ERID-260905

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SEP 0 5 2014

Date:
Symbol: ADESH-14-088
LAUR: 14-26860, 14-26823, 14-26900
Locates Action No.: U1402058

Mr. Ryan Flynn
Secretary
New Mexico Environment Department
Harold Runnel Building
1190 Saint Francis Drive
P.O. Box 5469
Santa Fe, NM 87502

Dear Mr. Flynn:

Subject: **Response to Information Request Regarding the Los Alamos National Laboratory Nitrate Salt Bearing Waste Container Isolation Plan**

The purpose of this letter is to provide response and documentation requested by the New Mexico Environment Department (NMED) via letter dated August 7, 2014. The letter sent to the U.S. Department of Energy (DOE) and the Los Alamos National Security, LLC (LANS), the Permittees, contained comments and requested additional documentation associated with 57 remediated nitrate salt-bearing waste containers and 29 un-remediated nitrate salt-bearing waste containers.

Information requested by the NMED focused on the designation of U.S. Environmental Protection Agency (EPA) Hazardous Waste Numbers to the waste containers described above. Enclosure 1 includes a reproduction of the NMED comments followed by the Permittees response to the comment. Documentation has been added as attachments to Enclosure 1 as necessary to fully address each of the NMED comments. Responses included within the enclosure provide further information and rationale for the assignation of the EPA Hazardous Waste Number for ignitability (D001) to both remediated and un-remediated nitrate salt-bearing waste containers; the application of the EPA Hazardous Waste Number for corrosivity (D002) to certain un-remediated waste containers; and provide an update on progress in determining remediation plans and schedules.

If you have comments or questions regarding this submittal, please contact Mark P. Haagenstad at (505) 665-2014 or Gene E. Turner at (505) 667-5794.

Sincerely,

Michael T. Brandt, DrPH, CIH
Associate Director
Environment, Safety & Health
Los Alamos National Laboratory

Sincerely,

Peter Maggiore
Assistant Manager
Environmental Projects Office
Los Alamos Field Office
U.S. Department of Energy

MTB:KBL:MPH:LRVH/lm

Enclosures: (1) Response to Los Alamos National Laboratory Nitrate Salt Bearing Waste Container Isolation Plan, Los Alamos National Laboratory, EPA I.D. Number NM0890010515

Cy: Tom Blaine, NMED, Santa Fe, NM, (E-File)
John Kieling, NMED, Santa Fe, NM (E-File)
Steve Pullen, NMED/HWB, Santa Fe, NM, (E-File)
Timothy Hall, NMED/HWB, Santa Fe, NM, (E-File)
Trais Kliphuis, NMED, Santa Fe, NM, (E-File)
Kimberly Davis Lebak, NA-LA, (E-File)
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Michael T. Brandt, ADESH, (E-File)
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Information requested by the NMED focused on the designation of U.S. Environmental Protection Agency (EPA) Hazardous Waste Numbers to the waste containers described above. Enclosure 1 includes a reproduction of the NMED comments followed by the Permittees response to the comment. Documentation has been added as attachments to Enclosure 1 as necessary to fully address each of the NMED comments. Responses included within the enclosure provide further information and rationale for the assignation of the EPA Hazardous Waste Number for ignitability (D001) to both remediated and un-remediated nitrate salt-bearing waste containers; the application of the EPA Hazardous Waste Number for corrosivity (D002) to certain un-remediated waste containers; and provide an update on progress in determining remediation plans and schedules.

ENCLOSURE 1

Response to *Los Alamos National Laboratory Nitrate Salt Bearing Waste Container Isolation Plan, Los Alamos National Laboratory, EPA I.D. Number NM0890010515*

ADESH-DO-14-088

LA-UR-14-26860

Date: SEP 0 5 2014

Response to *LANL Nitrate Salt Bearing Waste Container Isolation Plan, Los Alamos National Laboratory, EPA I.D. NM0890010515*

This document provides response to the August 7, 2014, New Mexico Environment Department (NMED) correspondence referenced in the title above. The letter was issued to the United States Department of Energy and Los Alamos National Security, LLC (collectively the Permittees) to provide comment and request further information about 57 remediated nitrate salt-bearing waste containers and 29 un-remediated nitrate salt-bearing waste containers. The Permittees hereby respond for the Los Alamos National Laboratory (LANL) to the comments and information requests provided by the NMED.

The NMED comments are included verbatim in italics to help with review. The Permittees' responses follow each NMED comment. There are four attachments to this document. Attachment A includes analytical results for samples collected from an un-remediated nitrate salt-bearing waste container. Attachment B is a position paper referenced in the Central Characterization Project's (CCP's) acceptable knowledge documentation. Attachment C includes the real-time radiography (RTR) videos associated with the un-remediated nitrate salt-bearing waste containers. Attachment D is a list of un-remediated nitrate salt-bearing waste containers that have an Environmental Protection Agency (EPA) Hazardous Waste Number for corrosivity (D002) assigned to them.

NMED Comments and Permittee Responses:

1. *The Permittees shall describe the regulatory basis for "provisionally" assigning the EPA Hazardous Waste Number D001. NMED is not aware that this approach is supported by regulations or EPA guidance documents. If there are such provisions, the Permittees shall provide copies of or links to the documents.*

The Permittees recognize that the term "provisionally" is not used in the regulations or guidance documents. However, as noted in Permittees' July 30, 2014 notice to NMED regarding our application of the D001 waste number, Permittees are required to ensure that the initial characterization of any hazardous waste stream managed under the Permit is reviewed or repeated to verify that the characterization is accurate. Due to information learned from the recent incidents at WIPP, Permittees began the process of reevaluating the waste characterization information concerning these nitrate salt waste streams (as required by LANL Permit Section 2.4.7). Permittees determined that the D001 waste number may be applicable to the waste stream, and made the determination to conservatively apply the code to specified containers pending completion of the review. In recognition of the fact that further investigation might result in a determination that the D001 waste number is not applicable, Permittees stated that the

application of D001 was considered provisional and could change to include and/or remove containers/waste streams in the future. The Permittees will not remove the D001 label from these specified containers unless future waste re-characterization efforts specifically support its removal from a specific container or group of containers.

2. *The Permittees shall thoroughly describe and provide the reasoning and analyses for the speculation that both the remediated and un-remediated waste is an oxidizer and the subsequent assignment of EPA Hazardous Waste Number D001.*

The following describes the Permittees' reasoning and analysis supporting the conclusion to assign EPA Hazardous Waste Number D001 to the remediated and un-remediated nitrate-salt bearing wastes stored at LANL.

Un-Remediated Nitrate-Salt Bearing Waste

On May 22, 2014, LANL received analytical results from two samples taken from an un-remediated nitrate salt-bearing waste drum stored at Area G, 231 (Attachment A). 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) un-remediated 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). 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 been able to sample a remediated nitrate salt-bearing waste drum. Between July 22 and 29, 2014, LANL had surrogate samples of the waste tested by Southwest Research Institute of San Antonio, Texas. The surrogates were formulated using materials to approximate the remediated nitrate salt waste including *Swheat*™ 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. The test indicated that the surrogates sampled could be classified as oxidizers.
Additional oxidizer tests are also being conducted to determine if the waste stream meets the definition of an oxidizer. However, based on these results, LANL determined that it could not exclude the application of D001 to the remediated nitrate salt-bearing wastes. For these reasons, LANL determined to conservatively apply D001 to the remaining remediated nitrate salt-waste containers stored at LANL.

3. *The Permittees have verbally notified NMED that they have conservatively assigned EPA Hazardous Waste Number D002 to some of the 29 un-remediated nitrate salt-bearing waste containers. The Permittees shall thoroughly describe and provide the reasoning and analyses, including the associated documentation for each container (e.g., real-time radiography videos and batch data reports, visual examination batch data reports, etc.), why the un-remediated waste is corrosive and why the assignment of EPA Hazardous Waste Number D002 is appropriate.*

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 recent information, LANL evaluated the remaining un-remediated suspect nitrate salt-bearing waste containers to identify those with free liquids using RTR and high-energy RTR (HERTR) analysis. The testing identified that 26 of the 29 containers contained free liquids. As a conservative measure, based on this information, LANL applied the D002 code to these remaining un-remediated suspect nitratesalt-bearing waste containers identified with free liquids.

The 27 RTR fast scan videos that are provided (Attachment C) were completed during the prescreen process specified in CCP-TP-066, *CCP Radiography Screening Procedure for Prohibited Items*. This process is used as a preliminary check to screen candidate containers to determine if they qualify for the extensive formal Waste Isolation Pilot Plant certification process. Videos are not specifically required as part of this screening process but were completed to provide information to assist the host site with their remediation process. This screening procedure is not used to certify waste and therefore the videos do not need to meet the rigorous requirements that are used in the certification process. As the only analysis that has been conducted on the waste containers was for prescreen purposes, no other visual examination batch data or reports exist for these waste containers. RTR video recordings are not available for 2 of the 29 un-remediated suspect nitrate salt-bearing waste containers as historically RTR video recordings were not created.

4. *The Permittees shall provide a list of the un-remediated nitrate salt-bearing waste containers that have EPA Hazardous Waste Number D002 assigned to them. The list shall include the container ID and the approximate quantity of free liquids in the container.*

Attachment D includes a list of containers that have EPA Hazardous Waste Number D002 assigned to them. The determinations of volume estimates within Attachment D were based on review of the RTR videos provided in Attachment C. If the operator conducting the RTR referenced an estimated volume of liquids, the information was included. No volume estimations have been provided if there was no comment made by the operator regarding the quantity of liquid within the waste container. For the two containers for which RTR video was not available, records for the container have been reviewed to determine the availability of the information requested.

5. *The Permittees shall provide an update on the progress of determining remediation plans and schedules, including the processes and location(s) that will be used to treat the waste to stabilize nitrate salts and remove the characteristics of ignitability (D001) and corrosivity (D002).*

The Permittees continue to evaluate plans and schedules ready for disposal of the 57 remediated nitrate salt-bearing waste containers and will continue to report progress during weekly conference calls. As research and planning progresses, the Permittees would welcome meeting with NMED personnel to discuss remediation plans.

Attachment A

Analytical Results from Un-remediated Nitrate Salt-bearing Waste Container

LA-UR-14-26900

Los Alamos NATIONAL LABORATORY EST. 1943

memorandum

Actinide Analytical Chemistry

To/MS: Nancy Sauer, ADCLES, F629
Thru : Mark McCleskey, C-DO, MS J515
Thru: Felicia Taw, C-NR, MS J514
From/MS: Randy Drake, C-AAC, MS G740
Phone/Fax: 7-0686/Fax 5-4737

Symbol: CAAC-14-23
Date: May 22, 2014

SUBJECT: Analytical Results from the Area G Nitrate Salt Samples Submitted to C-AAC

Table 1 is a summary of the analysis results on sample 4174-1-6/7 and 4174-2-6/7. The results in Table 2 are the major and trace metals analysis values. Samples 4174-1-6 and 4174-2-7 were introduced into a radiological glovebox in CMR for partitioning and analysis. Samples 4174-1-7 and 4174-2-6 were assayed by gamma spectrometry and then sent to TA 48 (C-NR) for further analysis. The validated analytical procedures used by C-AAC are cited at the end of this document. The results have not been approved by formal QA release.

Table 1: Sample summary

Sample Summary	**4174-1-6**	**4174-2-7**
Sample mass	13.4638 grams	5.6808 grams
Moisture (LOI @ 110C)	11.8 %	24.5 %
Sodium	23.7 %	8.5 %
Magnesium	0.017 %	4.9 %
Nitrate	67 %	57 %
Chloride	150 ppm	55 ppm
Fluoride	170 ppm	36 ppm
pH of the solid, moistened	~ 1	~ 3
X-ray diffraction (XRD)	Sample was identified as $NaNO_3$ (sodium nitrate, or its mineral form, nitratine).	Sample was identified as a mixture of $NaNO_3$ and $Mg(NO_3)_2$ (Magnesium nitrate).
Comments	Slightly moist crystalline solid dissolved completely in water or 2% nitric acid.	Dry crystalline solid, deliquesced during heating. Flecks of brown residue remained after 2% nitric acid dissolution. Silicon, iron and calcium were detected in the undissolved fraction; less than 1% of the

		total mass. Magnesium nitrate is a hygroscopic salt with 6 waters of hydration. The heating to 110 °C may not have released all the bound water.
Mass Spectrometry	**4174-1-6**	**4174-2-7**
Am-243/Am-241 atom ratio	1.8 E-05 (+/- 8%)	
Pu-240/Pu-239 atom ratio	0.09408 (+/- 0.106 %) Typical weapons grade < 0.06	
Gamma spec (NDA)	**4147-1-7**	**4174-2-6**
Sample mass	10.05 g	4.795 g
Pu-239 mass	1.41 E-04 g	2.86 E-04 g
Pu-239 activity	1.94 E+07 dpm	3.93 E+07 dpm
ppm Pu-239 (μg/g)	14	60
Am-241 mass	1.11 E-04 g	9.20 E-07 g
Am-241 activity	8.41 E+08 dpm	6.99 E+06 dpm
ppm Am-241 (μg/g)	11	0.2
Np-237 mass	6.15 E-06 g	1.90 E-07 g
Np-237 activity	9.83 E+03 dpm	2.97 E+02 dpm
ppm Np-237 (μg/g)	0.6	0.04
Am-243 mass	< 4.57 E-10 g	< 2.59 E-10 g
Am-243 activity	< 202 dpm	< 115 dpm
ppt Am-243 (pg/g)	< 45	< 54

Table 2: Major and Trace Elements Analysis Values

Metal	**4174-1-6 (ppm)**	**4174-2-7 (ppm)**
Sodium	240000	85000
Magnesium	170	49000
Potassium	1800	240
Aluminum	12	700
Barium	4	
Boron	3	1
Cadmium	2	
Calcium	180	69
Cerium	1	
Chromium	68	7
Copper	12	5
Gallium	1	3
Iron	270	38

Lanthanum	2	
Lead	110	3
Manganese	6	7
Mercury	3	
Molybdenum	20	
Neptunium	1	
Nickel	37	37
Tin	1	
Titanium	3	
Uranium(238)	840	9
Zinc	34	

The analytical procedures and work instructions used are given below. The "*" denotes that a variance was requested and used in accordance with QA-6, Record of Variance.

1) ANC 102, Inductively Coupled Plasma—Mass Spectrometry Using the VG Elemental Plasma Quad
2) *ANC130, Preparing Plutonium and Uranium Samples for Isotopic Analysis and Isotope Dilution Analysis
3) ANC 1311, Operation of the VG-3 (Sector 54) Mass Spectrometer
4) ANC 204, Preparation and Loading of Filaments for Mass Spectrometry
5) ANC 212, Ion Chromatography
6) ANC 221, Operating the Jobin-Yvon (JY) Inductively Coupled Plasma – Atomic Emission Spectrometer
7) *NF-ANC 124, Nuclear Materials—Weight Loss Determination
8) ANC 131, Determination of Uranium and Plutonium Isotopic Distribution and Assay by Isotope Dilution Mass Spectrometry
9) ANC 1325, X-Ray Fluorescent Spectrometers in CMR
10) WI-1, Working in Chemical Fume Hoods, Open-Front Boxes, and Gloveboxes at CMR
11) WI-5, Analytical Sample Receipt, Subsampling, and Distribution within Analytical Chemistry
12) WI-30, Chemical Analysis, Characterization and Research
13) WI-57, X-ray Diffraction
14) QA-1, Actinide Analytical Chemistry Quality Assurance Program
15) QA-6, Record of Variance

Cy: C-AAC File

Attachment B

Amount of Zeolite Required to Meet the Constraints Established by the EMRTC Report RF 10-13: Application to LANL Evaporator Nitrate Salts

Amount of Zeolite Required to Meet the Constraints Established by the EMRTC Report RF 10-13: Application to LANL Evaporator Nitrate Salts

5/8/2012

LANL-Carlsbad Office Difficult Waste Team

Purpose:

The following document was developed in support of the Los Alamos National Laboratory Transuranic Program (LTP) by the LANL-Carlsbad Office, Difficult Waste Team. The document is divided into five sections, with the section on conclusions provided first, followed by background, assumptions, discussion, and recommendation.

Conclusions:

1. Nitrate salts not yet remediated having no free liquid should be mixed with at least 1.2 volumes of Kitty Litter/Zeolite clay per volume of nitrate salts. For operational efficiency at WCRRF (rule-of-thumb) for every gallon of nitrate salt present the addition of two (2) gallons of zeolite/kitty litter may be added to help ensure the final mixture meets or exceeds EMRTC testing constraints.
2. Nitrate salts not yet remediated but having free liquids should be mixed with at least 1.2 volumes of Kitty Litter/Zeolite clay per composite volume of nitrate salt and liquid.[1] Ensure that no free liquid remains. For operational efficiency at WCRRF (rule-of-thumb) for every gallon of nitrate salt present the addition of two (2) gallons of zeolite/kitty litter may be added to help ensure the final mixture meets or exceeds EMRTC testing constraints.
3. Nitrate Salts previously remediated with Waste Lock 770® should be mixed with at least 1.2 volumes of Kitty Litter/Zeolite clay per composite volume of nitrate salt, absorbed liquid and Waste Lock 770®. For operational efficiency at WCRRF (rule-of-thumb) for every gallon of nitrate salt present the addition of two (2) gallons of zeolite/kitty litter may be added to help ensure the final mixture meets or exceeds EMRTC testing constraints.

Background:

Nitrates salts from evaporator operations at TA55 were packaged (up to around 1991) primarily in plastic bags and ranged in moisture content up to saturation (generator knowledge states the salts were "cursorily drained of liquid").[2] Visual review by WCRRF operators of nitrate salts brought to WCRRF for remediation showed that almost all of

[1] When free liquids are readily apparent, the use of a "fired zeolite clay" product may be more efficient in holding free liquids than non-fired (e.g., ordinary kitty litter). The following are examples only of some fired zeolites and no endorsement is made for any of the examples given: Oil-Dry QuickSorb1™, ZeoFill™, or Zeolit™.

[2] Email Gerald W. Veazey to Randy Fitzgerald, August 9, 2011, subject: *"RE: Information on 47 Drums of Suspect Nitrate Evaporator Salts (from TA-55)".*

evaporator salt drums had free liquids (as much as 12 gallons) or the salt itself appeared quite wet. As a result, the LANL TRU Program (LTP) added Waste Lock 770[3] ® as an absorbent to the free liquids and wet salt. In some cases several 50-pound bags of Waste Lock 770® were used to absorb the volume of free liquid present in a drum.[4] Neither the volume nor weight of Waste Lock 770® added to drums or POCs was recorded for the remedial nitrate salt actions taken at WCRRF.

Nitrate salts brought into WCRRF for remediation were not weighed nor were their volumes estimated. Salts that did not have free liquids were not mixed with Waste Lock 770®. A surface dose rate was taken directly on these nitrate salts and if the reading was >180 mrem/hr the salts were packaged into a 12" Pipe Overpack Container (POC). Nitrate salts having free liquids with surface dose rates > 180 mrem/hr were packaged into 12" POCs with Waste Lock 770®.

Currently, there are four (4) basic categories of evaporator nitrate salts identified by LTP in Solution Package - SP 72:

1. Non-remediated salts without free liquids, that may or may not have lead shielding
2. Non-remediated salts with free liquids, that may or may not have lead shielding
3. Salts repackaged into drums or POCs that did not have free liquids (no Waste Lock 770® added)
4. Remediated salts repackaged into drums or POCs that did have free liquids (Waste Lock 770® has been added)

The Energetic Materials Research and Testing Center (EMRTC)[5] operating in conjunction with LANL-Carlsbad Office and Washington TRU Solutions previously tested the most oxidizing mixture of sodium and potassium nitrate salts mixed with zeolite or grout. The results of EMRTC[6] 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. The results apply to LANL non-cemented nitrate salts. Accordingly, the application of the constraints established by EMRTC to the LANL evaporator nitrate salts, with certain bounding assumptions, provides sufficient information for the WIPP to affirm

[3] http://www.m2polymer.com/html/waste_lock_770.html. "[A] solid, granular superabsorbent polymer [that is] cross-linked polyacrylate material [that] swells and absorbs many times its weight in aqueous solutions…suited for the absorption and solidification of low level radioactive waste (LLRW)." Waste Lock 770®has a bulk density of 5.4 – 6.0 lbs/gal., for use in solutions with pH>4 (pH adjustment is recommended for pH4 or less).

[4] Oral communication with Energy Solutions WCRRF operations manager regarding the amount of Waste Lock 770® needed to absorb free liquids in some of the evaporator nitrate salts drums remediated at WCRRF.

[5] EMRTC is an approved examining agency (DOT/UN Testing and Classifications) for explosives and other hazardous materials.

[6] Graham Walsh, Research Scientist, Energetic Materials Research and Testing Center, New Mexico Institute for Mining and Technology, Socorro, New Mexico (Certified DOT Testing Laboratory), "*Results of Oxidizing Solids Testing, EMRTC Report RF 10-13*" prepared for Washington TRU Solutions, LLC, March 12, 2010.

that the LANL nitrate salts, when mixed with zeolite/kitty litter, will be considered a non-oxidizing solid.

Assumptions:

1. Bulk density of KNO_3 is approximately 0.8 g/cc and the crystal density about 2 g/cc; accordingly, the assumed density for the nitrate salt is 1 g/cc.[7]
2. Bulk density of kitty litter is about 0.4 g/cc to 0.5 g/cc.[8] Kitty litter is assumed to be ½ the bulk density of the nitrate salt.
3. Nitrate salts were loaded into POCs if the surface dose rate of the bare salt was >180 mrem/hr.
4. Density of the Waste Lock 770® plus water is assumed to be 1 g/cc (Waste Lock 770® is around 0.71 g/cc but the addition of water increases the density closer to 1)[9]
5. Cellulose used in the testing is more readily oxidized than Waste Lock 770®
6. The nitrate salts themselves cannot be readily removed from the salt/Waste Lock mixture
7. Weighing the mass of previously remediated nitrate salts in the WCRRF glovebox is impractical but the volume of the remediated salts can be estimated visually or by simple measurement (measurement of depth). Therefore, at least 10% excess of zeolite will be added to account for measurement error of the volume.

Discussion:

The bounding ratios for zeolite from the EMRTC report are:

50 wt.% cellulose
33 wt.% of nitrate salts
18 wt.% of zeolite/kitty litter

Using the assumptions stated above these values correspond to the following bounding volume ratios:
For nitrate salts not mixed with Waste Lock 770®:

48 vol.% of nitrate salts
52 vol% of zeolite/kitty litter

[7] See Merck http://www.merckmillipore.com/is-bin/INTERSHOP.enfinity/WFS/Merck-International-Site/en_US/-/USD/ViewPDFPrint.pdf?RenderPageType=ProductDetail&CatalogCategoryID=&ProductUUID=vdab.s1OzvUAAAEWevAW4z8b&PortalCatalogUUID=6dCb.s1Lbk0AAAEWf9cfVhTl, crystal density is listed at 2.109 in the Chemical Rubber Handbook for potassium nitrate.
[8] http://www.alibaba.com/showroom/cat-litter-bulk.html
[9] See footnote 2. The density of Waste Lock 770® is around 0.71 g/cc but the absorption of water increase the final density closer to 1 g/cc.

Therefore, for every liter of nitrate salt present at least 1.2 liters of zeolite/kitty litter must be added. For operational efficiency at WCRRF (rule-of-thumb) for every gallon of nitrate salt present the addition of two (2) gallons of zeolite/kitty litter may be added to help ensure the final mixture meets or exceeds EMRTC testing constraints

For nitrate salts mixed with Waste Lock 770® there is a certain ratio of Waste Lock 770® to nitrate where less zeolite than the pure nitrate case would be necessary to result in a non-oxidizing mixture. However the ratio of Waste Lock 770® to nitrate is not known so no credit can be taken for the dilution of nitrate. Therefore, for every liter of composite nitrate salt, absorbed liquid and Waste Lock 770® present at least 1.2 liters of zeolite/kitty litter must be added. For operational efficiency at WCRRF (rule-of-thumb) for every gallon of nitrate salt present the addition of two (2) gallons of zeolite/kitty litter may be added to help ensure the final mixture meets or exceeds EMRTC testing constraints.

Recommendation:

Actual tests at WCRRF have demonstrated a 10X reduction in dose when the salts are loaded into 55-gallon drums; therefore, some of the salts previously packaged into POCs at WCRRF were done under an overly conservative constraint and could be re-packaged into 55-gallon drums and still meet the <200 mrem/hr surface dose rate on the outside of the 55-gallon drum.

Attachment C

Real-Time Radiography Videos

LA-UR-14-26823

Attachment D

Un-remediated Nitrate Salt-Bearing Waste Containers Assigned Corrosivity (D002) Hazardous Waste Number

LA-UR-14-26860

PKG_ID	Liquids Observed in the RTR Video (gallons)	Liners inside the 55 gallon Drum: 90 Mil Poly and Lead	Free Liquid	Liquid Between 55g and 85g Drums
S851415	> 0.5 gallons	Historic RTR No Information on Liner Recorded	Yes	Historic RTR No Information on Liquid Between Drums Recorded
S844602	4.5 gallons	Historic RTR No Information on Liner Recorded	Yes	Historic RTR No Information on Liquid Between Drums Recorded
S802701	> 0.26 gallons	90 mil Poly and Lead	Yes	No
S813389	5 gallons	90 mil Poly and Lead	Yes	No
S793724	1-2 gallons	90 mil Poly and Lead	Yes	No
S801676	1-2 gallons	90 mil Poly and Lead	Yes	No
S802739	1-2 gallons	90 mil Poly and Lead	Yes	No
S802833	5 gallons	90 mil Poly and Lead	Yes	No
S803078	2-3 gallons	90 mil Poly and Lead	Yes	No
S804948	1-2 gallons	90 mil Poly and Lead	Yes	No
S804995	2 gallons	90 mil Poly and Lead	Yes	No
S805051	> 0.53 gallons	90 mil Poly and Lead	Yes	No
S805289	3 gallons	90 mil Poly and Lead	Yes	No
S813385	1 gallons	90 mil Poly and Lead	Yes	No
S813545	3-4 gallons	90 mil Poly and Lead	Yes	No
S816434	1 gallons	90 mil Poly and Lead	Yes	No
S816810	5 gallons	90 mil Poly and Lead	Yes	No
S818435	5 gallons	90 mil Poly and Lead	Yes	No
S822599	3-4 gallons	90 mil Poly and Lead	Yes	No
S822713	4-5 gallons	90 mil Poly and Lead	Yes	No
S822844	15-20 gallons	90 mil Poly and Lead	Yes	No
S823124	None	Lead Only	No	No
S823184	5 gallons	90 mil Poly and Lead	Yes	No
S825878	None	90 mil Poly and Lead	No	No
S825879	> 0.53 gallons	90 mil Poly and Lead	Yes	No
S842446	None	No Liners	No	No
S853714	2-3 gallons	90 mil Poly and Lead	Yes	No
S862888	2-3 gallons	90 mil Poly and Lead	Yes	No
S864213	< 5 gallons	90 mil Poly and Lead	Yes	No