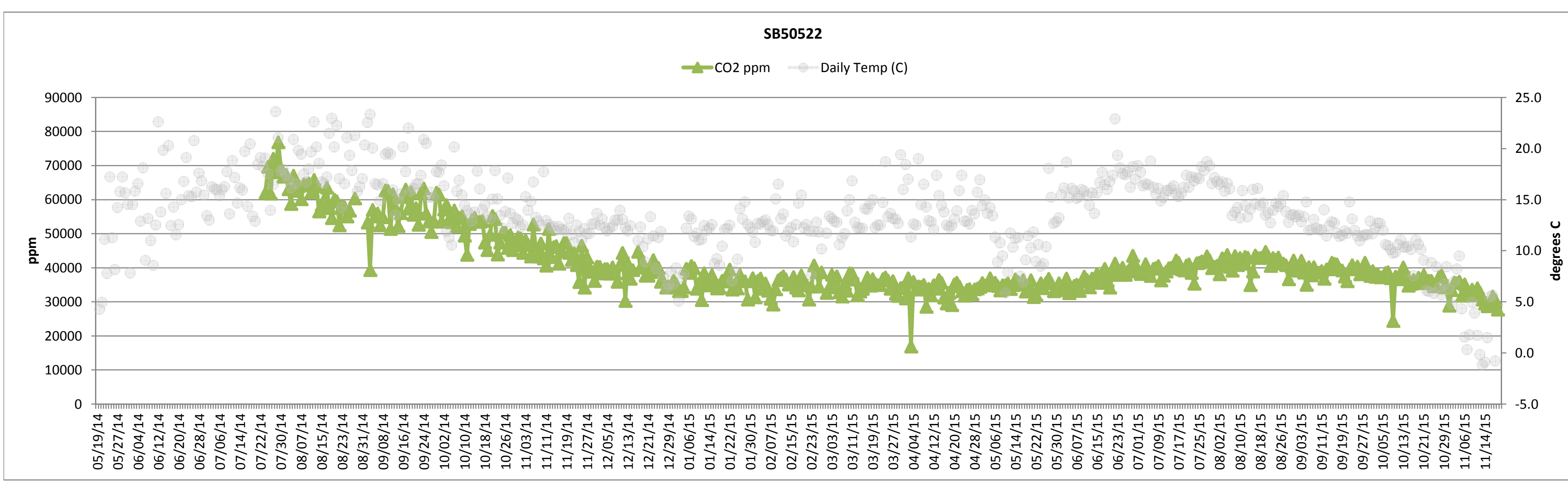


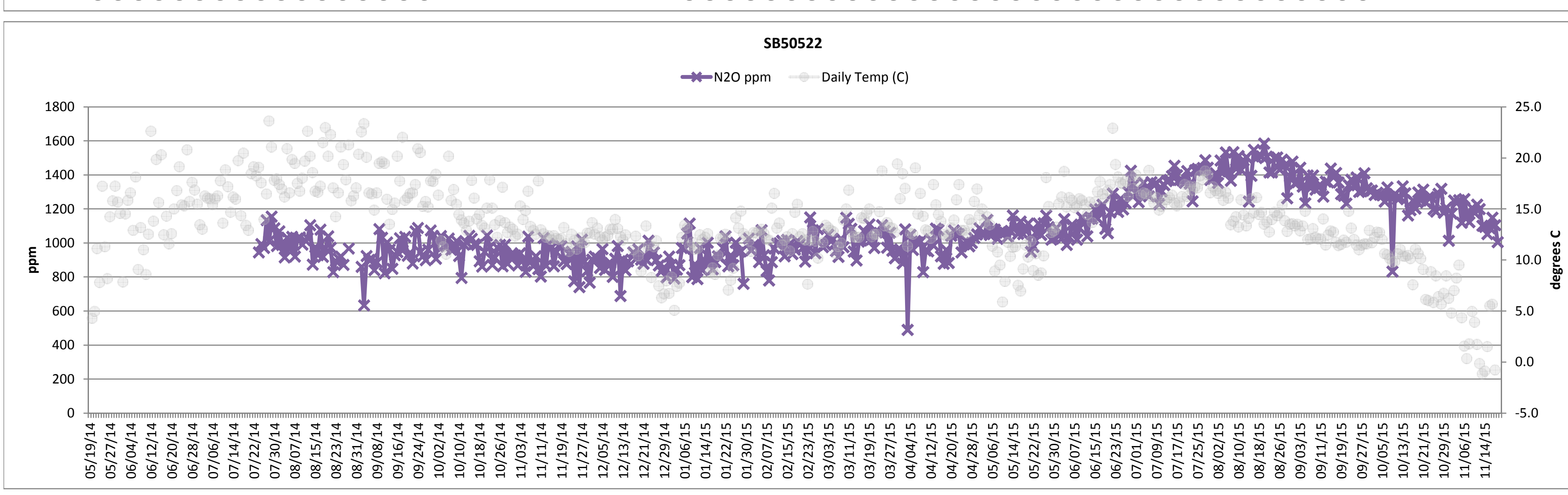


Remediated Nitrate Salt Container Headspace Gas and Temperature









Attachment 14

Los Alamos
NATIONAL LABORATORY

memorandum

Weapons Experiments Division

To/MS: Bruce A. Robinson, CNP, MS H816, robinson@lanl.gov
From/MS: David J. Funk, WX-DO, MS P942, djf@lanl.gov and David L. Clark, NSEC, MS T001, dlclark@lanl.gov
Phone/Fax: 7-9659 / 5-2326
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.

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.

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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