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Date: APR 1 1 2016
Symbol: EPC-DO-16-087
LA-UR: 16-22181
Locates Action No.: U1601004

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

Dear Mr. Kieling:

Subject: Replacement Pages for the Los Alamos National Laboratory Nitrate Salt-Bearing Waste Container Isolation Plan, Revision 5

The purpose of this letter is to submit replacement pages for the *Los Alamos National Laboratory (LANL) Nitrate Salt–Bearing Waste Container Isolation Plan, Revision 5* (Isolation Plan) as directed by the New Mexico Environment Department (NMED) in a letter dated March 25, 2016. The Los Alamos National Security, LLC (LANS) and the U.S. Department of Energy (DOE), collectively the Permittees, submitted the original draft of the Isolation Plan as required by the May 19, 2014, *Administrative Order,* which was then modified by letters on July 10, 2014; April 27, 2015; May 8, 2015; and August 12, 2015.

The Permittees have made the following changes to Revision 5 of the Isolation Plan:

1. **Part I, page 3:**
   The error was corrected and "Revision 4" was changed to "Revision 5".
2. **Part II.11, page 7:**
   The section was revised to indicate that corrected manifests had been received and provided to the NMED, and to clarify the rest of the section.
3. **Part IV.15, pages 23 (with editing marks) and 22-23 (clean-copy):**
   The Permittees plan to utilize the same trigger levels and response actions for all sized containers (standard waste boxes, 85-gallon and 55-gallon) in storage within the Technical Area 54, Area G, Dome 375 PermaCon©. The section was revised to replace "SWB" with "container" where appropriate.

For completeness and due to pagination changes, copies of the entire version of the *LANL Nitrate Salt–Bearing Waste Container Isolation Plan, Revision 5,* including all editing marks from Revision 4 and

without editing marks, are included as Enclosures 1 and 2. These enclosures are intended as replacement pages for the March 11, 2016 submittal. The crosswalk of changes and the attachments to the clean version of the Isolation Plan have not been provided with this submittal. Also, please note that the unlimited release number for the replacement pages was not revised and remains LA-UR-16-21411.

If you have comments/questions or would like to meet regarding this submittal, please contact Mark P. Haagenstad at (505) 665-2014 or David Nickless (505) 665-6448.

Sincerely,

John P. McCann
Acting Division Leader
Environmental Protection & Compliance Division
Los Alamos National Security, LLC

Sincerely,

Jody Pugh
Assistant Manager
National Security Missions
NNSA/Los Alamos Field Office

JPM:JMP:MPH:LRVH/lm

Enclosures: (1) Replacement pages for LANL Nitrate Salt-Bearing Waste Container Isolation Plan Revision 5 with Editing Marks
(2) Replacement pages for Clean-Copy LANL Nitrate Salt-Bearing Waste Container Isolation Plan Revision 5

Cy: Ryan Flynn, NMED, Santa Fe, NM, (E-File)
Kathryn Roberts, NMED, Santa Fe, NM, (E-File)
Dave Cobrain, NMED/HWB, Santa Fe, NM, (E-File)
Neelam Dhawan, NMED/HWB, Santa Fe, NM, (E-File)
Siona Briley, NMED/HWB, Santa Fe, NM, (E-File)
Douglas E. Hintze, EM-LA, (E-File)
Kimberly Davis Lebak, NA-LA, (E-File)
David J. Nickless, EM-WM, (E-File)
Lisa K. Cummings, NA-LA, (E-File)
Jody M. Pugh, NA-LA, (E-File)
Jordan Arnswald, NA-LA, (E-File)
Kirsten M. Laskey, EM-LA, (E-File)
Craig S. Leasure, PADOPS, (E-File)
William R. Mairson, PADOPS, (E-File)
Randall M. Erickson, ADEM, (E-File)
Cheryl D. Cabbil, ADNHHO, (E-File)
Michael T. Brandt, ADESH, (E-File)
Raeanna Sharp-Geiger, ADESH, (E-File)
Leslie K. Sonnenberg, EWMO-DO, (E-File)
John P. McCann, EPC-DO, (E-File)

Cy (continued):
Paul N. Newberry, WD-SRS, (E-File)
David E. Frederici, WD-WPE, (E-File)
Deborah K. Woitte, LC-ESH, (E-File)
Kenneth M. Hargis, WD-WPE, (E-File)
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NMED
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Mr. John E. Kieling, Chief
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2905 Rodeo Park Drive East, Building 1
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For completeness and due to pagination changes, copies of the entire version of the *LANL Nitrate Salt–Bearing Waste Container Isolation Plan, Revision 5,* including all editing marks from Revision 4 and

ENCLOSURE 1

Replacement pages for LANL Nitrate Salt-Bearing Waste Container Isolation Plan Revision 5 with Editing Marks

EPC-DO-16-087

LA-UR-16-22181

U1601004

Date: APR 1 1 2016

LANL Nitrate Salt-Bearing Waste Container Isolation Plan
Revision ~~4~~5

~~**December 2015**~~

March 2016

LA-UR-~~15-29287~~16-21411

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

~~This~~ Isolation Plan, Revision 4, ~~modifies~~modified and ~~updates~~updated the plan to include the following: ~~changes to the procedure~~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~~®; updates the procedure~~® and used for monitoring waste containers; ~~removal of~~removed the term "suspect" when referring to four waste containers discovered in February and March 2015; ~~updates~~updated status information for containers located at LANL; ~~introduces~~introduced additional flexibility in temperature measurement equipment~~, changes~~; changed the visual inspection frequency from hourly to daily~~.~~; and ~~incorporates~~incorporated NMED-directed changes to the frequency of written submittals to NMED from daily to monthly. Lastly, ~~this revision removes~~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 ~~includes~~included updated language for monitoring and potential response triggers/actions.

This Isolation Plan, Revision 5, incorporates the Permittees' plan to remove the overpack container lid from the 55-gallon remediated nitrate salt-bearing waste containers and add a pressure relief device with supplemental filtration to the waste container. Additional changes are also incorporated to correct language and provide for additional waste container sizes.

The ~~plan~~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 ~~or reevaluated~~ at LANL, and general information concerning remediation planning for unremediated and remediated nitrate salt waste containers currently stored at LANL.

Additional measures to those described in Isolation Plan, Revision 5~~4~~ may also be taken and will be identified to NMED during the technical calls established in Section IX.

II. Background and General Implementation Updates

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

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

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

and precautionary actions immediately to ensure protection of human health and the environment.

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

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

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

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

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

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

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

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

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

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

with either zeolite or grout. Based on the EMRTC testing, the LANL DWT concluded that the results can apply to LANL's non-cemented nitrate salts.

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

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

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

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

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

Method 1040. Additional analytical tests for ignitability have also been conducted on various surrogates related the investigation of nitrate-salt bearing wastes.

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

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

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

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

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

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

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.

III. Waste Container Categories

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

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

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

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

In total, there were 267 original nitrate salt parent containers identified during the initial query. A large portion of these 267 parent containers had been remediated into nitrate salt daughter

containers. As a result, the original inventory of nitrate salt-bearing waste containers was 707. After remediation, all of the remediated nitrate daughters were assigned to two homogeneous absorption waste streams; LA-MIN02-V.001 and LA-MIN04-S.001. However, after Real-time Radiography (RTR), daughter containers may have been re-assigned to a final waste stream based on the volume percentages of the final waste content.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Field Office. Since that time S855793 was determined to be the parent container of drums 68685 and 68660.

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

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

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

Some or all of these TIDs will be removed as part of the addition of pressure relief devices with supplemental filtration described in Section IV.16.

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

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

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

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

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

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

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

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

   The sprinkler system pre-action valve is automatically activated by a combination of any 2 of 3 types of electronic initiating devices located in the Dome or the Perma-Con®: smoke detection, heat detection, or fire alarm pull stations. During an event, fire alarm pull stations can be accessed and manually activated by staff. Pull stations are located in accordance with National Fire Protection Association (NFPA) standards in the Dome and the Perma-Con®. Also, access is facilitated by maintaining emergency egress aisles with a minimum aisle space of two feet in the Dome and the Perma-Con®. Further, in compliance with Permit Section 3.5.1(1), the Permittees will maintain adequate aisle

space to allow for the unobstructed movement of personnel, fire protection equipment, spill control equipment, and decontamination equipment within TA-54-375 Dome and Perma-Con®. Finally, in the event of an abnormal condition, staff will evacuate quickly and will promptly report to 911, the operations center or the shift manager. Should an abnormal condition be observed, the Permittees will implement their emergency response plan and provide notice to NMED within 24 hours.

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

7) The Permittees are monitoring, on a daily basis, the temperature of the ~~SWBs and 85 gallon~~overpack containers that contain remediated nitrate salt-bearing waste drums. As discussed above, all remediated nitrate salt-bearing containers are overpacked in SWBs or 85 gallon containers. ~~-~~Temperature measurements are taken of the top surface of the overpack container using a thermocouple, infrared thermometer, or Infrared Imaging Camera. After removal of SWB lids, temperature measurements will be 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 90 °F.

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

Additionally, these records and all temperature data (both daily, and if conducted as an additional measure under, hourly) will be available to NMED for inspection.

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

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

After removal of the overpack SWB lid, visual inspection of the 55-gallon waste containers within the open SWB will continue. During this time, visual inspection will be more difficult to conduct when compared to the closed SWB container, however, the drums will continue to be inspected 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 will be a more effective indicator of an abnormality, because the actual waste drum containing remediated nitrate salt-bearing waste will be the container inspected.

Additionally, the Permittees are using continuous air monitors (CAMs) with alarm capability, and will continue their use until further notice. There are CAMs in place in

the TA-54-375 Perma-Con® that can provide remote data if there is a significant airborne release. Lastly, the Emergency Response/Hazardous Materials organization has been briefed on the storage configuration.

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

8) The overpacks containing remediated nitrate salt-bearing waste containers are spaced an adequate distance apart to limit any potential interactions between the containers. This distance has been determined to be a minimum of ~~1 (~~one~~)~~ foot between containers. This distance is based on the Permittees' review of evidence from the event at WIPP, a calculation on the heat transfer from a container undergoing a similar reaction, and a review of fire protection and Permit requirements. ~~The~~Overpack containers ~~are currently~~have been stored with a minimum of 2 feet between containers and will not be moved prior to, or after, the addition of the pressure relief devices with supplemental filtration to the 55-gallon inner containers.

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

   The Permittees have performed a preliminary calculation on the minimum separation distance between containers to ensure that an incident in one container will not impact an adjacent container. Assuming the offending container reaches a maximum temperature of approximately 1100°F and that the adjacent container does not to exceed 200°F, the heat generated from the offending container drops off to below 200°F within 1 inch. The 2 foot spacing in use provides additional assurance that the adjacent containers will not be impacted by the heat generated during an exothermic event in a single container. Drawings that include the locations of the containers are included in *375 Permacon Nitrate-Salt Waste Container Abnormal Conditions*, EP-AREAG-RM-AOP-1299, R.1 (Attachment 4). The use of fire curtains in between containers will not provide a measurable reduction in the thermal conductivity across the 24 inches but does provide protection from flame impingement.

   Containers in the TA-54-375 Perma-Con® are placed in rows that allow for emergency egress and that have Permit compliant spacing between each row. If used, the fire

curtains will be placed within a row (that is, between the adjacent containers in that row) to mitigate the potential for interaction between adjacent containers. The Permittees have procured fire curtains are rated to a continuous temperature of 1800°F and intermittent temperatures of 2500°F.

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

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

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

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

Additionally, all originally identified remediated nitrate salt-bearing waste (in May 2014) were packed in new drums and overpacked into new SWBs, and suspect nitrate salt-bearing waste is located in 85 gallon overpacked POCs. Since SWBs and 85 gallon overpacked POCs are considered robust enough to prevent lid loss due to deflagration or fire, based on information in DOE-STD-5506-2007, they would act as a barrier to

provide a significant measure of worker protection. No other protective shields or barriers were~~are~~ deemed necessary for the protection of workers at this time.

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

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

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

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

After removal of the SWB lid, the internal 55-gallon remediated nitrate salt-bearing waste container will be stored within the open SWB. Appropriate labels will be applied to the top of the 55-gallon waste container and WCATS will be updated 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 will not be 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 will continue to be protective of human health and the environment, as daily visual inspections, temperature measurement, and headspace gas sampling on the 55-gallon drums will be 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 headspace gas sampling will be a more effective indicators of an abnormality, because the 55-gallon waste container will be 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_2, H_2, O_2, N_2, CH_4, CO, CO_2, and NO_4 in HSG samples. The HSG sample data (H_2, CO_2, CO, and N_2O) that the Permittees collected from the time the Isolation Plan was implemented through September 11, 2014 was included as an attachment to Isolation Plan Revisions 2 and 3. In conjunction with the data in those revisions and the data that the Permittees have provided in the written submissions, the Permittees have provided a current set of information to NMED. Attachment 11 graphically presents the H_2, CO_2, CO, and N_2O data collected for seven SWBs that are currently daily or twice weekly sampled. The CO_2 values are adjusted by the quantity of CO_2 in the field blank (i.e., the amount of CO_2 in the air at the time the sample is taken is subtracted from the CO_2 reading from the container). No other adjustments are made to the data.

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

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

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

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

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

The Permittees ~~continue to~~ conduct HSG sampling to measure concentrations of H_2, CO_2, CO and N_2O within the containers for the remediated nitrate salt-bearing waste. The Permittees:

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

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

HSG sampling was conducted for at least seven days on the four newly identified POCs (prior to overpacking). After the seven day sampling was completed, the POCs (~~now~~ 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 and N_2O after the addition of the pressure relief devices with supplemental filtration will continue following the same schedule described above.

The Permittees include HSG data (H_2, CO_2, CO and N_2O) in the written submissions provided to NMED, as established in Section IX. Between the data included with the Isolation Plan, Revisions 2 and 3 and the data that the Permittees provide in the written submissions, the Permittees have provided a current set of information to NMED. ~~Additionally, these~~These records, and all temperature data ~~will be~~, 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:
- Container 69490 (LA-MIN02-V.001)
- Container 69271 (LA-MIN03-NC.001)
- Container 68799 (LA-MIN03-NC.001)
- Container 57653 (LA-CIN01.001)

The range (high to low) of H_2 levels the Permittees observed in HSG data during that time frame was 28,020 parts per million (ppm) to 6,986 ppm. On July 30, 2014, the Permittees installed additional filters in the SWB to decrease concentrations. This approach was successful and concentrations of H_2 are present at a lower level. ~~Form~~ 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 temperature measurements through November 17, 2015 were:

SB50522 Temperature	Degrees Fahrenheit
High	84.1
Low	31.8

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

Dome 375 Cell 1 Temperature	Degrees Fahrenheit
High	90.6
Low	29.3

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

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

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

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

LANL began characterizing the headspace gas of 55 SWBs containing remediated nitrate salt-bearing waste for Volatile Organic Compounds (VOCs) by Gas Chromatography/ Mass Spectrometry (GC-MS) and for permanent gases using GC with a Thermal Conductivity Detector (GC-TCD). Permanent gases are those that remain gaseous at standard temperature and pressure. Daily monitoring of a subset of these 55 SWBs was initiated on May 19, 2014. All 55 SWBs have now been characterized. Elevated

concentrations of HSG compounds have been observed at concentrations well above normal atmospheric concentrations in some of these 55 SWBs (Attachment 13). These concentrations cannot be explained based on radiolysis of waste drum content and suggest that the gases are being produced from other processes. Specifically, N_2O is believed to result from the oxidation of material contained within the nitrate salt containing waste. The N_2O concentrations observed, ranging from (100 – 9000 ppm), are above the normal atmospheric concentration of ~ 350 ppb. The Permittees have ongoing work that may provide insight into this chemistry.

While high CO_2 concentrations (and potentially the ratio of CO_2 and H_2) are expected to be proportional to the magnitude of potential changes taking place in any given drum, they are not, on their own an indicator of significant changes to the waste within the container. ~~To date, LANL has~~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.10 above.

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

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

would be a strong indication that chemical reactivity has increased and therefore concern for safety would be increased.

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

16) As part of the Permittees continued evaluation for safe storage of remediated nitrate salt-bearing waste containers, tests continue with surrogate remediated nitrate salt-bearing waste mixtures. Current test results show that pressure is crucial to establishing a self-sustained thermal runaway in the tested material. These results point 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® that are within SWBs and are standard 55-gallon waste containers, not POCs. At this time, POCs stored within SWBs or 85 gallon overpack containers will not be opened.

The process for addition of the pressure relief devices with supplemental filtration will include opening the SWB overpack containers to gain access to the 55-gallon remediated nitrate salt-bearing waste container(s) within each overpack container, 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. Steps for this path forward are outlined below.

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

Removal of the SWB lid will be accomplished by first loosening all 42 lid bolts using a bit wrench. Bolts that strip, will be 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 be used concurrently within the TA-54-375 Perma-Con®. Although the tools proposed for use are not nonsparking tools, the potential for sparks will be minimized and the ignitable waste is sealed within the inner 55-gallon waste container.

When all of the bolts have been removed from the SWB, the lid will be removed and a radiological survey will be performed to verify that contamination levels are within radiological work permit limits. After this survey, the 55-gallon remediated nitrate salt-bearing waste drum will be visually inspected to ensure its integrity. The containers will be 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 will be conducted as outlined in Section IV.7.

Prior to the addition of the pressure relief device with supplemental filtration, an HSG sample will be collected from the 55-gallon drum for analysis. Within 24 hours of HSG sampling, the 2 inch bung will be removed from the 55-gallon drum by unscrewing. Operators will ensure that the tools used are at the same potential as the drum (through touching or bonding to the container). A borescope will be inserted in the bung hole to

examine the internal configuration of the waste within the container. If there is no indication of a chemical reaction, the process will continue on to the next step.

The liner bag in the 55-gallon drum will be pierced using a sharp instrument, and a pressure relief device with supplemental filtration will be screwed into the 2 inch bung hole. Piercing of the bag is necessary to ensure that there will be no pressure contained within the bag.

Remediated nitrate salt-bearing waste containers will remain in isolated storage within the TA-54-375 Perma-Con®. Regular HSG sampling and analysis to verify that the headspace gas concentrations are consistent with expected trends will be conducted as outlined in Section IV.12.

~~16)~~17) The isolation configuration described in this section continues to be protective of human health and the environment in light of the observed concentrations of H_2 and CO_2 in SWBs and 85 gallon containers, and in light of the conservative assignment of EPA Hazardous Waste Number D001. The facility being used for isolation is compliant with the LANL Hazardous Waste Facility Permit. The fire suppression systems, climate control and filtration systems, and other mechanisms described above are designed to protect human health and the environment in the event of a reaction within a container, a release, a fire, or an explosion. The Permittees continue to evaluate the effectiveness of the isolation configuration and will make changes to this configuration as appropriate to ensure continued protection of human health and the environment.

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

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

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

   Additionally, as described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including Dome 230.

This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants. These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

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

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

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

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

   Additionally, the Permittees used continuous air monitors CAMs with alarm capability. There were CAMs in place in the TA-54-231 Perma-Con® for the entire time unremediated nitrate salt-bearing waste containers were stored within the Perma-Con®.

Lastly, the Emergency Response/Hazardous Materials organization were briefed on the storage configuration while the containers were isolated.

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

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

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

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

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

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

some containers as described above), storage of the containers will meet all applicable conditions in Permit Section 2.8 and all other applicable sections of the LANL Hazardous Waste Facility Permit.

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

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

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

VI. Remediation Planning

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

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

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

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

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

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

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

discussions below include information about the Permittees' characterization of both legacy and newly generated cemented nitrate salt-bearing waste that has been generated since 1991.

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

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

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

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

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

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

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

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

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

VIII. Immediate Action Implementation Schedule

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

Activity	Due Date
Remediated Nitrate Salt-Bearing Waste Containers	
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
Pressure relief device with supplemental filtration	Scheduled to be complete prior to June 1, 2016.
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

Activity	**Due Date**
Remediation Team kick off	Completed 5/20/14

IX. Updates/Submissions

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

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

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

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

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

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

ENCLOSURE 2

Replacement pages for Clean-Copy LANL Nitrate Salt-Bearing Waste Container Isolation Plan Revision 5

EPC-DO-16-087

LA-UR-16-22181

U1601004

Date: APR 1 1 2016

LANL Nitrate Salt-Bearing Waste Container Isolation Plan
Revision 5

March 2016

LA-UR-16-21411

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LIST OF ATTACHMENTS

LA-UR-16-21411
March 2016

I. Introduction

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

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

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

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

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.

This Isolation Plan, Revision 5, incorporates the Permittees' plan to remove the overpack container lid from the 55-gallon remediated nitrate salt-bearing waste containers and add a

pressure relief device with supplemental filtration to the waste container. Additional changes are also incorporated to correct language and provide for additional waste container sizes.

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 5 may also be taken and will be identified to NMED during the technical calls established in Section IX.

II. Background and General Implementation Updates

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

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

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

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

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

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

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

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

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

8) On June 18, 2014, the Permittees began headspace gas (HSG) sampling on all SWBs containing remediated nitrate salt-bearing waste containers. The Permittees' intent was to

conduct HSG sampling on each of the 55 SWBs stored in the TA-54-375 Perma-Con®. This HSG monitoring was an additional measure above those described in the original May 19, 2014 Isolation Plan and the May 29, 2014 Revised Isolation Plan. When all 55 SWBs were sampled the Permittees transitioned to sampling a subset of the 55 SWBs on a regular basis.

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

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

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

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

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

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

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

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

11) The Permittees have finalized correspondence with Waste Control Specialists (WCS), the Waste Isolation Pilot Plant (WIPP), and any other agencies related to the assignment of EPA Hazardous Waste Number D001 to containers that were shipped to WCS and/or WIPP. The Permittees received copies of corrected manifests from WCS, but not WIPP to-date. The Permittees have provided NMED with WCS corrected manifests and will provide the WIPP corrected manifests within 15 business days of receipt. Additionally, the Permittees have provided NMED with all of the Permittees' other correspondence on this issue within Isolation Plan Revisions 2 & 3, and by letter dated October 22, 2015 (ENV-DO-15-0293).

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

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

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

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

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

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.

III. Waste Container Categories

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Some or all of these TIDs will be removed as part of the addition of pressure relief devices with supplemental filtration described in Section IV.16.

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

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

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

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

6) As described in Permit Attachment A.4.5 and Attachment D, TA-54 Area G, Table D-2, fire control equipment is located throughout Area G, including TA-54-375. This equipment includes ABC-rated or BC-rated fire extinguishers and several fire hydrants.

These fire hydrants will supply water at an adequate volume and pressure to satisfy the requirements of 40 CFR 264.32(d).

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

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

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

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

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

7) The Permittees are monitoring, on a daily basis, the temperature of the overpack containers that contain remediated nitrate salt-bearing waste drums. As discussed above, all remediated nitrate salt-bearing containers are overpacked in SWBs or 85 gallon containers. Temperature measurements are taken of the top surface of the overpack container using a thermocouple, infrared thermometer, or Infrared Imaging Camera. After removal of SWB lids, temperature measurements will be 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 90 °F.

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

   The Permittees performed visual inspections of these containers on an hourly basis, 24 hours per day, until the approval of the Permittees request to change the frequency of visual inspections from hourly to daily received on November 20, 2015 (ESHID-601027). On November 30, 2015, the Permittees began conducting daily visual inspections to identify abnormal conditions (e.g., signs of smoking and fire, evidence of deterioration, bulging). These activities are performed in accordance with LANL's

Procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring*, EWMO-AREAG-FO-DOP-1246, R.6. The Permittees maintain records of all visual monitoring. (See, Attachment 5) These records are updated on a daily basis and are available to NMED for inspection.

Recent studies, analysis, and a head space gas data report (Attachment 12) provides additional understanding of the safety of remediated nitrate salt-bearing waste containers onsite in the TA-54, Area G, Dome 375 Perma-Con®. The HSG data report demonstrated the correlation of HSG concentrations with environmental temperature, and showed that temperature influences the rate of chemical reaction. The HSG results provided a measure of chemical reactivity of the remediated nitrate salt waste stream that has greater fidelity than either temperature or visual monitoring. In fact, the HSG analysis can be used as an indicator of increased chemical reactivity and as an input to initiate a facility response for abnormal operating conditions. Visual inspection of the drums, while providing confirmation of an abnormal environment, is not a leading indicator of an abnormality. It is expected that any visual indication of an abnormality will be accompanied by a hot gas release, which would be detectable through continuous remote temperature monitoring of the 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 will continue. During this time, visual inspection will be more difficult to conduct when compared to the closed SWB container, however, the drums will continue to be inspected 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 will be a more effective indicator of an abnormality, because the actual waste drum containing remediated nitrate salt-bearing waste will be the container inspected.

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

Action levels have been established and response instructions prepared. These are contained in the LANL procedure on *Nitrate Salt-bearing TRU Waste Container Monitoring*, EWMO-AREAG-FO-DOP-1246, R.6 (Attachment 5). Should an abnormal condition be observed, the Permittees will implement their emergency response plan and

provide notice to NMED within 24 hours. Area G's building emergency plan is found in Attachment 6, and associated procedures are found at Attachments 7, 8, and 9.

8) The overpacks containing remediated nitrate salt-bearing waste containers are spaced an adequate distance apart to limit any potential interactions between the containers. This distance has been determined to be a minimum of 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 stored with a minimum of 2 feet between containers and will not be moved prior to, or after, the addition of the pressure relief devices with supplemental filtration to the 55-gallon inner containers.

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

   The Permittees have performed a preliminary calculation on the minimum separation distance between containers to ensure that an incident in one container will not impact an adjacent container. Assuming the offending container reaches a maximum temperature of approximately 1100°F and that the adjacent container does not to exceed 200°F, the heat generated from the offending container drops off to below 200°F within 1 inch. The 2 foot spacing in use provides additional assurance that the adjacent containers will not be impacted by the heat generated during an exothermic event in a single container. Drawings that include the locations of the containers are included in *375 Permacon Nitrate-Salt Waste Container Abnormal Conditions*, EP-AREAG-RM-AOP-1299, R.1 (Attachment 4). The use of fire curtains in between containers will not provide a measurable reduction in the thermal conductivity across the 24 inches but does provide protection from flame impingement.

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

   The NFPA consensus standards were also reviewed and NFPA 211 provided the most similar type of control. NFPA 211 covers the installation of chimney pipes and stoves and the distance recommended between the pipe and unprotected combustibles is 18

inches. There are no unprotected combustibles in the Perma-Con®s in Domes 231 and 375.

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

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

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

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

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

9) Prior to moving nitrate salt-bearing containers, the Permittees will notify the LANL Emergency Operations Center (EOC). The EOC will notify the Los Alamos Fire

Department and other responders, if needed. The Permittees will notify the EOC at the completion of the move. The Permittees do not anticipate that responders will be present during the movement of these containers, or that responders will be present/alerted during other actions.

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

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

    After removal of the SWB lid, the internal 55-gallon remediated nitrate salt-bearing waste container will be stored within the open SWB. Appropriate labels will be applied to the top of the 55-gallon waste container and WCATS will be updated 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 will not be 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 will continue to be protective of human health and the environment, as daily visual inspections, temperature measurement, and headspace gas sampling on the 55-gallon drums will be 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 headspace gas sampling will be a more effective indicators of an abnormality, because the 55-gallon waste container will be 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_2, H_2, O_2, N_2, CH_4, CO, CO_2, and NO_4 in HSG samples. The HSG sample data (H_2, CO_2, CO, and N_2O) that the Permittees collected from the time the Isolation Plan was implemented through September 11, 2014 was included as an attachment to Isolation Plan Revisions 2 and 3. In conjunction with the data in those revisions and the data that the Permittees have provided in the written submissions, the Permittees have provided a current set of information to NMED. Attachment 11 graphically presents the H_2, CO_2, CO, and N_2O data collected for seven SWBs that are currently daily or twice weekly sampled. The CO_2 values are adjusted by the quantity of CO_2 in the field blank (i.e., the amount of CO_2 in the air at the time the sample is taken is subtracted from the CO_2 reading from the container). No other adjustments are made to the data.

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

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

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

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

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

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

HSG sampling was conducted for at least seven days on the four newly identified POCs (prior to overpacking). After the seven day sampling was completed, the POCs (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 and N_2O after the addition of the pressure relief devices with supplemental filtration will continue following the same schedule described above.

The Permittees include HSG data (H_2, CO_2, CO and N_2O) in the written submissions provided to NMED, as established in Section IX. Between the data included with the Isolation Plan, Revisions 2 and 3 and the data that the Permittees provide in the written submissions, the Permittees have provided a current set of information to NMED. 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:
- 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 temperature measurements through November 17, 2015 were:

SB50522 Temperature	Degrees Fahrenheit
High	84.1
Low	31.8

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

Dome 375 Cell 1 Temperature	Degrees Fahrenheit
High	90.6
Low	29.3

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

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

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

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

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

While high CO_2 concentrations (and potentially the ratio of CO_2 and H_2) are expected to be proportional to the magnitude of potential changes taking place in any given drum, they are not, on their own an indicator of significant changes to the waste within the container. 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.10 above.

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

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

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

16) As part of the Permittees continued evaluation for safe storage of remediated nitrate salt-bearing waste containers, tests continue with surrogate remediated nitrate salt-bearing waste mixtures. Current test results show that pressure is crucial to establishing a self-sustained thermal runaway in the tested material. These results point 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® that are within SWBs and are standard 55-gallon waste containers, not POCs. At this time, POCs stored within SWBs or 85 gallon overpack containers will not be opened.

The process for addition of the pressure relief devices with supplemental filtration will include opening the SWB overpack containers to gain access to the 55-gallon remediated nitrate salt-bearing waste container(s) within each overpack container, 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. Steps for this path forward are outlined below.

Prior to opening the overpack container, an HSG sample will be collected from the SWB for analysis to verify the results do not indicate an adverse condition. Then, one of the four ¾ inch HEPA vent filters/plugs will be removed and a radiological survey will be

performed to verify contamination levels are within radiological work permit limits. If contamination levels are within permit limits, a borescope will be inserted in the vent hole to examine the condition of the SWB internals and the containers within the SWB. If there is no indication of a chemical reaction or drum deterioration, the Permittees will begin the process to remove the SWB lid.

Removal of the SWB lid will be accomplished by first loosening all 42 lid bolts using a bit wrench. Bolts that strip, will be 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 be used concurrently within the TA-54-375 Perma-Con®. Although the tools proposed for use are not nonsparking tools, the potential for sparks will be minimized and the ignitable waste is sealed within the inner 55-gallon waste container.

When all of the bolts have been removed from the SWB, the lid will be removed and a radiological survey will be performed to verify that contamination levels are within radiological work permit limits. After this survey, the 55-gallon remediated nitrate salt-bearing waste drum will be visually inspected to ensure its integrity. The containers will be 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 will be conducted as outlined in Section IV.7.

Prior to the addition of the pressure relief device with supplemental filtration, an HSG sample will be collected from the 55-gallon drum for analysis. Within 24 hours of HSG sampling, the 2 inch bung will be removed from the 55-gallon drum by unscrewing. Operators will ensure that the tools used are at the same potential as the drum (through touching or bonding to the container). A borescope will be inserted in the bung hole to examine the internal configuration of the waste within the container. If there is no indication of a chemical reaction, the process will continue on to the next step.

The liner bag in the 55-gallon drum will be pierced using a sharp instrument, and a pressure relief device with supplemental filtration will be screwed into the 2 inch bung hole. Piercing of the bag is necessary to ensure that there will be no pressure contained within the bag.

Remediated nitrate salt-bearing waste containers will remain in isolated storage within the TA-54-375 Perma-Con®. Regular HSG sampling and analysis to verify that the headspace gas concentrations are consistent with expected trends will be conducted as outlined in Section IV.12.

17) The isolation configuration described in this section continues to be protective of human health and the environment in light of the observed concentrations of H_2 and CO_2 in

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

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

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

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

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

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

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

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

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

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

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

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

warning signs posted at the entrance to the Perma-Con® in Dome 231 informing personnel of access restrictions.

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

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

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

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

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

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

   - CAMs with alarm capability are located within TA-54, Area G, Dome 230.
   - Waste will be stored with adequate aisle space (at least 2 feet) and separate from other wastes within the permitted unit.

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

VI. Remediation Planning

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

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

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

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

characteristics of ignitability (D001) and/or corrosivity (D002). Permittees shall discuss with NMED any permit modifications or authorizations that may be necessary for treatment of the nitrate salt-bearing wastes.

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

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

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

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

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

the contents. Analytical results provided to the NMED-HWB (ENV-DO-15-0313 or ESHID-601010) were used to determine that D001 and D002 were applicable for the subset of the LA-CIN01 waste stream that contain liquids (ADESH-15-162 or ESHID-601002). Management of these containers continues to be consistent with these types of wastes and do not require special isolation under this plan. Concurrently, the Permittees have reviewed existing RTR data (available for most of the LA-CIN01 waste containers), and will schedule RTR analysis for the remaining containers without RTR data, or pre-screen data, as soon as practicable.

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

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

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

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

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

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

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

VIII. Immediate Action Implementation Schedule

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

Activity	Due Date
Remediated Nitrate Salt-Bearing Waste Containers	
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
Pressure relief device with supplemental filtration	Scheduled to be complete prior to June 1, 2016.
Unremediated Nitrate Salt-Bearing Containers	
Movement of 85 gallon drums to designated areas (e.g., Domes 230, 231 and 375)	Began in Dome 230 on 5/1/14. All remaining moves completed on 6/3/14.
Daily/Hourly monitoring of containers	Daily/Hourly; began on 5/20/14 Daily/Hourly monitoring of containers was discontinued after the approval of Isolation Plan Revision 3 on 04/27/2015.
Appropriate spacing of containers	Completed in Dome 230 on 5/1/14. Completed in Domes 375 and 231 Perma-Con®s on 6/3/14
Updating procedures/safety basis documents for immediate implementation actions as appropriate	Completed 5/30/14
Remediation Team kick off	Completed 5/20/14

IX. Updates/Submissions

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

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

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

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

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

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