



**INDEPENDENT REVIEW TEAM REPORT
REGARDING UNCEMENTED NITRATE WASTE
AT LOS ALAMOS NATIONAL LABORATORY**

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SUBMITTED BY:

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ACRONYMS

ADEP	Associate Director for Environmental Protection
ADESH	Associate Director for Environment, Safety, and Health
ADNHHO	Associate Director for Nuclear and High-Hazard Operations
AK	Acceptable Knowledge
BIO	Basis of Interim Operation
DDP	Drum Disposition Project
DWT	Difficult Waste Team
ENV	Environmental Protection Division
ES	Energy Systems
ES&H	Environment Safety and Health
EWMO	Environmental Waste Management Operations
FCA	Facility Centered Assessment
FOD	Facility Operations Director
IH	Industrial Hygienist
IHSD	Industrial Hygiene and Safety Division
IPT	Integrated Project Team
ISMS	Integrated Safety Management System
IWD	Integrated Work Documents
JON	Judgment of Need
L&A	Longenecker and Associates
LANL	Los Alamos National Laboratory
LANS	Los Alamos National Security
LTP	LANL Transuranic Program
MAR	Material at Risk
MOV	Management Observations and Verifications
NHHO	Nuclear and High-Hazard Operations
R&D	Research and Development
R2A2	Roles Responsibilities Accountabilities and Authorities
RAD	Responsible Associate Director
RANT	Radioassay and Nondestructive Testing
RCA	Root Cause Analysis
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RLM	Responsible Line Management
RP	Radiation Protection
SCWE	Safety Conscious Work Environment
SME	Subject Matter Expert
SOM	Shift Operations Manager
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination

WAC	Waste Acceptance Criteria
WCRRF	Waste Characterization Reduction and Repacking Facility
WIPP	Waste Isolation Pilot Project

Executive Summary

Following a determination that waste material from Los Alamos National Laboratory (LANL or the Laboratory) might have played a contributing role in the release of airborne radioactivity that occurred at the Waste Isolation Pilot Plant (WIPP) on February 14, 2014, the LANL Laboratory Director commissioned an independent, systemic, root cause analysis (RCA) of the factors that led to various permitting noncompliances and the use of inappropriate materials in the packaging of uncemented nitrate salt bearing wastes from LANL. To assure the independent nature of this review, LANL selected Longenecker & Associates (L&A) to perform this analysis. L&A in turn contracted with three individuals that comprised the RCA Team (Team). The Team was given complete and unrestricted access to all files, information, and staff associated with this assignment. This report is the final product of that review.

The RCA was carried out over a six-week period in three phases. Phase 1 involved the review of numerous documents and prior analyses that were performed by the Laboratory and others. These prior reviews helped establish both the basic timeline of events that occurred prior to the releases at WIPP as well as the specifics of "what" happened. Phase 2 was carried out at the Laboratory and involved in-depth briefings and interviews with many of the key stakeholders ranging from the glovebox operators who participated in the packaging of the WIPP waste in question, to the Laboratory Director and his management team. This phase focused primarily on "why" the events took place. Phase 3 included: the analysis of the data presented, interpretation of the interviews conducted, and determination of the Team's findings. These inputs were then used to determine the root causes that led to these problems.

The four primary root causes are illustrated in Figure 1 to better communicate their highly interrelated and systemic nature. A fifth "generic" root cause pertaining to requirements management was also identified.

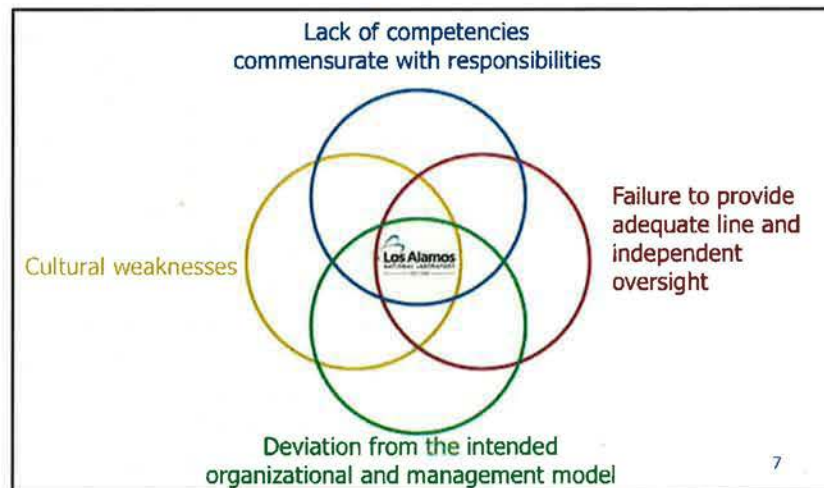


Figure 1: Primary Root Causes

Based on these root causes, the Team identified eight (8) Judgment of Needs (JONs) that are summarized in Table 1.

Table 1: Judgment of Needs

Root Cause	JONs
Lack of competencies commensurate with responsibilities	JON-1: All LANL ADEP staff needs to have technical and managerial competencies commensurate with their assigned responsibilities
Deviations from the intended Organizational and Management Model	JON-2: The LANL organization and management model needs to be implemented per laboratory policy in ADEP, especially as it pertains to waste processing positions, corresponding roles and responsibilities, and reporting chains
	JON-3: The Associate Director for Environmental Protection (ADEP) procedure review process needs to have greater formality and rigor.
Failure to provide adequate line and independent oversight	JON-4: ADEP line management needs to conduct oversight that is comprehensive from initial work planning through task completion. It must be tailored to the risks involved and must be performed rigorously by knowledgeable and competent individuals.
	JON-5: Defense in depth independent oversight, e.g., from ADESH, ADNHHO, Parent Organizations, etc. needs to be assertive in identifying and correcting technical, operational, and organizational problems from high level management systems down to work floor activities.
Cultural weaknesses	JON-6: LANL management needs to assure a consistent, robust, and healthy nuclear safety culture exists throughout the Laboratory.
	JON-7: LANS, LLC needs to improve alignment and teamwork by all of its member organizations.
Requirements management	JON-8: LANL management needs to ensure the comprehensive set of

	technical, regulatory, and operational requirements are formally identified and incorporated into all hazardous work planning documents.
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While the Team was able to identify numerous strengths and best practices at LANL, e.g., a fundamentally strong management model, structure, and highly competent staff, the fact that so many critical management, safety, and oversight mechanisms all failed simultaneously over an extended period of time and contributed to the mixing of incompatible materials and shipment of waste to WIPP, are of significant concern.

Based upon this RCA, the JONs, and other work performed by the Laboratory, the necessary corrective actions can, and will be, put in place to avoid such systemic failures from occurring in the future.

The Team is grateful to Laboratory management and staff for the open and honest manner in which they supported this review. Without such candid cooperation, we could not have completed this analysis.

I. Introduction

As a result of the recently identified hazardous waste permit noncompliances and the use of incompatible materials in the processing, packaging, and managing of the uncemented nitrate salt waste streams at the Los Alamos National Laboratory in preparation for disposal at the Waste Isolation and Pilot Plant (WIPP) the LANL Laboratory Director, Dr. Charles McMillan, appointed an independent "root cause evaluation team" on October 28, 2014. Reference Appendix A for the formal charge memorandum.

The purpose of this evaluation is to understand the fundamental cause(s) of the deficiencies, in order to identify and initiate sound corrective actions to prevent recurrence. The review specifically focused on the deficiencies that occurred at LANL that might have contributed to the release of radioactive material at WIPP, NOT what caused the release of radioactive material at WIPP.

The three person independent review team was contracted via Longenecker & Associates and included:

- William Madia, former director of Pacific Northwest National Laboratory and Oak Ridge National Laboratory as Team Leader.
- Michael Coyle, retired U.S. Navy Rear Admiral and former commercial nuclear industry executive.
- Richard Brake, former LANL Deputy Associate Director for Operations.

Brief resumes of the three Team members are included in Appendix B.

The following LANL staff members supported the Team:

- Raeanna Sharp-Geiger (ADESH)
- Steve Young (ADNHHO)
- Deborah Woitte (LC-ESH)
- Rita Henins (QPA-PA)

II. Methodology

LANL requested an evaluation and RCA spanning the following four areas:

1. Why did LANL package waste with incompatible materials?
2. Why did LANL conduct waste packaging activities not in compliance with the Lab's Resource Conservation and Recovery Act (RCRA) permit?
3. Why did the Lab's internal checks and balances not prevent (1) and (2)?
4. Why did the Lab's internal checks and balances not detect the issues prior to the external event?

The Team's analysis was limited to these areas, *i.e.*, the activities and management systems surrounding on-site processing of the waste and was specifically NOT extended to events associated with shipping the waste, disposal activities at the WIPP site, or the chemical reactions that may have taken place inside Drum #68660 at the WIPP site.

In Phase 1 of the review, prior to the on-site visit, LANL provided the Team with a collection of 21 documents containing background information and the results of LANL's internal investigations of the events leading up to the shipment of Drum #68660 to WIPP (see Appendix C for the complete list). These documents provided a mostly complete explanation of "what" happened and a partial list of management system breakdowns apparently contributing to the problem. The Team was contracted to probe for deeper causes, to ask "why" certain actions were taken and "why" the management systems intended to maintain safety and compliance failed to detect and correct the improper actions that led to the problem.

In Phase 2, the Team questioned or interviewed 22 LANL staff and managers associated with the planning, execution, and oversight of the waste processing work. The focus of the interviews was three-fold:

1. Confirm and expand on the key facts presented in the LANL documents the Team reviewed prior to on-site work.
2. Identify and fill any factual or data gaps not covered by those documents.
3. Ask each interviewee "why" the critical actions, inactions, and conditions that appeared to lead to the improper packaging and shipment were not detected and allowed to take place.

Interviews were carried out mostly in-person during the on-site visit, but several were by telephone after the Team left the site. The agenda for the on-site review is provided in Appendix D.

At the conclusion of the on-site review, the Director and his management team were briefed on October 30, 2014, which was then followed by this report. This phase focused primarily on "why" the events took place.

In Phase 3, the Team analyzed the collected data, interpreted the interviews, and developed findings. The storyline leading up to the improper waste processing spanned several years and involved numerous LANL organizations, subcontractors, and management systems, because of this, the Team opted to develop a timeline of key events (Appendix E). Existing timelines produced by LANL served as the starting point for this process.

The Discussion column of the Event Timeline (Appendix E) together with Findings listed in Section III include actions and inactions of involved individuals, issues regarding the working environment in ADEP, and deficiencies noted in the management systems. All of these comprise causal factors of the complex and adverse sequence of events. The broadest causal factors were then selected as those factors, which if corrected, would have prevented the adverse sequence and would reduce the future likelihood of this and similar improper waste processing at LANL.

The four overlapping root causes identified for this event are shown in Figure 2.

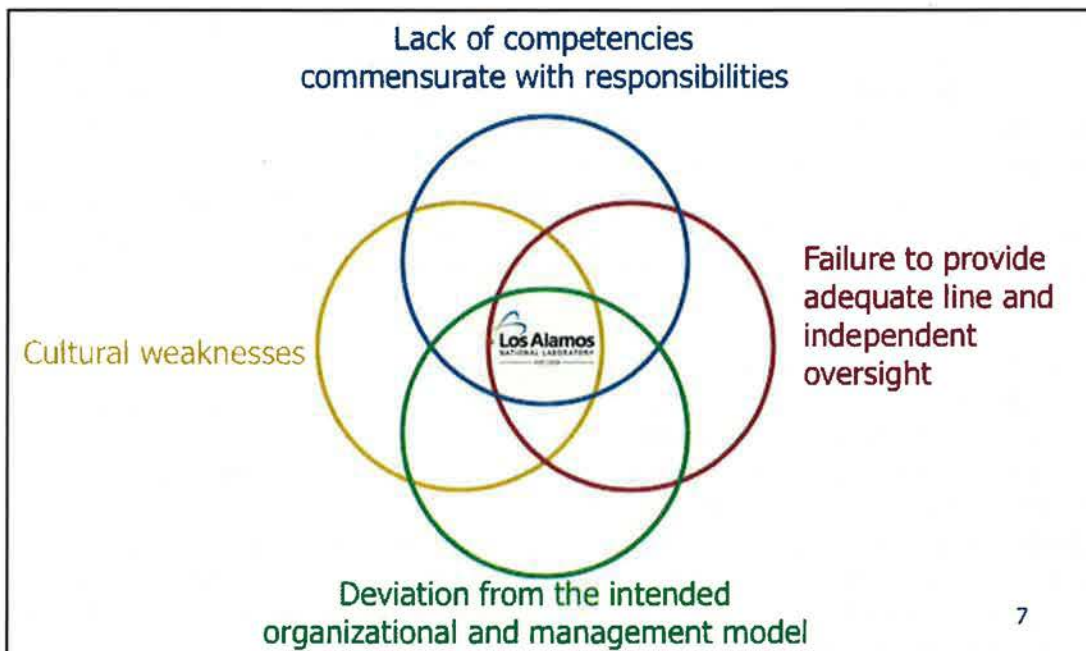


Figure 2: Root causes of Nitrate Salt Drum Processing

III. Findings

Lack of competencies commensurate with responsibilities

One of the Guiding Principles of an Integrated Safety Management System (ISMS) identified in the DOE ISMS Guide, DOE G 450.4-1C is "Competence Commensurate with Responsibilities" defined as *Personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities*. During the course of the Team's interviews, a number of issues emerged related to this principle.

Examples include:

- As facility owner and responsible line management (RLM) over the work in question, the ADEP management chain from the WCRRF work floor to the Associate Director for Environmental Programs have the primary responsibility and accountability to assure safe and compliant operation of WCRRF. Managers at every level in this chain stated in their own words they focused on production and relied on others ("ES&H", "Engineering", "the FOD," etc.) for safety and compliance.
- The Associate Director for Environmental Programs (ADEP) and Deputy possessed overview knowledge of the WCRRF operations and safety basis, and solicited expert advice from the Difficult Waste Team (DWT) and ENV RCRA specialists in 2011-2012. Both managers possessed the knowledge of basic chemistry to recognize the problem of mixing organic kitty litter with acid, but were completely unaware this was occurring at WCRRF. They stated that they thought the FOD and their subordinate managers were handling process issues, and

suggested that in hindsight a "process engineer" was needed at LANL to ensure operations were safe and compliant.

- The LANL Transuranic Program (LTP) Program Director and Deputy described their jobs as "cost and schedule based" and "interfacing with the various customers", indicating a lack of appreciation or acknowledgement of their nuclear operations obligations as line managers. As above, both managers possessed the technical knowledge to recognize the problem of mixing organic kitty litter with acid, but they were completely unaware this was occurring at WCRRF.
- The Drum Disposition Project (DDP) Manager, who assumed responsibility for WCRRF in August 2012, acknowledged that he did not review the procedures for the facility as he assumed the assignment and that he was unaware of the mixing of organic kitty litter and acid. He further stated that even if he had known of the improper mixing, he did not possess the basic knowledge of chemistry to recognize it as a problem.
- The WCRRF Operations Manager and one Shift Operations Manager, first line managers at WCRRF, were aware of the mixing of organic kitty litter and acid, but stated that they did not possess the basic knowledge of chemistry to recognize it as a problem. They paid close attention to personnel safety, but depended on others for RCRA and waste processing compliance.
- Knowledge of the RCRA permit ("processing" versus "treatment") and the WCRRF Basis for Interim Operations (BIO) were also inconsistent through the ADEP management chain.
- The Environmental Waste (EWMO) FOD recognized in hindsight the impact of the procedural change that formalized introduction of organic Kitty Litter into the WCRRF glove box but was not aware at the time that that the revision occurred. He acknowledged further that he was not aware of the continued practice over the period of an additional 15 months.
 - In doing so he neglected his core responsibility to be an independent check and balance needed to keep the LTP program in compliance.
- The WCRRF Operations Manager and others indicated that they had depended on the Industrial Hygienist (IH) in EWMO to ensure the compatibility of chemicals used and to know the RCRA impacts of changes.
- The Unreviewed Safety Question Determinations (USQDs) for processing Solution Package #72 under the WCRRF BIO was negative and both the Deputy ADEP and ADNHHO stated in hindsight the USQD evaluation was sloppy and the negative conclusion was "wrong."

- Reliance on Energy Solutions (ES), the subcontractor, that performed the work in question, without validating that their staff had the necessary technical skills to perform the assigned work.
 - Resumes were not used in contractor selection
 - Energy Solutions Operations Manager at WCRRF did not have a technical degree
 - The significance of the transition from a staff augmentation to task order contract was either not understood or appreciated
- WCRRF operations managers and supervisors did not have necessary technical or regulatory skills and knowledge.
 - Neutralization was not allowed at WCRRF per the LANL RCRA permit yet it was done.
 - The LANL Waste Acceptance Criteria (WAC) prohibits use of biodegradable absorbents yet they were used.
 - Appropriate SMEs were not consulted to review procedure changes
 - No one with a chemistry background was used to review the WCRRF procedure change that authorized the use of "organic" zeolite/kitty litter.
- A procedure writer removed previously established requirements for operators to notify and stop work from the operating procedure (1) if a liquid is potentially corrosive (acid pH <2 and base 12-15), and (2) if they observe a reaction after adding liquid to the absorbent.
 - The writer removed this from the WCRRF procedure during procedure validation without referring to an appropriate SME.

Failure to provide adequate line and independent oversight of waste activities

The Team reviewed oversight from the perspective that line management, in this case the ADEP organization, holds the primary responsibility to understand their operations and to ensure safe and compliant operations, followed as a sequence of "defense in depth" by

- i. The Facility Operations Director (FOD) and his staff
- ii. Internal subject matter experts from support organizations (ES&H and NHHO)
- iii. Hands on subcontractors (*i.e.*, Energy Solutions)
- iv. Internal independent and external entities, *i.e.*, Facility Centered Assessments, functional/topical audits, and Parent Organization Assessments.

Our Findings below are grouped by these distinct layers of oversight.

Line Management Oversight of work planning and execution:

- LTP developed groupings of wastes for processing and named them "solution packages." These solutions packages were developed to group similar waste streams and expedite remediation. It was well known that the nitrate salts were going to pose significant new challenges and would require additional review, and

hence this solution package was placed later in the overall drum disposition project.

- Planning for processing the high-MAR (Material at Risk), uncemented nitrate wastes, was performed by the Difficult Waste Team in Carlsbad, as well as LANL ENV-RCRA SMEs. The early phase of work planning appeared appropriate.
- When the waste processing procedures for WCRRF were initially developed, the critical proportion of absorbent to liquid was conservatively incorporated and pH levels that required a pause in the processing of the waste were captured.
- Over time, the procedure development process lost the required rigor as SME involvement narrowed to health and safety, critical procedural steps were revised, RCRA compliance was lost, and incompatible materials were mixed. SME involvement was left to the Operations Manager to determine but he was not aware of the nuances of the RCRA permit, lacked basic knowledge of chemical compatibility, and did not request SME assistance.
- Late in the procedure revision process inappropriate changes by the ES Operations Manager and a technical writer in EWMO were made completely outside the intended review/approval process.
- Oversight activities of work execution by the LTP line organization included over 172 field visits (Management Observations and Verifications (MOVs)) to LTP workspaces from March 2011 to February 2014. Of those, fewer than 10% were to WCRRF. Documentation of identified problems and/or corrective actions were not included in the LTP MOV documentation.
 - These line assessments and assessment-like activities did not focus on, detect, or correct the RCRA-noncompliant work that was taking place inside WCRRF.
- The Team concluded that LTP management of WCRRF processing procedures was insufficient, therefore the operating procedures did not retain critical parameters necessary to safely and compliantly process the waste.

FOD oversight, to include Safety Basis oversight:

- FOD oversight centers on authorizing work in a facility to ensure the activity is within the Safety Basis envelope and generally within the ES&H requirements for the institution and the facility. While Associate Director for Environment, Safety, and Health (ADESH) provided core and deployed services personnel to the FOD, oversight activities by ES&H personnel are covered separately.
- The EWMO-FOD indicated during the interview that he was presented Solution Package #72 for approval. He signed the solution package on July 11, 2012

without formally reviewing or validating the negative Unreviewed Safety Questions (USQ) finding, or the procedure revisions necessary for the work to proceed.

- USQs coordinated through EWMO for all WCRRF procedure revisions were negative based on judgments they did not create accident scenarios beyond those already covered by the BIO. The reviewers did not evaluate the changes against the restrictions for nitrate salts and/or oxidizers that were described in chapters 2 and 3 of the BIO. Hindsight reviews of these USQs by ADNHHO and ADEP deemed them of inadequate quality.
- The many WCRRF procedure revisions were reviewed by some of the deployed ES&H staff in EWMO, but at no point were reviewed by either the ESH Manager (direct report to the FOD), nor by the FOD himself.
- The Team concluded that oversight of WCRRF operations by the FOD was inadequate.

ESH Oversight from Core Programs and Deployed Services:

- ES&H staff was deployed from ADESH to EWMO-FOD to support programmatic and operational activities. For EWMO FOD, these ES&H personnel included an ES&H manager, Waste Management Specialists, Radiological Control Technicians (RCTs), an ENV generalist, and an Industrial Hygienist. The ES&H manager indicated he was primarily concerned with personnel safety and health issues and that he believed environmental and regulatory issues were addressed by environmental personnel from his team and the core ENV organization.
- Core ENV RCRA specialists were involved at ADEP's request in February 2012 to address the applicability of RCRA "D codes" to the nitrate wastes, but at no point were involved in the actual procedure development or revisions.
- In EWMO, the environmental generalist had connections to core RCRA specialists in ESH-ENV and the IH had connections to core chemical safety specialists in ESH-IHS, but neither adequately exercised these connections as WCRRF procedures were developed and repeatedly revised.
- Due to higher hazards, personnel safety support, Radiation Protection (RP) and IH ramped up throughout the 3706 campaign, but RCRA and chemical issues of processing received steadily decreasing support and oversight.
- The environmental generalist in EWMO reviewed DOP-0233 revisions through revision 19, but at the WCRRF Operations Manager's discretion, he was not involved after that point as the "corrosivity" hold point was removed and requirement to use organic kitty litter was introduced. ¹

- ESH-ENV provided RCRA inspections across all LANL operations but these inspections mirrored inspections performed by the external regulator, NMED and focused on waste drum storage, labeling, and record keeping. Drum storage is mainly outside the WCRRF; therefore, inspectors seldom entered the facility.
- The Team found that oversight from ADESH and ADNHHO, both core and deployed to EWMO, were generally competent and available. RP and IH were routinely present in the facility overseeing personnel safety but over the extended period of improper waste processing, core ENV and chemical safety support and oversight were neither effectively used (“pulled”) by ADEP management nor effectively “pushed” by ADESH into oversight of WCRRF operations

Subcontractor Oversight of Energy Solutions (ES):

- At the start of the 3706 campaign the Energy Solutions contract was converted to Task Order, nominally increasing the ES&H oversight responsibilities of ES for the higher hazard work, including an obligation for ES to perform its work in compliance with the LANS RCRA permit.
- The contract was not re-bid when this change occurred. LTP Program Director reported to the Team “there just wasn’t time to rebid the project.”
- Technical qualifications of proposed ES staff were not reviewed and no Integrated Project Team (comprising SMEs from all ES&H disciplines) was assembled.
- The ES Operations Manager assigned to WCRRF held an Associate Degree in Business and had 26 years of experience in waste operations, but lacked technical knowledge needed to manage the work.
- ES personnel reviewed and approved some, but not all, revisions of DOP-0233 from November 2009 through March 2013, but did not recognize the RCRA and chemical compatibility issues associated with the changes.
- ES established and executed a daily “RCRA inspection” of the WCRRF worksite, but these inspections mirrored NMED and LANL inspections limited to drum storage, labeling, and records.
- The Team concluded that daily oversight by the ES Operations Manager at WCRRF was less than adequate and that corporate oversight by ES management was virtually absent during critical times in the 3706 waste dispositioning campaign.

Independent Oversight (to include Facility-Centered Assessments, Parent-company reviews, and external reviews):

- A Facility Centered Assessment (FCA) conducted in 2011 by LANL's Contractor Assurance function documented an extensive review of work at Area G, WCRRF, and RANT facilities within EWMO FOD.
- The FCA identified multiple findings to include deficiencies associated with work management and organizational structure. These findings included issues with operating procedures not being fully processed as Integrated Work Documents (IWDs) and an organizational structure that did not adhere to P313. The FCA did not articulate problems with waste processing in the WCRR facility.
- The issue that was identified in the FCA regarding organizational structure, was ineffectively addressed by the LTP Program Director (see section on "Deviation from the Organizational Management Model.")
- An external parent oversight review by LANS, LLC covered Area G with a focus on Conduct of Operations. The review was favorable overall, but indicated some concern over the potential adverse impact that multiple changes to procedures might have on Conduct of Operations.
- The Team noted that the several external entities with oversight responsibilities for WCRRF, including NMED, CCP, CBFO, and LASO, were involved, but failed to detect and correct the problems. The Team did not evaluate oversight activities by these entities.

Deviation from the intended organizational and management model

- The Team reviewed the organizational and management model of ADEP/EWMO against institutional policy *Roles, Responsibilities, Authorities, and Accountability* (P313). P313 describes a Responsible Associate Director, or RAD (in this event ADEP) responsibility to direct and monitor safe and compliant performance of work, and the Facility Operations Director (FOD, in this event EWMO) to provide both support and oversight to ensure the work is within the facility safety basis and overall ES&H requirements for the facility. In addition, P313 establishes the distinct R2A2 for Line versus Program Managers in the LANL system.
- The Review Team identified that the management model implemented in ADEP/EWMO deviated from the model intended by P313, resulting in ambiguities and ineffectiveness in four key areas:
 - The FOD in EWMO officially reported to ADNHHO as the P313 model intends, but the Deputy FOD and FOD Designees in ADEP facilities reported directly to ADEP and were "dashed line" shared to the FOD.

- Overall FOD adherence to ADNHHO expectations for independent oversight of ADEP was stated in several interviews as uncooperative and ineffective
 - FOD Designees at WCRRF (Operations Manager and Shift Operations Managers (SOMs)) were advised in appointment memos to separate their roles as RLM (for the RAD) and FOD Designee (for the FOD), *i.e.*, "Cannot perform RLM and Operations Manager duties on the same work item." These dual roles weakened both RAD and FOD effectiveness at the WCRRF work floor.
 - The LANL model established by P300 for work control and procedure management in ADEP was modified, and in effect "loosened" to allow the Operations Manager's discretion in selection of SME reviewers. The process appeared disconnected from the IWD process mandated in P300, and provided neither the intended support nor necessary oversight from the FOD and ES&H.
 - The Review Team's interviews indicated that the ADEP chain of command over WCRRF, individuals titled "Program Directors" and "Project Managers," functioned primarily as project managers focused on cost and schedule rather than carrying out the full suite of safety and compliance oversight duties assigned by P313 to the RLM.
 - RCRA oversight responsibilities in ADEP were confused by the ADEP function titled Regulatory Management and Performance Assurance, causing some conflicts between RCRA experts in ADEP and ADESH. This potentially contributed to the inadequate involvement of RCRA specialists from ADESH in support and oversight of WCRRF.
- The Team concluded that the organizational deviations described above set the stage for the inadequate oversight of WCRRF operations by both ADEP managers and the FOD.

Cultural weaknesses

The Team identified cultural issues in LANL's ADEP organization in two major areas:

1. Nuclear safety culture, which is founded on a questioning attitude among workers and managers at all levels.
2. Corporate, or LLC culture, which depends on all LLC members being fully committed to a unified LANL management model.

Findings are listed below in these two areas.

Former Professor Edgar Schein of the Massachusetts Institute of Technology's Sloan School of Management, defines organizational culture as; "A pattern of shared basic assumptions that the group learned as it solved its problems that has worked well enough to be considered valid and is passed on to new members as the correct way to perceive, think, and feel in relation to those problems." Professor Schein's work

informed the efforts of the EFCOG/DOE Integrated Safety Management System Safety Culture Task Team's work to establish the framework for safety culture in DOE facilities. This work, which culminated in 2010, defined safety culture as, "An organization's values and behaviors, modeled by its leaders, and internalized by its members, which serve to make safe performance of work the overriding priority to protect the workers, public, and the environment." It identified three focus areas; Leadership, Employee/Worker Engagement, and Organizational Learning as foundational to a strong safety culture and further noted fifteen attributes that characterized these focus areas. See Table 2 below.

Table 2: DOE Safety Culture Focus Areas and Attributes

Leadership	Employee/Worker Engagement	Organizational Learning
Clear expectations and accountability	Personal commitment to everyone's safety	Performance monitoring through multiple means
Management engagement and time in the field	Teamwork and mutual respect	Use of operating experience
Risk-informed, conservative decision making	Participation in work planning and improvement	Credibility, trust and reporting errors and problems
Open communication and fostering an environment free from retribution	Mindful of hazards and controls	Questioning attitude
Demonstrated safety leadership		Effective resolution of reported problems
Staff recruitment, selection, retention, and development		

These attributes were incorporated into DOE G 450.4-1C, *Integrated Safety Management System Guide*, Attachment 10 in September of 2011. The relationship between organizational culture, safety culture, and a safety conscious work environment (SCWE), a key component of a healthy safety culture, is illustrated below in Figure 3.

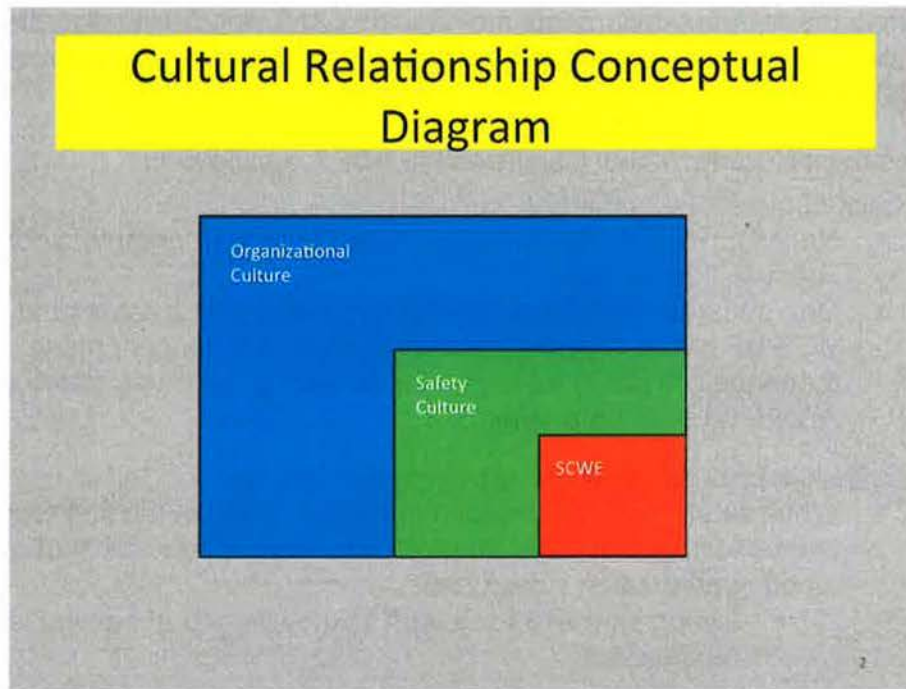


Figure 3: Relationship of Organizational Culture, Safety Culture, and a Safety Conscious Work Environment (SCWE)

For nuclear organizations such as the WCRRF, nuclear safety culture encompasses a number of areas of safety and quality as shown in Figure 4 below.

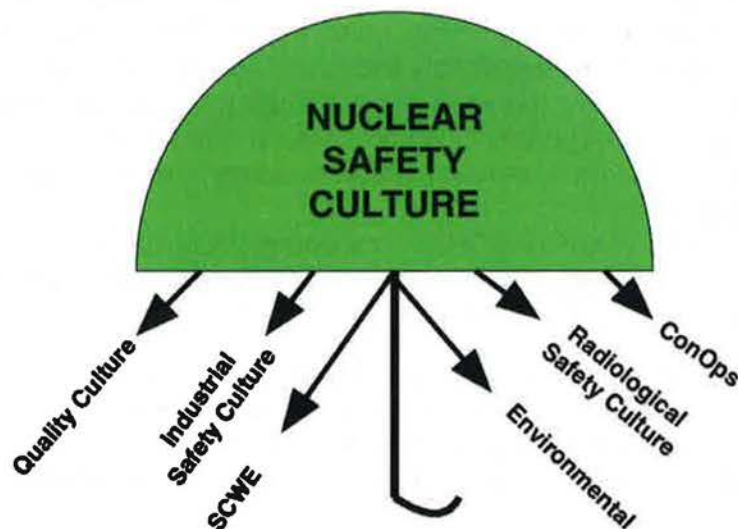


Figure 4: Nuclear Safety Umbrella

After reviewing the relevant documents provided by LANL and conducting the interviews, the Team noted, a number of nuclear safety culture and organizational weaknesses as evidenced by the following examples:

- Inconsistent Nuclear Safety Culture within ADEP and EWMO
 - Lack of questioning attitude
 - No evidence that the procedural change to use "organic" zeolite/kitty litter was challenged.
 - One manager stated that he had questioned the treatment of liquids in WCRRF but his question was dismissed. He did not pursue.
 - Inadequate USQDs were performed and accepted as stated by ADNHHO senior manager.
 - Schedule pressure was not appropriately managed.
 - While safety was discussed in meetings, often as the first topic, the overwhelming emphasis that was communicated to the staff was on meeting production milestones.
 - During interviews this was acknowledged at several levels in the organization
 - Unclear organizational alignment blurred accountability.
 - The Ops manager reported directly to both the program (LTP) and the FOD (EWMO) with sometimes perceived conflicting priorities
 - Lack of conservatism
 - As waste drum processing became more complex with the introduction of waste containing nitrate salts, rigor of the operating procedures in WCRRF was inexplicably reduced. The risk for determining if SMEs were to review the procedures shifted to being dependent on individuals instead of dependent on the process. That is to say, reviewers had to be invited into a review instead of being automatically required to review a document.
 - A requirement in WCRRF procedure (DOP-0233) to stop work if liquid with pH <2 was discovered was eliminated without justification and without proper SME review.
 - Lack of management engagement and time in the field
 - One interviewee indicated that management presence mostly occurred only when there was an external visit or tour
 - Senior managers were infrequently present at WCRRF
 - Inadequate understanding of expectations and accountabilities
 - The LANL study, *Systems Approach for Gap Identification* identified unclear roles and responsibilities in a number of areas such as:
 - Between LANL and the subcontractor that operated the WCRRF glovebox
 - Between the ADEP Regulatory Compliance organization and the ADESH environmental protection organization.

- Lack of performance monitoring through multiple means
 - Self-assessment and inspection activities tended to focus on storage issues, *i.e.*, labeling, instead of treatment. Management believed that they were not “treating” waste but failed to question the base assumption that only “processing” was taking place in WCRRF.
 - As the 3706 campaign ramped up, field and procedure reviews by Core organizations did not increase.
- Negative influence of differing corporate cultures in LANS, LLC
 - The Team concluded that corporate cultural influences contributed to deviations in the organization and management model found in ADEP and EWMO
 - The Deputy FOD, Operations Managers, and SOMs reporting directly to ADEP rather than ADNHHO appeared to be a “self-contained” management model.
 - The EWMO FOD functioned as a de facto direct report to the ADEP although organizationally he reported to the ADNHHO. This appeared to be more akin to the corporate organizational model of one of the LLC members as opposed to the defined LANL organizational model.
 - The Team concluded that corporate culture influences contributed to the inadequacy in Line Management competence and oversight.
 - Communications and cooperation between line managers and layers of support and oversight were inadequate during the 15-month course of high-risk, noncompliant work in the WCRRF glovebox.
 - Line managers in ADEP focused on cost and schedule, and depended on “ES&H” or “Engineering” to assure safe and compliant work practices. This appeared to be imported from a non-LANL management model.
 - Failure to cooperate, tap into broader laboratory expertise, and in some cases follow chain of command instructions, was evident in numerous interviews.
 - The Team concluded this component of the Cultural Weaknesses root cause potentially is an underlying situation at Los Alamos that must be corrected before any other sustainable corrections are possible.
 - The Team recognized that ADEP comprised approximately 300 employees led by 6-7 managers from a LANS, LLC parent company.
 - Many staff believed that corporate culture influence resulted in exceptions to the organization and management model; however, the Team could not verify this.
 - Less than adequate interdepartmental communication and alignment was evident.

IV. Judgments of Need

Table 3: Root Causes and Judgments of Need

Root Cause	JONs
Lack of competencies commensurate with responsibilities	JON-1: All LANL ADEP staff needs to have technical and managerial competencies commensurate with their assigned responsibilities
Deviations from the intended Organizational and Management Model	JON-2: The LANL organization and management model needs to be implemented per laboratory policy in ADEP, especially as it pertains to waste processing positions, corresponding roles and responsibilities, and reporting chains
	JON-3: The Associate Director for Environmental Protection (ADEP) procedure review process needs to have greater formality and rigor.
Failure to provide adequate line and independent oversight	JON-4: ADEP line management needs to conduct oversight that is comprehensive from initial work planning through task completion. It must be tailored to the risks involved and be performed rigorously by knowledgeable and competent individuals.
	JON-5: Defense in depth independent oversight, e.g., from ADESH, ADNHHO, Parent Organizations, etc. needs to be assertive in identifying and correcting technical, operational, and organizational problems from high level management systems down to work floor activities.
Cultural weaknesses	JON-6: LANL management needs to assure a consistent, robust, and healthy nuclear safety culture exists throughout the Laboratory.
	JON-7: LANS, LLC needs to improve alignment and teamwork by all of its member organizations.
Requirements management	JON-8: LANL management needs to ensure the comprehensive set of technical, regulatory, and operational

	requirements are formally identified and incorporated into all hazardous work planning documents.
--	---

Lack of competencies commensurate with responsibilities

JON-1: All LANL ADEP staff needs to have technical and managerial competencies commensurate with their assigned responsibilities.

- Competences are required across the board in every function in the TRU program
- Management must assure that those competencies are in place
- "Know enough to know what you don't know" (*i.e.*, when to ask a SME).
- Technical competence requirements peak at First Line Manager, but do not stop there.

Deviations from the intended Organizational and Management model

JON-2: The LANL organization and management model needs to be implemented per laboratory policy in ADEP, especially as it pertains to waste processing positions, corresponding roles and responsibilities, and reporting chains.

- Non-standard org structure in ADEP and EWMO resulted in R2A2 confusion re: P313 and P300 responsibilities both internal and external to the organization
 - RLM and Ops functions poorly defined, poorly implemented, and expectations not met
 - Senior Managers, RLM, and Program Manager functions also combined and confused
 - External organizations assume standard organizational model responsibilities resulting in widely misunderstood R2A2s
 - Regulatory Compliance function in ADEP added to the confusion
- Individuals with dual and competing job functions reporting into two different organizational managers results in potentially conflicting priorities
 - The WCRRF Operations Manager was an LTP employee but assigned collateral operations (FOD) responsibilities
- Loss of individual accountability

JON-3: The Associate Director for Environmental Protection (ADEP) procedure review process needs to have greater formality and rigor.

- ADEPs procedure development and review process lacked necessary formality and rigor required for nuclear operations
 - Rigor must be maintained throughout the procedure life cycle
 - All relevant SMEs must be identified from the beginning
 - Involvement of SMEs must be maintained throughout
 - SMEs responsibilities must be formally assigned (not assumed)
 - Changes should not be made outside of formal review (*e.g.*, SME signatures prior to final revision)
 - Changes to document development requirements lost over time (drift)

Failure to provide adequate line and independent oversight

JON-4: ADEP line management needs to conduct oversight that is comprehensive from initial work planning through task completion. It must be tailored to the risks involved and be performed rigorously by knowledgeable and competent individuals.

- Line managers must identify risks and ask, "what can negatively impact my people, programs, the environment, institution, or the public?"
- Assessments must be staffed with adequate competence, including the appropriate SMEs as needed.
- Base assumptions need to be challenged

JON-5: Defense in depth independent oversight, *e.g.*, from ADESH, ADNHHO, Parent Organizations, etc. needs to be assertive in identifying and correcting technical, operational, and organizational problems from high level management systems down to work floor activities.

- Assessments must be staffed with adequate competence, including the appropriate SMEs as needed
 - Attributes include:
 - Valued by the line
 - SMEs engaged throughout
 - Competent and comprehensive
 - Challenge base assumptions
 - Proactive
 - Self-critical
 - Functional single points of contact

Cultural weaknesses

JON-6: LANL management needs to assure a consistent, robust, and healthy nuclear safety culture exists throughout the Laboratory.

- Conduct an independent assessment of LANL safety culture against the focus areas and attributes of DOE G 450.4-1C, Attachment 10 (ISMS Guide). To address:
 - Reporting culture
 - Questioning attitude
 - Safety communications
 - Managing production pressure

JON-7: LANS, LLC needs to improve alignment and teamwork by all of its member organizations.

- We observed the influence of differing corporate cultures
- Conflicting priorities and allegiances
- Numerous exceptions to the standard LANL work model
- Insularity

Requirements Management

JON-8: LANL management needs to ensure the comprehensive set of technical, regulatory, and operational requirements are formally identified and incorporated into all hazardous work planning documents.

- Requirements identification must start at the policy but flow down into implementable documents
 - Removal of key requirements caused some of the problems

V. Recommendations

The following recommendations are based on our focused review of ADEP and associated support organizations involved with the TRU Waste operations. While these recommendations should be considered to focus on organizations involved in the review, a thorough extent of condition review of the balance of LANL organizations may reveal that broader application of these recommendations is warranted.

- Conduct an off-site retreat for lab leadership and LANS, LLC partners, facilitated by a professional organizational development specialist to gain alignment on a LANL culture that is embraced by all LLC partners.
- Assess nuclear safety culture against the focus areas and attributes of safety culture contained in DOE G 450.4-1C, Attachment 10. Identify gaps and develop a corrective action plan to address them.
- Conduct a gap analysis of the LANL current structure against the organizational and management model to identify areas that need to be brought back into conformance.
- Assess current ADEP staff qualifications to ensure that incumbents are qualified to perform their responsibilities. Where there are shortfalls, take action to correct either by reassignment or through training.
- Clarify roles and responsibilities between various organizational components such as ADESH and ADEP.
- Immediately revise the ADEP procedure development and revision process to ensure that qualified SMEs conduct reviews.
- Evaluate the extent of condition for each of the JONs in this report to ensure improvements are made across the Laboratory where appropriate.

VI. Closing

The Team is grateful to Laboratory management and staff for the open and honest manner in which they supported this review. Without this support and cooperation we could not have completed this analysis.

Appendices

Appendix A. Formal Charge Memorandum



To/MS: Distribution
From/MS: Charles F. McMillan, A100
Phone/Fax: 7-5101/7-2997
Symbol: DIR-14-170
Date: October 28, 2014

memorandum

Office of the Director

SUBJECT: Appointment of Root Cause Evaluation Team for Deficiencies Recently Identified in LANL TRU Program

I hereby establish the following evaluation team to determine the root cause(s) leading to the recently identified hazardous waste permit noncompliances and the use of incompatible materials in the processing, packaging and managing of the uncemented nitrate salts waste stream at LANL in preparation for disposal at WIPP. The purpose of this evaluation is to understand the fundamental cause(s) of the deficiencies so that sound corrective actions can be identified and initiated to prevent recurrence; the purpose is not to evaluate what caused the radioactive release at WIPP. I consider these deficiencies to be serious, and am therefore appointing the following evaluation team, contracted with Longenecker & Associates:

- William Madia, Team Lead
- Michael Coyle, Team Member
- Rick Brake, Team Member

In addition, the following LANL staff will provide assistance at the team's request.

- Racanna Sharp-Geiger (ADESH)
- Steven Young (ADNHHO)
- Deborah Woitte (LC-ESH)
- Rita Henins (QPA-PA)

The team will conduct a causal analysis of this event and will provide a report to me on the root cause(s) of the deficiencies and any recommendations for further action. The scope of the team's review must include, but not be limited to the following:

- Collecting all relevant facts, starting with a compilation of facts from existing lab inquiries, and filling gaps as necessary;
- Determining the causes of the deficiencies, including
 - Work environment, controls, and safety barriers applicable to the associated work activities,
 - Involvement of workers (managers and non-managers / LANS employees and contractors) on the above work environment, controls, and safety barriers,

Distribution
DIR-14-170

October 28, 2014

- Actions and inactions of the involved workers relevant to the above environment, controls, and safety barriers,
- Recommending improvements to address the causes and prevent recurrence.

After approving the analysis, I will assign responsibility for development of corrective actions to address the causal factors identified in the first stage of the investigation.

Electronic Distribution:

Beard, Carl A, [REDACTED]
Bivens, William T, [REDACTED]
Brandt, Michael T, [REDACTED]
Cabbil, Cheryl D, [REDACTED]
Erickson, Randy M, [REDACTED]
Guffee, Ray M, [REDACTED]
McMichael, Susan L, [REDACTED]
Reynolds, Robin P, [REDACTED]
Schnedler, Darren P, [REDACTED]
Torres, Enrique, [REDACTED]
Woitte, Deborah K, [REDACTED]

Cy: Archuleta, Jessica A, DIR, A100
Marquez, Richard A, DIR, A100
Sharp-Geiger, Raeanna R, ADESH, K491
Trujillo, Debbie T, PADOPS, A102
Weber, Mary-Jane, PADCAP, A107
Young, Steven L, ADNHHO, K778
IRM-RMS, A150
PADOPS File
DIR-14-170, A100

Appendix B. Resumes of Team Members

William J. Madia, Team Leader
Vice President, Stanford University
President, Madia & Associates, LLC.



Dr. Madia has been a leader in research, development, and deployment of energy systems for nearly four decades. He currently serves as Chairman of the Board of Overseers and Vice President for the SLAC National Accelerator Laboratory at Stanford University. He is also President of Madia & Associates, LLC, an energy consulting firm serving the needs of government, industry, and academia. Dr. Madia retired from Battelle in 2007 as Executive Vice President for Mergers and Acquisitions. During his 33-year career at Battelle, he developed acquisition strategies and led proposal teams for seven successful national laboratory contract bids. As Executive Vice President for Laboratory Operations, his organization grew eight-fold, resulting in annual revenues of \$4 billion and employing over 15,000 affiliated staff. During his career at Battelle, he held a variety of leadership positions including Laboratory Director of both the Pacific Northwest National Laboratory and the Oak Ridge National Laboratory. He was Director of Battelle's Columbus Laboratories and President of Battelle Technology International, a multi-national research organization with major laboratories in Frankfurt, Germany and Geneva, Switzerland and offices worldwide.

Dr. Madia's nuclear energy experience spans the entire nuclear fuel cycle. He created and led the first Nuclear Fuel Cycle analysis group at Battelle, managed Battelle's plutonium fuel fabrication laboratory and hot cell complex, developed proliferation resistant reprocessing flow sheets, and taught coursework in Nuclear Fuel Cycle technologies as an adjunct professor at the Ohio State University. He was a member of DOE's "Blue Ribbon Panel" on the decontamination and decommissioning of the damaged Three Mile Island reactor and provided technical support to the Chernobyl reactor stabilization and clean-up efforts. He led the national screening of geologic formations as part of DOE's High Level Nuclear Waste Disposal Program that resulted in Congress' selection of the Yucca Mountain site. At the request of Secretary of Energy Bill Richardson, he led a review of medical isotope applications for the Fast Flux Test Facility and was a member of the national Commission on Science and Security in the 21st Century. Prior to joining Battelle, he worked for General Physics Corporation, where he trained nuclear power plant operators. While serving in the U.S. Army, Dr. Madia led the Reactor Operator Qualification Phase of the Army's Nuclear Power program.

Richard J. Brake, Ph. D.

Consultant, Longenecker & Associates, Inc.



Dr. Brake has 36 years experience ranging from radiation research to nuclear safety and senior positions in operations management. He completed doctoral research at Oak Ridge National Laboratory in 1977, and began a 30-year career at Los Alamos National Laboratory. Through 1991 Dr. Brake established and managed an applied radiation and health physics research function in the ES&H organization at Los Alamos, supervised numerous master-, doctoral-, and postdoctoral-level students, and generated over 40 publications and presentations. He managed the reengineering of both the internal and external dosimetry programs of the Laboratory, and chaired both the DOE Expert Group on Internal Dosimetry and a new ISO working group focused on internal dosimetry. He served on the Advisory Board to DOE on Health Physics Educational Support, President of the Rio Grande Chapter of the Health Physics Society, and was an author of the first edition of the DOE Radiological Control Manual. At DOE request Brake served as lead dosimetry assessor on numerous Technical Safety Appraisals, Tiger Teams, and Special Assessments (e.g., ORNL, K-25, Y-12, Pantex, Rocky Flats, Mound Laboratories). In 1992 Brake was drafted to revamp the Los Alamos Occurrence Reporting and Processing System (ORPS), where he implemented a centralized cadre of trained investigators and causal analysts who executed a process of critique, causal analysis, corrective action, and lessons learned that was novel for the time and resulted in designation of the program "best in class" by the DOE Undersecretary for Environment, Safety, and Health. From 2001 through 2006 Brake served in several senior management positions at the Laboratory, including Deputy Associate Director for Operations, where he managed safety, environmental protection, security, emergency management and facility management. He played key roles in the Laboratory's response to numerous Type B investigations, special assessments by the DOE offices of Nuclear Safety, Independent Oversight, and Enforcement, and eventually the 2004 Laboratory-wide work suspension and resumption. After the LANL contract was awarded to Los Alamos National Security in 2006 Brake served two years developing a deployed model of implementing the key Contractor Assurance System for the Laboratory, before retiring in 2008. Since retirement Brake has worked intermittently as either a LANL Affiliate or as a consultant through H&P, Inc. or Longenecker & Associates.

Dr. Brake holds a B.S. in Physics from the University of Oklahoma (1971, Summa cum Laude), and a Ph.D. in Biophysics from the University of Tennessee Graduate School of Biomedical Sciences, Oak Ridge National Laboratory (1977).

RADM Michael T. Coyle, USN (Ret):
Consultant, Longenecker & Associates, Inc.



RADM Coyle has over 49 years of experience in the maintenance and operation of Naval and commercial nuclear power, which includes significant positions of leadership.

After completing the Navy Nuclear Propulsion and Submarine training programs he served in nuclear submarines before transitioning to the Navy's Engineering Duty Officer program where his duties included extensive experience in naval shipyards that specialized in nuclear submarine and surface ship maintenance and repair. He eventually commanded the Pearl Harbor, Hawaii and Mare Island, California. After selection for Rear Admiral his Flag Officer assignments were Deputy Commander for Submarines at the Naval Sea Systems Command, Maintenance Officer for the Pacific Fleet, and Deputy Commander for Engineering at the Naval Sea Systems Command.

Following retirement from the Navy in 1998 he continued his involvement with nuclear power in the commercial nuclear power industry where he was the Site Vice President at the Clinton, Illinois Nuclear Power Station and later, the Site Vice President at the Cooper Nuclear Plant in Brownville, Nebraska. From 2004 to 2006 he was on loan to the Nuclear Energy Institute (NEI) in Washington, DC where he was intimately involved in helping the Nuclear Regulatory Commission develop its initial regulatory framework for nuclear safety culture. From 2006 to 2009 he was Vice President, Special Projects for Exelon, the largest operator of commercial nuclear plants in the United States.

From 2009 to 2012 he was employed by URS at the Hanford, Washington Waste Treatment and Immobilization Plant (WTP) where he was instrumental in leading the development of the WTP Nuclear Safety and Quality Culture (NSQC) initiative.

In March 2012 he joined the Longenecker and Associates consulting team where he continues to participate in activities aimed at establishing and improving an organization's nuclear safety culture.

RADM Coyle has a Bachelor's degree from the U.S. Naval Academy where he graduated with distinction in 1965, and a Master of Science degree in Mechanical Engineering from the U.S. Naval Postgraduate School in Monterey, California where he received the Naval Sea Systems Command award for Naval Engineering.

Appendix C. List of Documents reviewed by Team

1. WIPP Laboratory Counsel Review - presentation by attorneys Blakeslee & Woitte
2. Overview and Summary of LANL Organizational Design for Line Management - presentation
3. Nitrate Salt Process and Waste Description - presentation by Randy Erickson (Acting ADEP)
4. Nitrate Salt Causal Review - presentation by Torres (Deputy ADEP)
5. LANL TRU Waste Processing: Causal Review of September 8, 2014
6. LANL TRU Waste Stream Systems Approach for Gap Identification - presentation by Ray Guffee
7. RCRA Permit and Controls - presentation by Michael Brandt
8. TRU Waste Nuclear Safety Basis and Controls - presentation by Cheryl Cabbil (ADEP NHHO)
9. Subcontracting Management - presentation by Robin Reynolds (STR Lead, Environmental Projects)
10. Amount of Zeolite Required to Meet the Constraints Established by the EMRTC Report RF 10-13: Application to LANL Evaporator Nitrate Salts (DWT Report of 5/8/2012)
11. CCP/LANL Interface Document (CCP-PO-012)
12. EP-WCRR-WO-DOP-1198, *WCRRF Waste Characterization Glovebox Operations* (formerly EP-WCRR-WO-DOP-0233)
13. New Mexico Tech Report, *Results of Oxidizing Solids Testing* (EMRTC Report FR 10-13)
14. Independent Perspectives Report by Jeff Smith of September 23, 2014
15. Los Alamos National Laboratory's Revised Nitrate Salt-Bearing Waste Container Isolation Plan
16. Basis for Interim Operation for Waste Characterization, Reduction, and Repackaging Facility (WCRRF) (ABD-WFM-005, R.2.1)
17. Swheat Cat Litter Description
18. DOE/IG-0922, *Remediation of Selected Transuranic Waste Drums at Los Alamos National Laboratory - Potential Impact on the Shutdown of the Department's Waste Isolation Pilot Plant* of September 2014
19. Solution Package: Report 72, Salt Waste (SP #72) Rev 1
20. P2010-3232/ERID-210739, *Legacy TA-55 Nitrate Salt Wastes at TA-54 - Potential Applicability of RCRA D001/D002/D003 Waste Codes*
21. DOE Accident Investigation Report - *Phase 1 Radiological Release Event at the Waste Isolation Pilot Plant on February 14, 2014* of April 2014

Appendix D. Agenda for on site visit by Team



External Management Review of LANL's TRU Waste Processing

William Madia

Team Lead, Longenecker & Associates

Michael Coyle

Team Member, Longenecker & Associates

Rick Brake

Team Member, Longenecker & Associates

October 28-30, 2014

***SECURITY NOTICE:** Electronic devices are NOT allowed in LANL limited security areas and above. To comply with DOE, NNSA, and LANL security procedures and to protect our data infrastructure, devices including personal smart/cell phones, two-way pagers, non-LANL government owned Blackberries/IOS devices (not part of the NNSA Reciprocity agreement), laptop computers, tablet PC's, thumb-drives, cameras, etc. are not allowed.*

Visitors going behind the security fence are asked to leave all controlled articles in vehicles or hotel rooms. Additionally, please adhere to the DOE and LANL prohibited articles procedure and do not bring firearms, explosives, knives greater than 2.5 inches, alcohol, illegal drugs, etc., onto Laboratory property. All personnel on Laboratory property are subject to random inspections by Protective Force Officers.

Tuesday, October 28, 2014
TA-03, Location – Otowi (Building 261)

7:30 Arrive at LANL/Badging..... Roberta Salazar
Protocol

TA-03, Bldg. 1400, Director's Office

8:00 Meet with LANL Director Dr. Charles McMillan
(Longenecker Staff, Marquez, Henry, Beard) Laboratory Director, LANL

Purpose:	External Management Review	POC: Roberta Salazar
Institutional Host:	Carl Beard	Dress: Business Casual
Technical Host:	Carl Beard	Revised: 10/30/14
Catering:	ARAMARK, 7-4628, (cell) 412-8997	
LANL Update:	505-667-6622 or 1-877-723-4101: Provides information about changes in the Laboratory schedule (i.e., closings or delays) Protocol Office will adhere to all weather delays/closings.	



External Management Review

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TA-03, Location – University House (Building 443)

- 8:30 Security Briefing..... **Darren Schnedler**
Security Manager, Integrated Services/Security
- 8:40 Overview and Summary of LANL Organizational Design
for Line Management/Checks/Balances **Will Bivens**
Deputy Principal Associate Director, Operations
- 9:00 Background of Nitrate Salts and Science Investigation..... **Randy Erickson**
Associate Director, Environmental Programs
- 10:30 **BREAK**..... **All**
- 10:45 Draft Causal Analysis Report **Enrique Torres**
Deputy Associate Director, Environmental Programs
- 11:30 **Working Lunch: Systems Approach for GAP Identification**..... **Ray Guffee**
(Invitation Only: Evaluation Team, Guffee, Blakeslee, Torres, DIR/PAD Representation) *Division Leader, Defense Systems & Analysis*
- 12:30 Laboratory Counsel Review **Deborah Woitte**
(Limited Participation) *ES&H Group Leader, Office of Laboratory Counsel*
Julia Lapis Blakeslee
ES&H Staff Attorney, Office of Laboratory Counsel
- 1:15 RCRA Permit & Controls **Michael Brandt**
Associate Director, Environment, Safety, & Health
- 1:45 **BREAK**..... **All**
- 2:00 Safety Basis & Controls..... **Cheryl Cabbil**
Associate Director, Nuclear & High Hazard Operations



External Management Review

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2:30 Subcontracting Management Robin Reynolds
STR Lead, Environmental Projects

3:00 Open Discussion & Information Follow-up Requests All/Evaluation Team

Wednesday, October 29, 2014
TA-03, Location – University House (Building 443)

7:30 Closed Discussion Evaluation Team

9:00 INTERVIEW: Gary Schramm (ESH) Evaluation Team

10:00 INTERVIEW: Steve Henry (ADEP) Evaluation Team

11:00 INTERVIEW: Victoria (Tori) George (OPA-PAAA) Evaluation Team

12:00 **Working Lunch** Evaluation Team

**TA-50, Location – Waste Characterization, Reduction,
and Repackaging Facility (WCRRF)**

12:30 TOUR: WCRRF (controlled, non-PPE) Evaluation Team
(Evaluation Team, Wolffe, Sharp-Geiger, Young, Erickson)

1:30 INTERVIEW: Louis Jalbert (LTP-WRP) Evaluation Team
Randy Axtell (LTP-WRP)



External Management Review

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TA-03, Location – University House (Building 443)

3:00 INTERVIEW: Kathryn Johns-Hughes (LTP) Evaluation Team
James (Steve) Clemmons (LTP)

4:00 INTERVIEW: David Frederici (LTP-SSS) Evaluation Team

Thursday, October 30, 2014
TA-03, Location – University House (Building 443)

7:30 Closed Discussion Evaluation Team

8:30 INTERVIEW: Glenn Clemons (ASM-PROJPR) Evaluation Team

9:00 INTERVIEW: Cheryl Cabbil (ADNHHO) Evaluation Team

9:30 INTERVIEW: Derek Gordon (ADNHHO) Evaluation Team

10:00 Closed Discussion Evaluation Team

12:00 **Working Lunch** Evaluation Team

2:00 Generate Directors Briefing Evaluation Team

4:40 Data Transfer with Security Andrew Wall/Darren Schnedler

TA-03, Bldg. 1400, Director's Office

5:00 Outbrief with LANL Director Evaluation Team
(Longenecker Staff, Marquez, Henry, Beard, Sherry, Sosinski)

Appendix E. Event Timeline

Event	Discussion
1970s-1990s Nitrate salt waste produced at LANL starting in 70's.	<ul style="list-style-type: none"> • Generated nitrate salt wastes with differing remediation needs: <ul style="list-style-type: none"> ○ Some nitrates were evaporated and cemented in the late 80's, not all were cemented. ○ Since September 1991, all nitrate salts generated at TA-55 were cemented.
1999 The WIPP repository opens	
April 2000 Difficult Waste Team (DWT) is sanctioned by DOE CBFO located in Carlsbad to support the national TRU Program	<ul style="list-style-type: none"> • DWT members are LANS employees, but get primary direction from CBFO to support the TRU waste program on a national scale. • CCP/CBFO uses AK to determine whether the waste meets one of four established categories that are acceptable under the WIPP permit. (e.g., homogeneous solids) • The waste generator characterizes waste by container to determine if it is within RCRA storage permit requirements.
2005 Energy Solutions is selected through competitive process to perform environmental remediation work at multiple sites across the DOE complex. At LANL ES is contracted as staff augmentation, then converted to Task Order for the 3706 campaign.	<ul style="list-style-type: none"> • Obligations included in the contract for Energy Solutions: <ul style="list-style-type: none"> ○ To prepare shipping containers in accordance with appropriate site waste acceptance criteria ○ To provide SME's to assist in the development of procedures ○ To characterize, classify, label and/or package waste properly. ○ To ascertain and adhere to DOE, LANL and other governmental requirements. ○ To comply with all applicable laws and regulations ○ To be responsible for compliance with ES&H requirements applicable to the work. • The contract was expanded and converted to Task Order (see below) but never re-bid at LANL.
2006 P313, Roles, Responsibilities, Authorities, and	<ul style="list-style-type: none"> • Establishes distinction between line, facility, and program managers in model for use by LANS, LLC • Defines and distinguishes R2A2 for Responsible

Event	Discussion
Accountability issued.	Associate Director (RAD) and Facility Operations Director (FOD), thus establishing the "FOD model" for LANS, LLC <ul style="list-style-type: none"> • Flows down RAD R2A2 to Responsible Line Management (RLM) chain; flows down FOD R2A2 to FOD staff, including Operations Managers (OMs) and Shift Operations Managers (SOMs)
2007 The WCRR facility becomes a DOE Hazard Category 2 facility	<ul style="list-style-type: none"> • Facility operations are to support TRU waste shipments to WIPP, including waste characterization, reduction and repackaging • BIO states Ch2/3 "Class 1 oxidizers such as nitrates....are not expected, " and specifies that no chemical processing occurs in WCRRF • BIO states "Class 1 oxidizers such as nitrates....are prohibited items in the WCRRF."
2007 Operating Procedure, EP-WCRR-WO-DOP-0233, R.0, "Processing Waste in the Waste Characterization Glovebox" becomes effective	<ul style="list-style-type: none"> • States that liquids are to be absorbed with "absorbent" if there is no reaction after adding a small amount of absorbent into the liquid. • States that liquids are assessed for corrosives (determined qualitatively) and dispositioned by contacting the "Laboratory's solid waste regulatory group, an industrial hygienist, and/or other Laboratory personnel."
October 2008 P315, Conduct of Operations Policy issued.	<ul style="list-style-type: none"> • Defines responsibilities for both FOD and RLM <ul style="list-style-type: none"> ○ "The RLM is specifically responsible and accountable for the safe execution of work associated with R&D/Programmatic procedures. The RLM will coordinate activities with the FOD to ensure the facility safety envelopes are maintained, collocated hazards have been addressed, ..." • Captures approval authorities and conditions appropriate for technical procedures. <ul style="list-style-type: none"> ○ "The [RLM]...determines if elements of an activity ...should follow a Technical Procedure... If the activity is moderate hazard or high-hazard/complex, the RLM, in consultation with the FOD, may do either of the following...[develop an IWD or develop a procedure that is compliant with P300]."
June 2009 NCR-LANL-0509-09	<ul style="list-style-type: none"> • NCR Conditions: addresses 47 drums flagged by TA-55 Waste Fixation Group to CCP as being un-

Event	Discussion
initiated by CCP	cemented, whereas the AK had discussed cemented evaporator salts.
2009 LTP initiates discussions and work planning to address the NCR	<ul style="list-style-type: none"> • ADEP personnel plan two solution packages based on identified uncemented nitrate salts. Debris and unconsolidated salts become Solution Package 72.
July 2009 DWT researches nitrate salt wastes with respect to potential WIPP waste	
August 2009 Energy Solutions contract, Task Order 10, executed.	<ul style="list-style-type: none"> • STR requests re-bid of the contract and to provide additional oversight through IPT, but proposal is rejected by LTP because "there is no time" for the process. • Contract expands to near \$20M and provides for an original period of performance through September 30, 2010 • Qualifications of ES staff and management assigned to WCRRF were not evaluated in the contract expansion process.
2009 ADEP/EWMO FOD structure is established	<ul style="list-style-type: none"> • The FOD in EWMO is hard-line report to NHHO, but dotted line to ADEP. • The Deputy FOD is hard-line direct report to ADEP. • The FOD subsequently delegates "FOD Designee" responsibilities to WCRRF Operations Manager and Shift Operations Managers, who are hard-line direct reports to ADEP/DD Project Manager resulting in the employees being "dual hatted" with line and oversight responsibilities. • WCRRF operating procedures are managed by WCRRF OM and executed by Technical Writer in EWMO
February 2010 DOP-0233 Revisions 16 (approved for training) and 17 are issued, Addressing nitrate salt waste processing in Appendix 2, page 34.	<ul style="list-style-type: none"> • Liquids/corrosive: <ul style="list-style-type: none"> ○ Introduced requirement to perform a pH test "using strips to verify if the liquid is potentially corrosive" in the introduction. ○ Retained previously existing language indicated that if liquid is present and it is potentially corrosive or a peroxide forming chemical, then the operators are to place it in a safe configuration, cease work and make notifications. Notifications included Shift Operations

Event	Discussion
	<p>Supervisor or Shift Operations Manager, who is to notify LANL's "solid waste regulatory compliance group, and industrial hygienist and/or other Laboratory personnel..."</p> <ul style="list-style-type: none"> ○ Introduces specific pH values for corrosive liquid, acid having a pH between 0 and 2, and a base having a pH between 12 and 15. ○ Liquids: Retained previously existing language indicated that if liquid is encountered, an operator can add absorbent, but if there is a reaction, the operator should stop work and "complete an IWD to address hazards and controls". <ul style="list-style-type: none"> • Absorbent: Introduced the word "approved" to read "approved absorbent" to be placed in container with liquids. • Oxidizers: Retained previously existing language in the Precautions and Limitations Section (pg. 9) identified a statement about class I oxidizers prohibited in WCRRF and in section 8 of procedure on oxidizers included a stop work if operators encountered them. • Rev 17 is approved by six individuals from EWMO, including Rad Con, IH, and RCRA (the ENV Generalist deployed to EWMO).
<p>March 2010 EMRTC report issued</p>	<ul style="list-style-type: none"> • EMRTC report was originally developed for nitrate waste from Idaho, which was not containerized. • From background section: "The EPA SW-846 test method 1040 ...is suitable for assessing the relative oxidizing hazard of solid substances, including solids.... Some materials bound for storage at WIPP are co-mingled with nitrate salts, which in pure form, are categorized for transportation as oxidizers. This test series determined the amount of inert material (zeolite clay and ground high strength grout) that must be mixed into the most reactive ratio of sodium nitrate and potassium nitrate in order to classify the mixture as a Category IV (non-oxidizer)."
<p>July – October 2010</p>	<ul style="list-style-type: none"> • DOP-0233 expanded from 49 to 91 pages in

Event	Discussion
DOP-0233 Revisions 19 (approved for training) and 20 of operating procedure	<p>length</p> <ul style="list-style-type: none"> ○ Included examples of corrosives as a note in one subsection and discussed performing pH evaluation, but the action to stop work if corrosive identified is removed. There is no action in the procedure to record pH ○ Deleted specific pH values denoting corrosivity ○ Retained the requirement to notify if a reaction occurred between the absorbent and liquid, but only the WCRRF Operations Center was to be notified. <ul style="list-style-type: none"> • Oxidizers: Precaution and limitation note on oxidizers prohibited in WCRRF still existed, and to stop work if they are discovered. • The removal of the corrosivity stop work and pH values occurred during table top validation at the end of the revision process and the draft of the revision with this change was not reviewed by the listed reviewers.
March 2011 DOP-0233 Rev 25 issued	<ul style="list-style-type: none"> • Document Action Request (DAR) indicates reviewers by functional area to include WDP-TWP/SME, WDP SOM, Engineering, QA, WDP-STA, RP and IH/S (not ENV, or RCRA). • Oxidizers: Precaution about Oxidizers prohibited still within the procedure, but the stop work associated with discovery of oxidizers is removed.
April 2011 USQ on Rev 25 of the procedure completed	<ul style="list-style-type: none"> • Identifies that the changes made do not increase the potential for described accident scenarios
August-September 2011 WCRRF operations transition to Energy Solutions as the Task Order contractor in WCRRF.	<ul style="list-style-type: none"> • Prior to this time, LANL operators were working on the floor with ES operators. • EWMO continues to provide support services such as RCTs, IH, etc.
July 2011 Facility Centered Assessment (FCA) completed for RANT, WCRRF and Area G: PFITS Parent Record = 2010-1634	<ul style="list-style-type: none"> • FCA was subject of independent oversight from DOE-HSS Headquarters • Issues were identified with R2A2 and organizational structure and ISM/IWM as reflected below: <ul style="list-style-type: none"> ○ “There were ISM weaknesses, including the lack of subcontractor full involvement in

Event	Discussion
	<p>preparing IWDs and ensuring subcontractor IWDs are integrated with WDP/DOPs; poor communication with subcontractor ...” lack of availability of full set of individuals with relevant expertise to scope and analyze work; lack of preparedness to execute planned work..”</p> <ul style="list-style-type: none"> ○ “Management roles, responsibilities authorities and accountabilities are not consistent with P 313 from the SOS through FOD ... The FOD has no organization, and the OM is not assigned as an operations manager based on the R2A2 in P 313.” ○ There is no evidence these identified issues are corrected by ADEP/EWMO
<p>October 20, 2011 Remediation of nitrate salt parent drums begins</p>	<ul style="list-style-type: none"> • Remediation process included use of Waste Lock 770 • Waste Lock 770 is organic polymer absorbent
<p>Late 2011 DWT member identifies problem with processing drums with Waste Lock in WCRRF</p>	<ul style="list-style-type: none"> • DWT input is that DWT member notified LTP, but also notified CCP/CBFO once recognized that this occurred
<p>January 2012 NMED and DOE/NNSA enter a non-binding Framework Agreement, establishing the 3706 TRU Waste Campaign</p>	<ul style="list-style-type: none"> • The Framework Agreement sets timeline targets for dispositioning of the above-ground non-cemented TRU waste as a priority for the State of New Mexico and LANL • Impact on the Consent Order is that some of those funds are re-directed to TRU waste dispositioning to WIPP.
<p>February 19, 2012 Nitrate salt waste stream AK report issued</p>	<ul style="list-style-type: none"> • AK is signed by FOD and CBFO/CCP • AK still reflects use of inorganic sorbents • CCP incorporates Solution Package 72 into the AK
<p>February 28, 2012 ADEP and EWMO invoke a pause in processing of nitrate salt waste, and initiate remediation plans for waste that had been processed with Waste Lock 770</p>	
<p>February 29, 2012 Memorandum ENV-RCRA-12-0053, “Legacy TA-55 salt wastes at TA-54.</p>	<ul style="list-style-type: none"> • ADEP updating AK documentation and in late 2011 had requested input from ENV-CP (core RCRA experts in ADESH) • ENV-RCRA concluded that the D001 and D003

Event	Discussion
<p>Potential Applicability of RCRA D001/D002/D003 Waste Codes”</p>	<p>codes did not apply and that D002 would not apply after remediation</p> <ul style="list-style-type: none"> ○ RE D002- concluded that the D002 code will not apply to the solid-form unconsolidated nitrate salts, by definition, but that any liquid encountered most likely would be a RCRA corrosive liquid (D002). ENV-RCRA recommended that all confirmed unconsolidated salts drums undergo verification that no liquids are present prior to shipment (according to routine LANL and CCP procedures) and stated that sorption of any free liquid encountered would eliminate any concern that prohibited liquid-and D002 waste- might inadvertently be sent to WIPP. ○ Other than routine RCRA training, this review is the only identified inclusion of ENV-RCRA by ADEP/LTP in nitrate waste process planning efforts. ENV-RCRA had not been included by ADEP/LTP or FOD organization as reviewer of WCRRF processing procedures. <p>Note: sampling of waste of concern not completed.</p>
<p>March 6, 2012 Solution Package Scope Definition REPORT-72, Salt Waste (SP#72) Rev 0: Approval process stopped (per AIB prepared timeline)</p>	
<p>Week of March 14, 2012 Difficult Waste Team, LTP program from ADEP, and Energy Solutions meet in Las Vegas (Corporate Board meeting)</p>	<ul style="list-style-type: none"> • No formal notes were documented for this meeting. • The Secretary of the Corporate Board verbally confirmed the meeting date to the current (November 2014) ADEP Deputy.
<p>March 13 and 14, 2012 DWT and LTP get input from LANL chemistry personnel</p>	<ul style="list-style-type: none"> • E-mail traffic indicates discussion back and forth between chemists, LTP and DWT regarding use of polymer sorbent for acidic liquids as well as discussion about potential for creation of an oxidizer.
<p>May 8, 2012 DWT report issued, “Amount of Zeolite Required to Meet the</p>	<p>DWT white paper concludes “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</p>

Event	Discussion
<p>Constraints Established by the EMRTC Report RF 10-13: Application to LANL Evaporator Nitrate Salts”</p>	<p>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.</p> <p>Conclusion of report: “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... 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. ... 3. Nitrate Salts previously remediated with Waste Lock 770® should be mixed with at least 1.2 volumes of Kitty Litter/Zeolite clay ...</p> <ul style="list-style-type: none"> ○ Footnotes indicate that 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...” There is no evidence this “recommendation” was acted upon by ADEP.
<p>May - June 2012 DWT report was provided to procedure writer, LANL WCRR Operations Manager, others</p>	<ul style="list-style-type: none"> • DWT white paper provided to the WCRRF Ops Mgr., the WCRRF DD Project Mgr., LTP Program Director, Energy Solutions personnel to include the ES Operations Manager. • This is one of 2 possible meetings in which ES Operations Manager potentially heard “an organic” from DWT member, but DWT member indicates used word “inorganic.” “Inorganic” was subsequently entered into operating procedure, but revised by the ES OM to “an organic.”
<p>June 14, 2012 Email received from Los Alamos Field Office to ADEP RE: “Nitrate Salt Processing guidance:</p>	<ul style="list-style-type: none"> • DOE TRU Waste Manager attached the DWT report with Field Office concurrence regarding applicability to current challenge waste: “... this attachment is a collaborative effort by CCP and LANS that provides a technical solution to the nitrate salt drums. As the DOE TRU Waste Manager, I agree with the approach.”
<p>July 2012 Solution Package Scope Definition Report-72, Salt Waste (SP#72) Rev 1</p>	<ul style="list-style-type: none"> • SP#72 Rev 1 was developed by LTP Engineering • Approvals include EWMO-FOD, CCP, EWMO-ESH mgr., and LTP • AIB timeline indicates that this identifies the

Event	Discussion
	<p>revised processing path and requirements for getting the nitrate salt drums shipped to WIPP.</p> <ul style="list-style-type: none"> • SP#72 refers to "kitty litter/zeolite" as used in the DWT report. AK does not reflect same terminology.
<p>July 30, 2012 DOP-0233 Revision 36 issued to include a separate section focused on nitrate salts (section 10.6)</p>	<ul style="list-style-type: none"> • DAR indicated reviewers by functional area included Energy Solutions Operations Manager, Engineering, RP, QA, Energy Solutions Operations Manager and SOS, Safety (not ENV or RCRA). • Absorbent: Changed "absorbent" in the materials and equipment list to "kitty litter/zeolite absorbent." • Absorbent: Added section for processing nitrate salt drums instructing that "an organic absorbent (Kitty Litter/Zeolite)" is "added to the waste material at a minimum of 1.5 absorbent to 1 part waste ratio." • The new section and organic absorbent language was requested by the Energy Solutions Operations Manager during the comment period of the revision. The procedure writer did not email the revision draft containing these changes back out to all the listed reviewers for review. • Liquids/Corrosive: Retains previously existing language (added in Rev. 21) in one subsection denotes pH values ("Acid (less than 7) and Caustic (base greater than 7)").
<p>July 17, 2012 USQ on Revision 36 of the procedure is finalized</p>	<ul style="list-style-type: none"> • USQ did not acknowledge the introduction of nitrate salts • USQ indicated no increase in accident potentials
<p>October 1, 2012 Processing uncemented nitrate salt waste resumed under DOP-0233, starting with remediation of the waste previously processed using Waste Lock 770</p>	<ul style="list-style-type: none"> • This begins introduction of organic kitty litter into waste stream destined for WIPP
<p>December 12, 2012 CCP-AK-LANL-006, Central Characterization Program Acceptable Knowledge Report for Los Alamos National</p>	<ul style="list-style-type: none"> • Revised AK is now expanded to encompass both cemented and uncemented nitrate salt wastes, and includes the MIN02 waste stream. • Revised AK does not refer to organics, instead MIN indicates mixed inorganic nitrates, which connotes the waste stream when remediated,

Event	Discussion
Laboratory TA-55 Mixed Transuranic Waste Streams: LA-MDH01.001 LA-CIN01.001 LA-MIN02-V.001 LA-MIN04-S.001 Revision 12 approved for use	<p>would be primarily inorganic. (CIN = cemented inorganic, MHD indicated mixed heterogeneous debris)</p> <ul style="list-style-type: none"> • Revised AK does not address neutralizers as authors have no knowledge of DOP-0233 and processing steps taken in WCRRF • The waste generator, under WIPP permit, has a responsibility to notify CCP if AK becomes different than what is approved. • Revised AK is approved by CCP/CBFO
March 20, 2013 DOP-0233 Revision 37 issued directing use of neutralizer	<ul style="list-style-type: none"> • DAR indicates reviewers include Energy Solutions Operations Manager, SOM, Engineering, QA, IH/S, RP, WCRR-SSW • Absorbent: Changed ratio of organic absorbent to "a minimum ratio of 3-parts absorbent to 1-part waste or at a ratio as directed by supervision:" (Note that absorbent acted as radiation shielding and reduced dosage to allow use of 55 gal drums instead of pipe over-packs) • Liquids/corrosive: Introduced requirement to "neutralize the liquid, as necessary." • Liquids: Did not change requirement to notify Ops Center if there was a reaction between the absorbent and free liquid
March 2013 Negative USQD of DOP-0233 Rev 37	<ul style="list-style-type: none"> • USQD review does not identify issues with the change to the operating procedure against the BIO accident scenarios
May 8, 2013 ES IH emails LANS STR regarding approval for use of Kolersafe Liquid Acid Neutralizer (MSDS No 1006) and Kolersafe Liquid Base Neutralizer (MSDS No 1007) at WCCRF	<ul style="list-style-type: none"> • STR forwarded proposed use to safety professionals in EWMO for concurrence • EWMO-ESH staff concur with use of neutralizers • Interviews by Team indicated a reliance on those EWMO SMEs to forward to others with need to review and concur
June 2013 DNFSB review of Con Ops completed	<ul style="list-style-type: none"> • Area G focus, not specific to WCRRF • Identified issues with R2A2 and oversight of same subcontractor to ensure Con Ops requirements met out in the domes. A ConOps Mentor program was identified as addressing the concerns with focus on following areas: <ul style="list-style-type: none"> ○ Procedural compliance, activity operations monitoring, activity turnover, pre-job briefings, log keeping, formal and effective communications, safety,

Event	Discussion
	radiological controls, formality of operations, and keeping the EWMO Operations Support manager informed of facility status and abnormal situations.
September 2, 2013 STR for LANS grants approval to use Kolersafe Liquid Acid Neutralizer (MSDS No 1006) and Kolersafe Liquid Base Neutralizer (MSDS No 1007).	STR relied on earlier email concurrence from EWMO staff, as Oversight Plan has not been developed to specify how/who would be involved in making these determinations from within ADEP.
December 4, 2013 WCRRF staff process parent drum creating Daughter Drums #68660 and one sibling	<ul style="list-style-type: none"> • At this point WCRRF staff have processed nitrate over a period of 14 months using acid neutralizers and organic kitty litter as absorbent, per DOP-0233 • Parent drum of #68660 contains 2 gallons liquid at an initial pH 0; acid is neutralized with Kolersafe Liquid Acid Neutralizer per procedure, and organic kitty litter absorbent is added as the two daughter drums are created.
January 21-29, 2014 Drum #68660 is certified for shipment to WIPP, and departs LANL in shipment #LA140017	Drum #68660 is emplaced at WIPP on January 31, 2014, two weeks before the apparent exothermic event occurs.

